

Project Specifications for:

Mount Saint Mary College

Guzman Hall Renovation & Addition

330 Powell Ave
Newburgh, NY

Issued for Bidding
Date: 08.09.2021

**Kimmel Bogrette Architecture + Site, Structural Engineer,
Civil Engineer, Landscape Engineer & MEP Engineers**

DOCUMENT 00 01 01 - PROJECT TITLE PAGE

I.1 PROJECT MANUAL

- A. Mount St Mary College – Guzman Hall
- B. Owner: Mount St Mary College
330 Powell Ave., Newburgh, NY
- C. Architect: Kimmel-Bogrette Architecture + Site
482 Norristown Rd., Ste 200, Blue Bell, PA 19422
- D. Copyright 2021 All rights reserved.

END OF DOCUMENT 000101

SECTION 00 01 03 - PROJECT DIRECTORY

OWNER – Mount Saint Mary College

Name	Title	Address	Email	Phone
Maryann Pilon	Executive Director of Facilities & Liaison for Strategic Space Planning	330 Powell Ave Newburgh, NY	Maryann.pilon@msmc.edu	845-569-3332
Douglas Smith	Assistant Director of Facilities	330 Powell Ave Newburgh, NY	Douglas.smith@msmc.edu	845-569-3645

ARCHITECT – KIMMEL BOGRETE ARCHITECTURE + SITE

Name	Title	Address	Email	Phone
Joe Horan	Principal	Kimmel Bogrette Architecture + Site 482 Norristown Rd, Ste 200 Blue Bell, PA 19422	jhoran@kimmel-bogrette.com	610-834-7039
Laura Gamble	Project Manager	Kimmel Bogrette Architecture + Site 482 Norristown Rd, Ste 200 Blue Bell, PA 19422	lgamble@kimmel-bogrette.com	610-834-7039

CIVIL ENGINEER – E&LP

Name	Title	Address	Email	Phone
Matt Connors	Associate	140 W Main St High Bridge, NJ 08829	mconnors@elp-inc.com	908-238-0544

STRUCTURAL ENGINEER – Reuther & Bowen

Name	Title	Address	Email	Phone
Marc Bowen	President & Managing Principal	326 Ward St. Dunmore, PA 18512	mbowen@reutherbowen.com	570-496-7020
Mike Stremski	Senior Associate	326 Ward St. Dunmore, PA 18512	mstremski@reutherbowen.com	570-496-7020

MEP/FP ENGINEER- McHugh Engineering Associates

Name	Title	Address	Email	Phone
Michael Witkowski	Vice President	136 Poplar St Ambler, PA 19002	mwitkowski@mchugheng.com	215-641-1158
Andrew Foley	Project Manager	136 Poplar St Ambler, PA 19002	afoley@mchugheng.com	215-641-1158

LANDSCAPE ENGINEER- ThinkGreen LLC				
Name	Title	Address	Email	Phone
Peter Johnson		PO Box 528 Glenside, PA 19038	pjohnson@thinkgreenllc.com	215-887-2595

SECTION 00 01 15 - LIST OF DRAWINGS

PART I - GENERAL

- I. Refer to cover sheet of contract documents for list of drawings.

END OF SECTION 00 01 15

SECTION 00 01 16 - LIST OF REFERENCE DOCUMENTS

PART I - GENERAL

- I. The following drawing(s) have been made available for the contractor's reference, they are not a part of the contract drawings:
 - a. Paradigm's Asbestos Testing Report
 - b. DL Flow Tech's Flow Report
 - c. Exhibit B – Schedule of Insurance rec 2020
 - d. HECAP Award Letter
 - e. Cabrini Executed Grant Agreement
 - f. New Vendor Set-up Form
 - g. A101-2017 – Blank
 - h. A201-2017 – Blank

END OF SECTION 00 01 16



PARADIGM
ENVIRONMENTAL, LLC.

Asbestos Bulk Sampling Analysis Report

prepared for:

Mount Saint Mary College
330 Powell Avenue
Newburgh, New York 12550

performed by:

Paradigm Environmental, LLC.
3 Neptune Road – Suite A-18E
Poughkeepsie, New York 12601

performed at:

Guzman Hall
330 Powell Avenue
Newburgh, New York 12550

Wednesday, April 14th, 2021

Paradigm Job #21.2414P



PARADIGM
ENVIRONMENTAL, LLC.

Tuesday, April 20th, 2021

Mount Saint Mary College
330 Powell Avenue
Newburgh, New York 12550
Mr. Douglas Smith
845.569.3645 (phone)
douglas.smith@msmc.edu

Re: Guzman Hall: Asbestos Bulk Sampling & Analytical Services

Paradigm Job Number: 21.241P

The purpose of this letter is to explain the results of the Polarized-Light Microscope (PLM) and Transmission Electron Microscopy (TEM) Bulk Sample Analysis that was performed on Tuesday, April 20th, 2021. A total of seven (7) Friable and eight (8) Non-friable Organically Bound (NOB) Bulk Samples were analyzed.

Field ID Number	Lab ID Number	Sample Description	Asbestos Present?	Analytical Result
1	7448	Gray Thermal System Fitting Insulation (Classroom 2 - above Ceiling)	No	No Asbestos Detected
2	7449	Gray Thermal System Fitting Insulation (Classroom 2 - above Ceiling)	No	No Asbestos Detected
3	7450	Gray Caulking on Metal Window Frame (Exterior - North)	Yes	6.5% Chrysotile Asbestos
4	7451	Gray Caulking on Metal Window Frame (Exterior - North)	Assumed	Analysis Stopped at 1 st Positive
5	7452	Black Tar on Roof Edge (Chapel)	Yes	19% Chrysotile Asbestos



Field ID Number	Lab ID Number	Sample Description	Asbestos Present?	Analytical Result
6	7453	Black Tar on Roof Edge (Chapel)	Assumed	Analysis Stopped at 1 st Positive
7	7454	Black Roof Field (Chapel)	Yes	14% Chrysotile Asbestos
8	7455	Black Roof Field (Chapel)	Assumed	Analysis Stopped at 1 st Positive
9	7456	Black Roof Field – Middle Layer (Chapel)	No	No Asbestos Detected
10	7457	Black Roof Field – Middle Layer (Chapel)	No	No Asbestos Detected
11	7458	White Roof Field – Bottom Layer (Chapel)	No	No Asbestos Detected
12	7459	White Roof Field – Bottom Layer (Chapel)	No	No Asbestos Detected
13	7460	White Plaster (Chapel – Roof Soffit)	No	No Asbestos Detected
14	7461	White Plaster (Chapel – Roof Soffit)	No	No Asbestos Detected
15	7462	White Plaster (Chapel – Roof Soffit)	No	No Asbestos Detected



PARADIGM
ENVIRONMENTAL, LLC.

Analysis Notes:

1. As per NYSDOL ICR 56-2.1 (p), an Asbestos Containing Material (ACM) is defined as any material containing greater than one percent (1%) of asbestos, also known as Asbestos Material. Samples determined to be ACM are identified by ***bold/italicized type and are highlighted in yellow.***

If you have any additional questions concerning this report, please do not hesitate to call me at 845.462.1466 or email me at jkunicki@paradigmenvllc.com. Thank you.

Sincerely,

Jack Kunicki

Jack Kunicki
Paradigm Environmental, LLC.



PLM & TEM BULK ASBESTOS ANALYSIS REPORT
via NYSDOH ELAP Method 198.1, 198.4 and 198.6

Client: Paradigm Environmental, LLC
Location: MSMC
330 Powell Avenue, Newburgh, New York

Job No: 0874-21B
Page: 1 of 4

Sample Date: 4/14/2021

Sample Received Date: 4/16/2021

Client ID	Lab ID	Sampling Location	Description	PLM Asbestos Fibers Type & Percentage	PLM Total Asbestos	NOB	TEM Asbestos Fibers Type & Percentage	TEM Total Asbestos	PLM Non-Asbestos Fibers Type & Percentage	Non-Fibrous Matrix Material %
1	7448	Classroom 2 - Above Ceiling	Gray Fibrous Thermal Systems Insulation Fitting	None Detected	0%		Not Required	N/A	Mineral Wool 20%	80%
2	7449	Classroom 2 - Above Ceiling	Gray Fibrous Thermal Systems Insulation Fitting	None Detected	0%		Not Required	N/A	Mineral Wool 20%	80%
3	7450	Exterior - North	Gray Window Frame Caulk	Chrysotile 6.5%	6.5%	✓	Not Required	N/A	None Detected	93.5%
4	7451	Exterior - North	Gray Window Frame Caulk	STOP	POSITIVE	✗	SAMPLE	NOT	ANALYZED	N/A
5	7452	Chapel - at Edge	Black Fibrous Roof Tar	Chrysotile 19%	19%	✓	Not Required	N/A	None Detected	81%
6	7453	Chapel - at Edge	Black Roof Tar	STOP	POSITIVE	✗	SAMPLE	NOT	ANALYZED	N/A
7	7454	Chapel - Top	Black Fibrous Roof Field	Chrysotile 14%	14%	✓	Not Required	N/A	None Detected	86%
8	7455	Chapel - Top	Black Roof Field	STOP	POSITIVE	✗	SAMPLE	NOT	ANALYZED	N/A
9	7456	Chapel - Middle	Black Roof Field	Inconclusive No Asbestos Detected	0%	✓	None Detected	<1.0%	None Detected	100%
10	7457	Chapel - Middle	Black Roof Field	Inconclusive No Asbestos Detected	0%	✓	None Detected	<1.0%	None Detected	100%

KEY TO NOB COLUMN SYMBOLS

No Symbol in the NOB column denotes sample analyzed by ELAP Method 198.1 (PLM).

✓ NOB (non-friable organically bound) denotes material analyzed by ELAP Method 198.6 (PLM) and 198.4 (TEM) as noted.

√ denotes material analyzed by ELAP Method 198.6 (PLM) per NYSDOH. This Method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing greater than 10% vermiculite.

denotes friable material analyzed by ELAP Method 198.6 (PLM) and 198.4 (TEM) as noted.

✗ denotes sample prepped only by ELAP Method 198.6.

** Polarized-light microscopy is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials.

N/A - Not Applicable

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.

PLM Bulk Asbestos Analysis by New York State Department of Health, ELAP Method 198.1, 198.4 and 198.6 ("Polarized Light Microscopy and Transmission Electron Microscopy Identifying and Quantitating Asbestos in Bulk Samples and in Non-Friable Organically Bound Bulk Samples.") per EPA 600/M4-82-020 per 40 CFR 763.

ELAP ID No.: 11955

PLM Date Analyzed: 4/20/2021
PLM Analyst: A. Maciejewski
Microscope: Olympus BH-2 #241709

TEM Date Analyzed: 4/20/2021
TEM Analyst: A. Dembski
Microscope: Hitachi 600 AB

Laboratory Results Approved By:
Asbestos Technical Director or Designee

Amy Dembski

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PARADIGM

ENVIRONMENTAL SERVICES, INC.

1430-B Millersport Hwy., Williamsville, NY 14221 (Office) 716.775.5777

PLM & TEM BULK ASBESTOS ANALYSIS REPORT **via NYSDOH ELAP Method 198.1, 198.4 and 198.6**

Client: Paradigm Environmental, LLC
Location: MSMC
330 Powell Avenue, Newburgh, New York

Job No: 0874-21B
Page: 2 of 4

Sample Date: 4/14/2021

Sample Received Date: 4/16/2021

Client ID	Lab ID	Sampling Location	Description	PLM Asbestos Fibers Type & Percentage	PLM Total Asbestos	NOB	TEM Asbestos Fibers Type & Percentage	TEM Total Asbestos	PLM Non-Asbestos Fibers Type & Percentage	Non- Fibrous Matrix Material %
11	7458	Chapel - Roof Field - Bottom	White Fibrous Drywall	None Detected	0%		Not Required	N/A	Cellulose 30%	70%
12	7459	Chapel - Roof Field - Bottom	White Fibrous Drywall	None Detected	0%		Not Required	N/A	Cellulose 30%	70%
13	7460	Chapel - Roof Soffit	White Plaster	None Detected	0%		Not Required	N/A	None Detected	100%
14	7461	Chapel - Roof Soffit	White Plaster	None Detected	0%		Not Required	N/A	None Detected	100%
15	7462	Chapel - Roof Soffit	White Plaster	None Detected	0%		Not Required	N/A	None Detected	100%

KEY TO NOB COLUMN SYMBOLS

No Symbol in the NOB column denotes sample analyzed by ELAP Method 198.1 (PLM).

✓ NOB (non-friable organically bound) denotes material analyzed by ELAP Method 198.6 (PLM) and 198.4 (TEM) as noted.

√ denotes material analyzed by ELAP Method 198.6 (PLM) per NYSDOH. This Method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing greater than 10% vermiculite.

denotes friable material analyzed by ELAP Method 198.6 (PLM) and 198.4 (TEM) as noted.

X denotes sample prepped only by ELAP Method 198.6.

** Polarized-light microscopy is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials.

N/A - Not Applicable

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.

PLM Bulk Asbestos Analysis by New York State Department of Health, ELAP Method 198.1, 198.4 and 198.6 ("Polarized Light Microscopy and Transmission Electron Microscopy Identifying and Quantitating Asbestos in Bulk Samples and in Non-Friable Organically Bound Bulk Samples.") or EPA 600/M4-82-020 per 40 CFR 763.

ELAP ID No.: 11955

PLM Date Analyzed: 4/20/2021
PLM Analyst: A. Maciejewski
Microscope: Olympus BH-2 #241709

TEM Date Analyzed: N/A
TEM Analyst: N/A
Microscope: N/A

Laboratory Results Approved By:
Asbestos Technical Director or Designee

Amy Dembski

Paradigm Environmental Services, Inc. is not responsible for the data supplied by an independent inspector. New York State Department of Health Environmental Laboratory Program (ELAP) requirements mandate that this report must not be reproduced except in full without the approval of the laboratory. This report relates ONLY to the items received by the lab. This report must not be used to claim product endorsement by NYS ELAP or any agency of the U.S. Government. Quality control data (including 95% limits and laboratory or analysts' accuracy and precision) is available upon request.

0874-21B 4/20/2021



PARADIGM
ENVIRONMENTAL, LLC.

CHAIN OF CUSTODY FOR BULK ASBESTOS ANALYSIS

3 Neptune Road, Suite A-18E Poughkeepsie, New York 12601 845.462.1466 (phone) www.paradigmenv.com	Client Name: MSMC	Client Contact: Doug Smith	OFFICE USE ONLY
Client Mailing Address:	Client Telephone Number:	Client Email Address:	Lab Job #: 0874-213
Results To:	PARADIGM, LLC.	Turnaround Time (results by End of Day): 04.20.21	Page: 1 of 2
Date Sampled:	04/14/21	Paradigm, LLC. Job Number: 21.2414P	Date Logged In: 4/16/21
Project Location: 330 Powell Avenue Newburgh NY		Logged In by: AW	

Client ID	Lab ID	Sample Description/Location	Color	Type of Material	Material (SF/LF)
1	7442	T&E Fitting (above Ceiling)	Gray	Friskle	Classroom 2
2	-49	" " "	"	"	"
3	-50	Window Frame Caulk	Gray	NOB	Exterior - North
4	-51	" " "	"	"	"
5	-52	Roof Tar @ Edge	Black	NOB	Chapel
6	-53	" " "	"	"	"
7	-54	Roof Field Top	Black	NOB	"
8	-55	" " "	"	"	"
9	-56	" " Middle	"	"	"
10	-57	" " "	"	"	"




Sampled by: 	Date: 04/14/21	All samples will be analyzed by the appropriate New York State Department of Health methods (198.1, 198.4 and 198.6) unless EPA 600/M4/82/020 per 40 CFR 763 and/or EPA 600/R-93/116 methods are requested.	
Relinquished by:	Date:		Analytical Comments: Stop @ 1st Positive for All Homogeneous Samples Please email report to: jkunicki@paradigmenvllc.com
Received at Lab by: Amy Dumbek 4/16/21 0900 UPS	Date:		TOTAL NUMBER OF SAMPLES ON ALL CHAINS OF CUSTODY: 15



CHAIN OF CUSTODY FOR BULK ASBESTOS ANALYSIS

3 Neptune Road, Suite A-18E Poughkeepsie, New York 12601 845.462.1466 (phone) www.paradigmenv.com	Client Name:	Client Contact:	OFFICE USE ONLY
Client Mailing Address:	Client Telephone Number:	Client Email Address:	Lab Job #: 0874-213
Results To:	PARADIGM, LLC.	Turnaround Time (results by End of Day):	Page: 2 of 2
Date Sampled:		Paradigm, LLC. Job Number:	Date Logged In: 4/16/21
Project Location:			Logged In by: [Signature]

[illegible]

Sampled by:		Date:	04/14/21
Relinquished by:		Date:	
Received at Lab by:		Date:	4/14/21 0900 UPS



Date: 7/22/2021

FT#: 21-237

Technician: MC

Project

**Guzman Hall Renovation
Pre-Construction Survey of Chilled Water Pumps
Mount St Mary College
Newburgh, NY**

Architect

Engineer

McHugh Engineering Associates

Prepared For

Mount St Mary's College



Date: 7/22/2021

FT#: 21-237

Technician: MC

Report Sections

1	<i>Quality Assurance</i>
2	<i>Summary</i>
3	<i>Air Balance Report</i>
4	<i>Hydronic Balance Report (if applicable)</i>
5	<i>Definitions</i>
6	<i>Sketch</i>
7	<i>Instrumentation</i>
8	<i>Certifications</i>



FT# 21-237

Certification
Guzman Hall Renovation
Pre-Construction Survey of Chilled Water
Pumps
Mount St Mary College
Newburgh, NY

The data presented in this report is a record of the system performance and was obtained in accordance with the standards and procedures as outlined by the National Environmental Balancing Bureau and has been balanced to within the physical limits of the systems. Any variances from design quantities which exceed plus or minus ten percent of design, are noted through-out the attached report.

Submitted and Certified By:



7/22/2021

Certified Professional: Dennis LaVopa





Date: 7/22/2021

FT#: 21-237

Technician: MC

Established in 1982, dL Flow Tech, Inc is a independent Heating and Air Conditioning company specializing in HVAC system diagnostics, holding certifications from NEBB(National Environmental Balancing Bureau) , TABB (Testing Adjusting and Balancing Bureau) and IAQA (Indoor Air Quality Association) . dL Flow Tech is also affiliated wish SMACNA (Sheet Metal & Air Conditioning Contractors National Assn.) and ASHRAE (American Society of Heating, Refrigerating & Air Conditioning Engineers).

Our company offers the following services:

*Air and Hydronic Testing and Balancing
HVAC System Survey
Retro-Commissioning
Sound and Vibration Measurement
Pipe Thickness Testing
Blower Door Testing
Duct Leakage Testing
Fire Damper Testing*

For more information please visit www.dlflowtech.com or call 845-265-2828

*Thank You,
The dL Flow Tech Staff*

July 22, 2021

FT #: 21-237

Project: MSMC Guzman Hall Chilled Water Survey

Our professional services have been performed and our findings obtained in accordance with customary principles in the engineering field. It should be noted that evaluations are inherently limited in the sense that conclusions are drawn from information obtained during dL Flow Tech's visit to the site. Balancing and testing has been performed as per the Procedural Standards set forth by the National Environmental Balancing Bureau (NEBB) to within the physical limits of the system testing. In NEBB's definition of a TAB report they note it "does not guarantee that systems included are balanced to design flows." This is noted to highlight the fact as a TAB contractor we do not perform testing and balancing services and guarantee it will work as intended, as we did not design it or install it. The dL Flow Tech, Co highly recommends that any commendations or suggestions noted in this report should be reviewed with your design professional.

Scope:

Provide a pre-construction survey on three pumps serving Guzman Hall.

Project Notes:

1. System is a dual temp. During the survey the system was in summer mode for cooling.
2. There is no system bypass, DP sensor or VFD on the pumps to control the water flow. As per MSMC personal the control valves in the space are 3 way valves.
3. In order to simulate a full flow scenario, all local thermostat temperature set points were decreased in order to get any control valves to open.
4. At this time it is unclear as to the condition of the control valves etc. in the space.
5. 1 Chiller provides chilled water for the system. There is full flow through the chiller at all times while in cooling mode.
6. 3 pumps are installed. Multiple tests were done with 1 pump running and 2 pumps running with 1 pump on standby for redundancy.
7. No pumps curves were provided. A full work up was performed on the pumps. 2 pumps were running when the work up was done. Water flow was determined by means of non-invasive ultra-sonic readings.

dL Flow Tech, Inc.

Pump Summary

[illegible]

Pump Performance Data

Pump No CWP-11			
Manufacturer Taco			
Size FI3009E2GAJ1LOA			
Impeller 9.25			
Service Chilled Water			
	GPM	FT HD	BHP
Design	Not Available	Not Available	Not Available
Valve Open	***	42	4.2
Discharge	39.36		
Suction	21.24		
dP	18.12	X 2.31 =	41.86
Pump Shut-off Head	GPM	FT HD	BHP
	0	49	2.9
Discharge	39		
Suction	17.9		
dP	21.1	X 2.31 =	48.74
Final	GPM	FT HD	BHP
	***	42	4.2
Discharge	39.36		
Suction	21.24		
dP	18.12	X 2.31 =	41.86
System Static Head	23 PSI		
Discharge Valve set @ Open			
System dP Set Point None			

Motor Mfg Baldor		
Frame 184T		
HP 5		
RPM 1750		
	Design	Actual
Amps	13.2	11
Voltage / Phase	230/3	208/3

Remarks:

Refer to port sheet for actual water flows as no pump curves were provided.

2 pumps running

Pump Performance Data

Pump No CWP-12			
Manufacturer Taco			
Size FI3009E2GAJ1LOA			
Impeller 9.25			
Service Chilled Water			
	GPM	FT HD	BHP
Design	Not Available	Not Available	Not Available
Valve Open	***	40	4.3
Discharge	40.83		
Suction	23.5		
dP	17.33 X 2.31 = 40.03		
Pump Shut-off Head	GPM	FT HD	BHP
	0	46	3.2
Discharge	45.23		
Suction	25.19		
dP	20.04 X 2.31 = 46.29		
Final	GPM	FT HD	BHP
	***	40	4.3
Discharge	40.83		
Suction	23.5		
dP	17.33 X 2.31 = 40.03		
System Static Head	23 PSI		
Discharge Valve set @ Open			
System dP Set Point None			

Motor Mfg Baldor		
Frame 184T		
HP 5		
RPM 1750		
	Design	Actual
Amps	13.2	11.3
Voltage / Phase	230/3	208/3

Remarks:

Refer to port sheet for actual water flows as no pump curves were provided.

2 Pumps running

Pump Performance Data

Pump No CWP-13			
Manufacturer Taco			
Size FI3009E2GAJ1LOA			
Impeller 9.25			
Service Chilled Water			
	GPM	FT HD	BHP
Design	Not Available	Not Available	Not Available
Valve Open	***	45	4.5
Discharge	38.01		
Suction	18.74		
dP	19.27 X 2.31 = 44.51		
Pump Shut-off Head	GPM	FT HD	BHP
	0	46	3.2
Discharge	45		
Suction	25		
dP	20 X 2.31 = 46.20		
Final	GPM	FT HD	BHP
	***	45	4.5
Discharge	38.01		
Suction	18.74		
dP	19.27 X 2.31 = 44.51		
System Static Head	23 PSI		
Discharge Valve set @ Open			
System dP Set Point None			

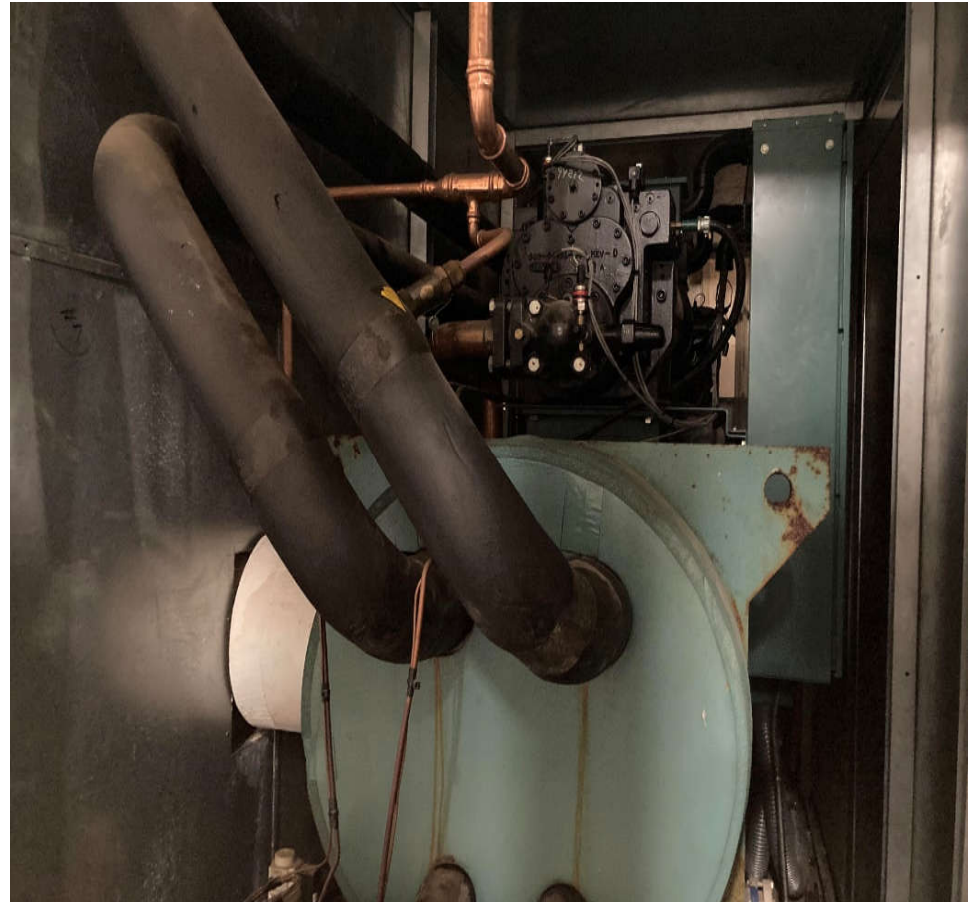
Motor Mfg Baldor		
Frame 184T		
HP 5		
RPM 1750		
	Design	Actual
Amps	13.2	11.8
Voltage / Phase	230/3	208/3

Remarks:

Refer to port sheet for actual water flows as no pump curves were provided.

2 Pumps running

Ultrasonic Flow Test								
Location	Pipe Size	Material	Schedule	Transducer Space	Design GPM	Actual FPS	Actual GPM	Remarks
2 pumps running								
P-11 and P-13	5"	Steel Carbon	40	4.562"	Not Available	6.1	380	
P-11 and P-12	5"	Steel Carbon	40	4.562"	Not Available	5.9	371	
P-12 and P-13	5"	Steel Carbon	40	4.562"	Not Available	6	374	
1 Pump Running								
P-11	5"	Steel Carbon	40	4.562"	Not Available	4.8	301	
P-12	5"	Steel Carbon	40	4.562"	Not Available	4.7	296	
P-13	5"	Steel Carbon	40	4.562"	Not Available	5.0	314	



Code	Remarks
AS Req't'd	Final airflow has been adjusted to suit requests of occupants
ABV CLG	Register (ETC) is located above ceiling line
BKN DPR	Volume Damper (VD), Face Damper (OPD), Splitter Damper (SD) is broken/stuck
CC	Ceiling conflict; kinked flex duct causing low flow
DD	Unit is direct drive; no adjustment can be made without a speed controller.
DD on HI	Direct drive fan set to High, medium (MED) or low (LO)
DT	Duct Traverse
DLF	DL Flow Tech Inc.
FACE	Velocity taken at the balance point
HDW MSG	Volume or splitter damper hardware is missing
Inline	Fan is an inline fan; Actual RPM can not be obtained
Long Flex	Flexible duct configuration and length is probable cause for low flow
Locked	No key available at time of balance
Max Flow	Maximum flow achievable
MAN OPN'D	Temporarily opened manually to set
New outlet	Outlet not shown on contract drawing; no CFM given; CFM assigned by DLF
Noisey	Register (ETC) has been set low to reduce objectionable air noise.
NPA	No provision to adjust; requires installation of volume damper / face damper
NI	Outlet not installed
NW	Device not working
TP	Test point location for duct traverse and/or static pressure
PT	Poor take -off / inlet flex to VAV box causing turbulence / probable cause for low flow
RAW	Raw opening -- Ductwork and collar is installed; register (etc.) is missing; tap is balanced high to compensate.
Set High	Set high due to missing register and/or to maintain total room flow (etc).
T'stat REV	The t'stat is reverse or opposite of design
T'stat LOC	T'stat not in area served
VD FO	Volume Dampers are in their maximum open position
VD FC	Volume Dampers are in their full closed position
VAV	Variable air volume box
CAV	Constant Volume Box
FPVAV	Fan powered variable air volume box
Register Types	
CD	Ceiling Diffuser
CR	Ceiling Register
EC	Egg Crate Type register
ER	Exhaust Register
FH	Fume Hood
LD	Linear Diffuser
LT	Light Troffer
WMS	Wire Mesh Screen
TR	Top Register
BR	Bottom Register
RAW	Raw opening
No CC	Flow metering device not installed, temp/pressure differential across elements used to determine flow.
Simulated flow	Where available pump or fan capacity is less than the total flow requirements, flow temporarily restricted to other parts.

TAB Equipment List dL Flow Tech NEBB CERT# 2582

FUNCTION	RANGE	MINIMUM ACCURACY	INSTRUMENT INFORMATION
Rotating Measurement	0 to 5000 RPM	+/- 2% of reading, +/- 2 RPM	Shimpo DT 207L
Temperature Measurement	Air: 40-140 Immersion: 40-140 Contact: 40-140	0.1 % + 1,4 degrees F (for all)	Make and Model: Shortridge ADM 860
Electrical Measurement	0 to 600 VAC 0 to 100 Amps	+/-2% +/-5 digits +/-2% +/- 5 digits	Make and Model: Fluke 323 Clamp On Meter
Air Pressure Measurement	0 to 10.00 in. w.g.	+/-2% +/- 0.0001 in. w.g.	Make and Model: Shortridge ADM 860
Air Velocity Measuring Rotating Vane	50-2500 FPM	+/-5% of reading	Make and Model: Testo
Humidity Measurement	10 - 90% RH	+/-3% RH	Make and Model: Extech RH390
Direct Reading Hood	100-2000 CFM	+/-5% of reading, +/- 5 cfm	Make and Model: Shortridge ADM 860
Pitot Tubes (2 required)	adequate length and width for intended use	N/A	
Hydronic Pressure Measuring	-30"hg - 60psi 0-100 psi 0-200 ps1	+/-2% of reading, +/- 1 psi +/-2% of reading, +/- 1 psi +/-2% of reading, +/- 1 psi	Shortridge HDM 250
Hydronic DP Measurement	0-100 in. W.G. 0-100 ft. W.G.	+/-2% of reading, +/- 2 in. w.g. +/-2% of reading, +/- 0.2 ft. w.g.	Shortridge HDM 250
Ultrasonic Flow Meter (Optional)	0.5" to 24" dia.	+/-1% of reading	Make and Model: Fuji FSCS

**All instrumentaion meets or exceeds NEBB Standards. Certificates are available upon request.



Firm Certification

DL FLOW TECH, INC.

**HAS MET ALL REQUIREMENTS FOR NEBB CERTIFIED
STATUS IN THE FOLLOWING DISCIPLINE**

Testing, Adjusting and Balancing of Environmental Systems

2582

NEBB Certification Number

March 31, 2022

Expiration Date

NEBB President

NEBB President-Elect

EXHIBIT B

Schedule of Insurance

The Contractor shall purchase and maintain insurance of the following types of coverage and limits of liability through insurance carriers licensed to provide insurance in the State of New York and have an A. M. Best Company rating of "A" or better. These insurances shall be maintained by the Contractor and its Subcontractors prior to the earlier of the commencement of work or the effective date of the Contract, whichever comes first, through and including any warranty period along with and including any Completed Operations requirements. These insurances shall be purchased at Contractor's own expense.

In no event shall the failure of the Owner to verify coverage, receive or require certification of coverage or identify deficiencies in any insurance provided by Contractor relieve Contractor from any insurance or contractual obligations set forth herein. All obligations to procure and maintain the following insurance are separate and independent of the duty to furnish certified copies or certificates of such insurance policies.

- 1) Commercial General Liability (CGL)
 - a) CGL with limits of Insurance of not less than Two Million Dollars and Zero Cents (\$2,000,000.00) each occurrence and Four Million Dollars and Zero Cents» (\$ 4,000,000.00) Annual Aggregate.
 - b) CGL coverage shall be written on ISO Occurrence form CG 00 01 10 01 or a substitute form providing equivalent coverage and shall cover liability arising from premises, operations, products, completed operations, personal & advertising injury and independent contractors as well as liability assumed in a Contract including the Tort Liability of another assumed in a contract.
 - c) The policy shall be endorsed for the General Aggregate to apply separately to this project.
 - d) The Owner, Owner's consultants and its agents ("additional insureds") shall be included as insureds/additional insureds on the CGL, using ISO Additional Insured Endorsement CG 20 10 11 85 or an endorsement providing equivalent coverage to the additional insureds for both on-going operations and completed operations. This insurance for the additional insureds shall be as broad as the coverage provided for the named insured Contractor. Coverage for the additional insureds shall apply as primary insurance (hereinafter called "Primary") before any other insurance or self-insurance, including any deductible, maintained by, or provided to the additional insureds and shall not require the contribution of any of the insurances available to the Additional Insureds (hereinafter called "Non-contributory), evidenced by ISO Endorsement Form CG 20 01 04 13 or equivalent.
 - e) Contractor shall maintain CGL coverage as set forth herein for itself and all additional insureds for the duration of the project and maintain Completed Operations coverage for itself and each additional insured for at least 2 years after completion of the Work.
- 2) Business Automobile Liability
 - a) Business Auto Liability (BAL) with limits of at least One Million Dollars and Zero Cents (\$1,000,000.00) each accident.
 - b) Business Auto coverage must include coverage for liability arising out of all owned, leased, hired and non-owned automobiles.
 - c) Owner shall be included as an insured on the auto policy.
- 3) Workers Compensation and Employers Liability
 - a) Workers Compensation at statutory levels.
 - b) Employers Liability Insurance limits of at least \$1,000,000 each accident for bodily injury by accident and \$1,000,000 each employee for injury by disease.
 - c) Where applicable, U.S. Longshore & Harborworkers Compensation Act, Maritime Coverage and Voluntary Compensation Endorsements shall be attached to the policy.
 - d) Coverage is required for those who are statutorily exempt i.e. Sole Proprietors, Partners, Limited Liability Members or Executive Officers.
- 4) Umbrella/Excess Liability

Umbrella Liability Policy with limits of Insurance of not less than Five Million Dollars and Zero Cents (5,000,000.00) each occurrence/aggregate. Coverage is in excess of Contractor's CGL, Business Auto and Employer's Liability and must name additional insureds as set forth above in paragraph 1(d).

Unless otherwise specified in the Contract Documents, Contractor may maintain Excess/Umbrella insurance, providing excess coverage over all limits for Employers Liability, Commercial General Liability and Automobile Liability to satisfy the limits required above.

- 5) Property Insurance

Property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees, if any, as loss payees.

Waiver of Subrogation

All insurance policies maintained by the Contractor shall include a waiver of any and all rights of subrogation of the Contractor or its Insurers against the Owner, along with all other Additional Insureds / Indemnified Parties and their agents, officers, directors and employees for recovery of damages. Contractor further waives its right of subrogation against the Owner or any Additional Insured or Indemnified Party for any damage or loss to the Contractor's scope of work, tools, equipment, materials or any other loss within the scope of any insurance maintained by Contractor.

Notice of Cancellation

All insurance coverage required herein shall be endorsed that the Insurer providing such coverage shall provide Owner thirty (30) days written notice of non-renewal or ten (10) days notice of cancellation for non-payment. In the event the Insurer is unable to provide such endorsement, the Contractor agrees that it is its responsibility to provide such notice to the Owner as soon as practically possible but in no event more than seven (7) days from when they receive notice of the non-renewal or cancellation. Failures to advise the Owner of cancellation or to maintain the insurance coverages outlined herein shall constitute of Breach of Contract allowing the Owner to terminate the Contract and suspend all payments until such time that the Contractor has provided evidence that the affected coverage have been reinstated or replaced as of the date of non-renewal or cancellation.

No Limitation

Insurance coverages outlined herein, maintained or not, by the Owner shall not be interpreted to limit any of the Contractor's indemnity obligations or other liabilities under the Contract Documents. Insurance coverages maintained by the Contractor that exceed the minimum requirements of this agreement shall be applicable to this Project and available to the Additional Insureds and Indemnitees.

Certificate / Evidences of Insurance

An ACORD 25 - Certificate of Liability Insurance and ACORD 855 – New York Construction Certificate of Liability Insurance Addendum shall be provided reflecting “all work performed by the Contractor for the Owner” and all of the above coverages. The Copies of All Policies including Endorsements reflecting Additional Insured status, Primary and Non-Contributory Coverage, Waiver of Subrogation and Notice of Cancellation/Change on the above policies must be attached to the Certificate of Insurance as evidence that the Contractor is compliant with its Contractual requirements. Failure to provide the necessary coverages, Certificates and/or Policies or Endorsements may preclude the Contractor from working or any payments being made to the Contractor.



DASNY

ANDREW M. CUOMO
Governor

ALFONSO L. CARNEY, JR.
Chair

REUBEN R. MCDANIEL, III
President & CEO

March 15, 2021

VIA EMAIL

Mr. Arthur Glass
Vice President for Finance and Administration
Mount Saint Mary College
330 Powell Avenue
Newburgh, NY 12550

*Re: New York State Higher Education Capital Matching Grant ("HECap")
Guzman Hall Renovation
Project ID: 24287*

Dear Mr. Glass:

We are pleased to inform you that, based on the Application submitted by Mount Saint Mary College (the "Institution") in response to the Higher Education Capital Match Program (HECap) Request for Grant Applications RFP #5545 ("RGA") issued pursuant to Chapter 63 of the Laws of 2005, as amended (the "HECap Statute"), the HECap Board has awarded a HECap grant in the amount of \$1,042,414 to your organization (the "Grant Award"). This Grant Award was made following a competitive review process performed in accordance with the procedures and criteria set forth in the RGA and the HECap Statute. The Dormitory Authority of the State of New York ("DASNY") serves as staff to the HECap Board.

Please note that this letter is not a final commitment to disburse the Grant Award. The Grant Award is subject to compliance with the conditions set forth in this award letter and the RGA.

The sole source of funds for the HECap grant program will be bond proceeds, which by law may only be used for certain eligible purposes. DASNY, in consultation with bond and tax counsel, shall determine whether the purposes and costs described by the Institution are eligible for payment from the HECap Grant Award. Although a preliminary determination has been made as to eligibility, updated information is required before a Grant Disbursement Agreement will be forwarded for execution. Please note that all requested information and documentation must be provided to DASNY before final approval of the Grant Award. Accordingly, ***please forward the information set forth below via e-mail to HECapRFPCoordinator@dasny.org***

- Update on the status of the project to be funded by the HECap Grant Award;
- If the budget and timeline has changed since the initial Application was submitted, please provide an updated budget and timeline as well as any updates to the information provided in the application with respect to committed funding sources that will be utilized to meet the 3:1 match requirement or pay project costs in addition to the HECap Grant;
- If the construction contracts were not provided with the initial Application, please provide the construction contracts for the entire project to be funded with the HECap Grant Funds and **tab the page that contains the Appendix B: Standard Clauses for Higher Education Capital Matching Grant Program Contracts.**
 - Compliance with the requirements outlined in Appendix B is required by the enabling legislation for the HECap program and must be documented prior to the execution of a Grant Disbursement Agreement and payment of any grant funds to the Grantee.
 - The HECap enabling legislation requires Grantees to voluntarily comply with the provisions of Article 15-A of the Executive Law. In accordance with this requirement, goals may be established for MWBE participation. Generally, for State contracts, a 30% MWBE participation rate is required—18% minority-owned businesses and 12% women-owned businesses. In order to demonstrate compliance with this requirement, Grantees must provide a utilization plan to DASNY for approval setting forth the contractors it plans to use in connection with the project. Alternatively, in the event that the percentage goals cannot be met, Grantees must demonstrate that they made good faith efforts to retain MWBE contractors. These documents are located on DASNY's website on the Request for Grant Application page (<https://www.dasny.org/about-us/what-we-do/grants-administration/hecap-board>).
 - Neither DASNY nor the HECap Board has the authority to waive this statutory mandate.
- In accordance with NYS Comptroller guidelines, please be sure that the Institution maintains and updates the Vendor Responsibility Questionnaire ("VRQ") on file through the New York State VendRep System (<https://portal.osc.state.ny.us/Enrollment/login>);
- In accordance with the New York State Grants Reform Gateway guidelines as well as DASNY's Policy, please be sure that the Institution updates and maintains the Institution's Document Vault and the status of Prequalification or exemption is kept current.
- Site control is required to evidence that the Grantee has sufficient authorization and control to undertake the project at the project location. In order to verify the Grantee owns, leases, or otherwise has control over the site where the project will be located, please provide a copy of the deed, lease, or other document evidencing site control by the Grantee. In the case of a vehicle purchase, title and registration will be needed at the time that requisitions for Grant funds are submitted. DASNY will also need to know the location for where the vehicle will be kept.
- Please note that in order to verify that we enter into a Grant Disbursement Agreement with the appropriate Grantee, we will need to review the incorporation papers or the charter for the Grantee organization and verify that the Grantee is authorized to do business in the State of New York. If the Grantee has a D/B/A, we will need the paperwork establishing the D/B/A as well.
- Provide an updated Proof of Workers' Compensation Coverage and Proof of Disability Benefits Coverage in the form of one of the following:

Proof of Workers' Compensation Coverage

- **Form C-105.2** – Certificate of Workers' Compensation Insurance issued by private insurance carriers, or **Form U-26.3** issued by the State Insurance Fund³; or
- **Form SI-12** – Certificate of Workers' Compensation Self-Insurance; or **Form GSI-105.2**⁵ Certificate of Participation in Workers' Compensation Group Self-Insurance; or
- **CE-200** – Certificate of Attestation of Exemption from NYS Workers' Compensation and/or Disability Benefits Coverage.

Please note – an ACORD form is not acceptable proof of New York State workers' compensation or disability benefits insurance coverage.

The Forms where a certificate holder can be indicated, please indicate that it is with the **Dormitory Authority of the State of New York on behalf of the Higher Education Capital Match Program (HECap) Board, 515 Broadway, Albany, NY 12207**

Proof of Disability Benefits Coverage

- **Form DB-120.1** - Certificate of Disability Benefits Insurance; or
- **Form DB-155** - Certificate of Disability Benefits Self-Insurance; or
- **CE-200** – Certificate of Attestation of Exemption from New York State Workers' Compensation and/or Disability Benefits Coverage.

In addition, please provide the following documents provided as attachments to this letter:

- **W-9 Form**

- This form is utilized to set up the Grantee as a vendor in the DASNY's financial system. The Grantee's Federal Employer Identification Number (FEIN) or Taxpayer Identification Number (TIN) is required to make payment. Please be sure that the FEIN number and Legal Organization name (as well as any d/b/a) is accurately reflected on the W-9. The Legal Organization name and FEIN should match the Legal Organization name and FEIN that the Internal Revenue Service has on file for the Grantee which should also correspond with the Grantee's Incorporation Papers.

- **Grantee Certification**

- Certain laws prohibit the use of public funds to finance religious programs or programs that may favor one religion over another. As the issuer of the bonds that will finance the project to be funded with Grant funds, DASNY must verify that it is in compliance with all applicable Federal and State laws and regulations.

Accordingly, please review the attached Grantee Certification (at the end of this letter) to ensure it accurately states the purposes for which the Grant funds will be used. Please arrange for two Authorized Officers of your organization to sign the Grantee Certification.

An Environmental Manager from DASNY's Office of Environmental Affairs (OEA) will be contacting you regarding the environmental review required pursuant to the State Environmental Quality Review Act (SEQRA). If an



environmental review for this project has already been undertaken, you will be asked to provide a copy of the SEQR determination.

For your convenience, we have enclosed a form cover letter for you to use when you return the completed documents to DASNY. **Incomplete documents will delay the processing the HECap funding.** You will be contacted during the review process if additional information is needed.

Should you have any questions concerning this Award Letter or whether certain information is needed from the Institution, please address your inquiry to HECapRFPCoordinator@dasny.org (include the name of the Institution, the grant program and project identification number in the subject line of the e-mail). A webinar will be announced in the near future whereby DASNY will outline the process. The date of the webinar will be posted on the DASNY website.

Very truly yours,

A handwritten signature in black ink that reads "Sara Richards". The signature is written in a cursive, flowing style.

Sara Richards
Managing Senior Director, Governance & Administration

PLEASE PRINT ON GRANTEE LETTERHEAD

Grants Administration
DASNY
515 Broadway
Albany, New York 12207

RE: *Higher Education Capital Match Program Competitive Round Grant ("HECap-CR")*
Guzman Hall Renovation
Project ID: #24287

Dear Grants Administration:

Enclosed please find the following documents in connection with the HECap-CR Grant awarded to our organization:

1. Status of Project
2. Updated Budget and Timeline
3. Evidence of Committed Funding Sources
4. Construction Contracts with Appendix B: Standard Clauses for Higher Education Capital Matching Grant Program Contracts tabbed.
5. Exhibit F1: HECap MWBE Utilization Plan and/or Exhibit F2: MWBE Waiver Request
5. Proof of Workers' Compensation Coverage
6. Proof of Disability Benefits Coverage
7. Completed and signed W-9 with correct Legal Organization Name and Tax ID number filled in
8. Evidence of Site Control
9. Articles of Incorporation or Charter
10. Completed Grantee Certification signed by two authorized officers

If any further information is needed or if you have any questions, please give [Grantee Contact Person] a call at () _____.

Signature

Print Name

Title

Enclosures

APPENDIX B

STANDARD CLAUSES FOR HIGHER EDUCATION CAPITAL MATCHING GRANT PROGRAM CONTRACTS

The parties, the Contractor and the College, to the attached agreement (the "Contract") acknowledge that the performance of their obligations under the Contract must comply with the requirements of Part U of chapter 63 of the Laws of 2005, as amended, including, by reference, the applicable provisions of Article 9 of the State Finance Law, Article 15-A of the Executive Law and Articles 8, 9 and 10 of the Labor Law. In order to insure such compliance, the Contractor and the College hereby agree to be bound by all such requirements. The following clauses, which are intended to either explain such requirements or to add additional requirements, are hereby made part of the Contract. The numbered clauses which follow are not intended to be a complete listing of the requirements referenced above:

1. **GOVERNING LAW.** The Contract shall be governed by the laws of the State of New York.
2. **APPROVAL BY THE STATE.** In accordance with Part U of Chapter 63 of the Laws of 2005, as amended, the Contract is subject to the approval of the Comptroller of the State of New York, and, as to form, by the Attorney General of the State of New York.
3. **NON-ASSIGNMENT CLAUSE.** In accordance with Section 138 of the State Finance Law, the Contract may not be assigned by the Contractor or its right, title or interest therein assigned, transferred, conveyed, sublet or otherwise disposed of without the previous consent, in writing, of the College and any attempts to assign the Contract without the College's written consent are null and void.
4. **RECORDS.** The Contractor and the College shall establish and maintain complete and accurate books, records, documents, accounts and other evidence directly pertinent to performance under the Contract (hereinafter, collectively, "the Records"). The Records must be kept for the balance of the calendar year in which they were made and for six (6) additional years thereafter. The State Comptroller, the Attorney General and any other person or entity authorized to conduct an examination, shall have access to the Records during normal business hours at an office of the Contractor or at the College within the State of New York or, if no such office is available, at a mutually agreeable venue within the State, for the term specified above for the purposes of inspection, auditing and copying.
5. **INDEMNIFICATION.** Neither the HECap Board, DASNY, nor the State of New York shall in any event whatsoever be liable for any injury or damage, cost or expense of any nature whatsoever that occurs as a result of or in any way in connection with the Project and the Grantee hereby agrees to indemnify and hold harmless the HECap Board, DASNY, and the State and their respective agents, officers, employees and directors (collectively, the "Indemnitees") from and against any and all such liability and any other liability for injury or damage, cost or expense resulting from the payment of the Grant by the HECap Board to the Grantee or use of the Project in any manner, including in a manner which, if the bonds are issued on a tax-exempt basis, (i) results in the interest on the bonds issued by DASNY the

Page two – Appendix B
Standard Clauses For Higher Education Capital Matching Grant Contract

proceeds of which were used to fund the Grant (the “Bonds”) to be includable in gross income for federal income tax purposes or (ii) gives rise to an allegation against DASNY by a governmental agency or authority, which DASNY defends that the interest on the Bonds is includable in gross income for federal income tax purposes, other than that caused by the gross negligence or the willful misconduct of the Indemnitees.

6. **CONFLICTING TERMS.** In the event of a conflict between the terms of the Contract (including any and all attachments thereto and amendments thereof) and the terms of this Appendix B, the terms of Appendix A: Standard Clauses for NYS Contracts (attached), shall control.
7. **WAGE AND HOURS PROVISIONS.** In accordance with Part U of Chapter 63 of the Laws of 2005, as amended, the Contractor and the College agree to comply with the requirements of Articles 8, 9 and 10 of the New York State Labor Law. Neither Contractor’s employees nor the employees of its subcontractors may be required or permitted to work more than the number of hours or days stated in said statutes, except as otherwise provided in the Labor Law and as set forth in prevailing wage and supplement schedules issued by the State Labor Department. Contractor and its subcontractors must pay at least the prevailing wage rate and pay or provide the prevailing supplements, including the premium rates for overtime pay, as determined by the State Labor Department in accordance with the Labor Law.
8. **MINORITY AND WOMEN OWNED BUSINESS REQUIREMENTS.** In accordance with Part U of Chapter 63 of the Laws of 2005, as amended, the Contractor and the College agree to comply with the requirements of Article 15-A of the New York Executive Law.

STANDARD CLAUSES FOR NYS CONTRACTS

The parties to the attached contract, license, lease, amendment or other agreement of any kind (hereinafter, "the contract" or "this contract") agree to be bound by the following clauses which are hereby made a part of the contract (the word "Contractor" herein refers to any party other than the State, whether a contractor, licensor, licensee, lessor, lessee or any other party):

1. EXECUTORY CLAUSE. In accordance with Section 41 of the State Finance Law, the State shall have no liability under this contract to the Contractor or to anyone else beyond funds appropriated and available for this contract.

2. NON-ASSIGNMENT CLAUSE. In accordance with Section 138 of the State Finance Law, this contract may not be assigned by the Contractor or its right, title or interest therein assigned, transferred, conveyed, sublet or otherwise disposed of without the State's previous written consent, and attempts to do so are null and void. Notwithstanding the foregoing, such prior written consent of an assignment of a contract let pursuant to Article XI of the State Finance Law may be waived at the discretion of the contracting agency and with the concurrence of the State Comptroller where the original contract was subject to the State Comptroller's approval, where the assignment is due to a reorganization, merger or consolidation of the Contractor's business entity or enterprise. The State retains its right to approve an assignment and to require that any Contractor demonstrate its responsibility to do business with the State. The Contractor may, however, assign its right to receive payments without the State's prior written consent unless this contract concerns Certificates of Participation pursuant to Article 5-A of the State Finance Law.

3. COMPTROLLER'S APPROVAL. In accordance with Section 112 of the State Finance Law (or, if this contract is with the State University or City University of New York, Section 355 or Section 6218 of the Education Law), if this contract exceeds \$50,000 (or the minimum thresholds agreed to by the Office of the State Comptroller for certain S.U.N.Y. and C.U.N.Y. contracts), or if this is an amendment for any amount to a contract which, as so amended, exceeds said statutory amount, or if, by this contract, the State agrees to give something other than money when the value or reasonably estimated value of such consideration exceeds \$25,000, it shall not be valid, effective or binding upon the State until it has been approved by the State Comptroller and filed in his office. Comptroller's approval of contracts let by the Office of General Services is required when such contracts exceed \$85,000 (State Finance Law § 163.6-a). However, such pre-approval shall not be required for any contract established as a centralized contract through the Office of General Services or for a purchase order or other transaction issued under such centralized contract.

4. WORKERS' COMPENSATION BENEFITS. In accordance with Section 142 of the State Finance Law, this contract shall be void and of no force and effect unless the

Contractor shall provide and maintain coverage during the life of this contract for the benefit of such employees as are required to be covered by the provisions of the Workers' Compensation Law.

5. NON-DISCRIMINATION REQUIREMENTS. To the extent required by Article 15 of the Executive Law (also known as the Human Rights Law) and all other State and Federal statutory and constitutional non-discrimination provisions, the Contractor will not discriminate against any employee or applicant for employment, nor subject any individual to harassment, because of age, race, creed, color, national origin, sexual orientation, gender identity or expression, military status, sex, disability, predisposing genetic characteristics, familial status, marital status, or domestic violence victim status or because the individual has opposed any practices forbidden under the Human Rights Law or has filed a complaint, testified, or assisted in any proceeding under the Human Rights Law. Furthermore, in accordance with Section 220-e of the Labor Law, if this is a contract for the construction, alteration or repair of any public building or public work or for the manufacture, sale or distribution of materials, equipment or supplies, and to the extent that this contract shall be performed within the State of New York, Contractor agrees that neither it nor its subcontractors shall, by reason of race, creed, color, disability, sex, or national origin: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. If this is a building service contract as defined in Section 230 of the Labor Law, then, in accordance with Section 239 thereof, Contractor agrees that neither it nor its subcontractors shall by reason of race, creed, color, national origin, age, sex or disability: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. Contractor is subject to fines of \$50.00 per person per day for any violation of Section 220-e or Section 239 as well as possible termination of this contract and forfeiture of all moneys due hereunder for a second or subsequent violation.

6. WAGE AND HOURS PROVISIONS. If this is a public work contract covered by Article 8 of the Labor Law or a building service contract covered by Article 9 thereof, neither Contractor's employees nor the employees of its subcontractors may be required or permitted to work more than the number of hours or days stated in said statutes, except as otherwise provided in the Labor Law and as set forth in prevailing wage and supplement schedules issued by the State Labor Department. Furthermore, Contractor and its subcontractors must pay at least the prevailing wage rate and pay or provide the prevailing supplements, including the premium rates for overtime pay, as determined by the State Labor Department in accordance with the Labor Law. Additionally, effective April 28, 2008, if this is a public work contract covered by Article 8 of the Labor Law, the Contractor understands and agrees that the filing of payrolls in a manner consistent with Subdivision 3-

a of Section 220 of the Labor Law shall be a condition precedent to payment by the State of any State approved sums due and owing for work done upon the project.

7. NON-COLLUSIVE BIDDING CERTIFICATION. In accordance with Section 139-d of the State Finance Law, if this contract was awarded based upon the submission of bids, Contractor affirms, under penalty of perjury, that its bid was arrived at independently and without collusion aimed at restricting competition. Contractor further affirms that, at the time Contractor submitted its bid, an authorized and responsible person executed and delivered to the State a non-collusive bidding certification on Contractor's behalf.

8. INTERNATIONAL BOYCOTT PROHIBITION. In accordance with Section 220-f of the Labor Law and Section 139-h of the State Finance Law, if this contract exceeds \$5,000, the Contractor agrees, as a material condition of the contract, that neither the Contractor nor any substantially owned or affiliated person, firm, partnership or corporation has participated, is participating, or shall participate in an international boycott in violation of the federal Export Administration Act of 1979 (50 USC App. Sections 2401 et seq.) or regulations thereunder. If such Contractor, or any of the aforesaid affiliates of Contractor, is convicted or is otherwise found to have violated said laws or regulations upon the final determination of the United States Commerce Department or any other appropriate agency of the United States subsequent to the contract's execution, such contract, amendment or modification thereto shall be rendered forfeit and void. The Contractor shall so notify the State Comptroller within five (5) business days of such conviction, determination or disposition of appeal (2 NYCRR § 105.4).

9. SET-OFF RIGHTS. The State shall have all of its common law, equitable and statutory rights of set-off. These rights shall include, but not be limited to, the State's option to withhold for the purposes of set-off any moneys due to the Contractor under this contract up to any amounts due and owing to the State with regard to this contract, any other contract with any State department or agency, including any contract for a term commencing prior to the term of this contract, plus any amounts due and owing to the State for any other reason including, without limitation, tax delinquencies, fee delinquencies or monetary penalties relative thereto. The State shall exercise its set-off rights in accordance with normal State practices including, in cases of set-off pursuant to an audit, the finalization of such audit by the State agency, its representatives, or the State Comptroller.

10. RECORDS. The Contractor shall establish and maintain complete and accurate books, records, documents, accounts and other evidence directly pertinent to performance under this contract (hereinafter, collectively, the "Records"). The Records must be kept for the balance of the calendar year in which they were made and for six (6) additional years thereafter. The State Comptroller, the Attorney General and any other person or entity authorized to conduct an examination, as well as the

agency or agencies involved in this contract, shall have access to the Records during normal business hours at an office of the Contractor within the State of New York or, if no such office is available, at a mutually agreeable and reasonable venue within the State, for the term specified above for the purposes of inspection, auditing and copying. The State shall take reasonable steps to protect from public disclosure any of the Records which are exempt from disclosure under Section 87 of the Public Officers Law (the "Statute") provided that: (i) the Contractor shall timely inform an appropriate State official, in writing, that said records should not be disclosed; and (ii) said records shall be sufficiently identified; and (iii) designation of said records as exempt under the Statute is reasonable. Nothing contained herein shall diminish, or in any way adversely affect, the State's right to discovery in any pending or future litigation.

11. IDENTIFYING INFORMATION AND PRIVACY NOTIFICATION. (a) Identification Number(s). Every invoice or New York State Claim for Payment submitted to a New York State agency by a payee, for payment for the sale of goods or services or for transactions (e.g., leases, easements, licenses, etc.) related to real or personal property must include the payee's identification number. The number is any or all of the following: (i) the payee's Federal employer identification number, (ii) the payee's Federal social security number, and/or (iii) the payee's Vendor Identification Number assigned by the Statewide Financial System. Failure to include such number or numbers may delay payment. Where the payee does not have such number or numbers, the payee, on its invoice or Claim for Payment, must give the reason or reasons why the payee does not have such number or numbers.

(b) Privacy Notification. (1) The authority to request the above personal information from a seller of goods or services or a lessor of real or personal property, and the authority to maintain such information, is found in Section 5 of the State Tax Law. Disclosure of this information by the seller or lessor to the State is mandatory. The principal purpose for which the information is collected is to enable the State to identify individuals, businesses and others who have been delinquent in filing tax returns or may have understated their tax liabilities and to generally identify persons affected by the taxes administered by the Commissioner of Taxation and Finance. The information will be used for tax administration purposes and for any other purpose authorized by law. (2) The personal information is requested by the purchasing unit of the agency contracting to purchase the goods or services or lease the real or personal property covered by this contract or lease. The information is maintained in the Statewide Financial System by the Vendor Management Unit within the Bureau of State Expenditures, Office of the State Comptroller, 110 State Street, Albany, New York 12236.

12. EQUAL EMPLOYMENT OPPORTUNITIES FOR MINORITIES AND WOMEN. In accordance with Section 312 of the Executive Law and 5 NYCRR Part 143, if this contract is: (i) a written agreement or purchase order instrument, providing for a total expenditure in excess of

\$25,000.00, whereby a contracting agency is committed to expend or does expend funds in return for labor, services, supplies, equipment, materials or any combination of the foregoing, to be performed for, or rendered or furnished to the contracting agency; or (ii) a written agreement in excess of \$100,000.00 whereby a contracting agency is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon; or (iii) a written agreement in excess of \$100,000.00 whereby the owner of a State assisted housing project is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon for such project, then the following shall apply and by signing this agreement the Contractor certifies and affirms that it is Contractor's equal employment opportunity policy that:

(a) The Contractor will not discriminate against employees or applicants for employment because of race, creed, color, national origin, sex, age, disability or marital status, shall make and document its conscientious and active efforts to employ and utilize minority group members and women in its work force on State contracts and will undertake or continue existing programs of affirmative action to ensure that minority group members and women are afforded equal employment opportunities without discrimination. Affirmative action shall mean recruitment, employment, job assignment, promotion, upgradings, demotion, transfer, layoff, or termination and rates of pay or other forms of compensation;

(b) at the request of the contracting agency, the Contractor shall request each employment agency, labor union, or authorized representative of workers with which it has a collective bargaining or other agreement or understanding, to furnish a written statement that such employment agency, labor union or representative will not discriminate on the basis of race, creed, color, national origin, sex, age, disability or marital status and that such union or representative will affirmatively cooperate in the implementation of the Contractor's obligations herein; and

(c) the Contractor shall state, in all solicitations or advertisements for employees, that, in the performance of the State contract, all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color, national origin, sex, age, disability or marital status.

Contractor will include the provisions of "a," "b," and "c" above, in every subcontract over \$25,000.00 for the construction, demolition, replacement, major repair, renovation, planning or design of real property and improvements thereon (the "Work") except where the Work is for the beneficial use of the Contractor. Section 312 does not apply to: (i) work, goods or services unrelated to this contract; or (ii) employment outside New York State. The State shall consider compliance by a contractor or subcontractor with the requirements of any federal law concerning equal employment opportunity which effectuates the purpose of this clause. The

contracting agency shall determine whether the imposition of the requirements of the provisions hereof duplicate or conflict with any such federal law and if such duplication or conflict exists, the contracting agency shall waive the applicability of Section 312 to the extent of such duplication or conflict. Contractor will comply with all duly promulgated and lawful rules and regulations of the Department of Economic Development's Division of Minority and Women's Business Development pertaining hereto.

13. CONFLICTING TERMS. In the event of a conflict between the terms of the contract (including any and all attachments thereto and amendments thereof) and the terms of this Appendix A, the terms of this Appendix A shall control.

14. GOVERNING LAW. This contract shall be governed by the laws of the State of New York except where the Federal supremacy clause requires otherwise.

15. LATE PAYMENT. Timeliness of payment and any interest to be paid to Contractor for late payment shall be governed by Article 11-A of the State Finance Law to the extent required by law.

16. NO ARBITRATION. Disputes involving this contract, including the breach or alleged breach thereof, may not be submitted to binding arbitration (except where statutorily authorized), but must, instead, be heard in a court of competent jurisdiction of the State of New York.

17. SERVICE OF PROCESS. In addition to the methods of service allowed by the State Civil Practice Law & Rules ("CPLR"), Contractor hereby consents to service of process upon it by registered or certified mail, return receipt requested. Service hereunder shall be complete upon Contractor's actual receipt of process or upon the State's receipt of the return thereof by the United States Postal Service as refused or undeliverable. Contractor must promptly notify the State, in writing, of each and every change of address to which service of process can be made. Service by the State to the last known address shall be sufficient. Contractor will have thirty (30) calendar days after service hereunder is complete in which to respond.

18. PROHIBITION ON PURCHASE OF TROPICAL HARDWOODS. The Contractor certifies and warrants that all wood products to be used under this contract award will be in accordance with, but not limited to, the specifications and provisions of Section 165 of the State Finance Law, (Use of Tropical Hardwoods) which prohibits purchase and use of tropical hardwoods, unless specifically exempted, by the State or any governmental agency or political subdivision or public benefit corporation. Qualification for an exemption under this law will be the responsibility of the contractor to establish to meet with the approval of the State.

In addition, when any portion of this contract involving the use of woods, whether supply or installation, is to be performed by

any subcontractor, the prime Contractor will indicate and certify in the submitted bid proposal that the subcontractor has been informed and is in compliance with specifications and provisions regarding use of tropical hardwoods as detailed in § 165 State Finance Law. Any such use must meet with the approval of the State; otherwise, the bid may not be considered responsive. Under bidder certifications, proof of qualification for exemption will be the responsibility of the Contractor to meet with the approval of the State.

19. MACBRIDE FAIR EMPLOYMENT PRINCIPLES. In accordance with the MacBride Fair Employment Principles (Chapter 807 of the Laws of 1992), the Contractor hereby stipulates that the Contractor either (a) has no business operations in Northern Ireland, or (b) shall take lawful steps in good faith to conduct any business operations in Northern Ireland in accordance with the MacBride Fair Employment Principles (as described in Section 165 of the New York State Finance Law), and shall permit independent monitoring of compliance with such principles.

20. OMNIBUS PROCUREMENT ACT OF 1992. It is the policy of New York State to maximize opportunities for the participation of New York State business enterprises, including minority- and women-owned business enterprises as bidders, subcontractors and suppliers on its procurement contracts.

Information on the availability of New York State subcontractors and suppliers is available from:

NYS Department of Economic Development
Division for Small Business
Albany, New York 12245
Telephone: 518-292-5100
Fax: 518-292-5884
email: opa@esd.ny.gov

A directory of certified minority- and women-owned business enterprises is available from:

NYS Department of Economic Development
Division of Minority and Women's Business Development
633 Third Avenue
New York, NY 10017
212-803-2414
email: mwbecertification@esd.ny.gov
<https://ny.newnycontracts.com/FrontEnd/VendorSearchPublic.asp>

The Omnibus Procurement Act of 1992 (Chapter 844 of the Laws of 1992, codified in State Finance Law § 139-i and Public Authorities Law § 2879(3)(n)-(p)) requires that by signing this bid proposal or contract, as applicable, Contractors certify that whenever the total bid amount is greater than \$1 million:

(a) The Contractor has made reasonable efforts to encourage the participation of New York State Business Enterprises as suppliers and subcontractors, including certified minority- and

women-owned business enterprises, on this project, and has retained the documentation of these efforts to be provided upon request to the State;

(b) The Contractor has complied with the Federal Equal Opportunity Act of 1972 (P.L. 92-261), as amended;

(c) The Contractor agrees to make reasonable efforts to provide notification to New York State residents of employment opportunities on this project through listing any such positions with the Job Service Division of the New York State Department of Labor, or providing such notification in such manner as is consistent with existing collective bargaining contracts or agreements. The Contractor agrees to document these efforts and to provide said documentation to the State upon request; and

(d) The Contractor acknowledges notice that the State may seek to obtain offset credits from foreign countries as a result of this contract and agrees to cooperate with the State in these efforts.

21. RECIPROCITY AND SANCTIONS PROVISIONS.

Bidders are hereby notified that if their principal place of business is located in a country, nation, province, state or political subdivision that penalizes New York State vendors, and if the goods or services they offer will be substantially produced or performed outside New York State, the Omnibus Procurement Act 1994 and 2000 amendments (Chapter 684 and Chapter 383, respectively, codified in State Finance Law § 165(6) and Public Authorities Law § 2879(5))) require that they be denied contracts which they would otherwise obtain. NOTE: As of October 2019, the list of discriminatory jurisdictions subject to this provision includes the states of South Carolina, Alaska, West Virginia, Wyoming, Louisiana and Hawaii.

22. COMPLIANCE WITH BREACH NOTIFICATION AND DATA SECURITY LAWS.

Contractor shall comply with the provisions of the New York State Information Security Breach and Notification Act (General Business Law § 899-aa and State Technology Law § 208) and commencing March 21, 2020 shall also comply with General Business Law § 899-bb.

23. COMPLIANCE WITH CONSULTANT DISCLOSURE LAW.

If this is a contract for consulting services, defined for purposes of this requirement to include analysis, evaluation, research, training, data processing, computer programming, engineering, environmental, health, and mental health services, accounting, auditing, paralegal, legal or similar services, then, in accordance with Section 163 (4)(g) of the State Finance Law (as amended by Chapter 10 of the Laws of 2006), the Contractor shall timely, accurately and properly comply with the requirement to submit an annual employment report for the contract to the agency that awarded the contract, the Department of Civil Service and the State Comptroller.

24. PROCUREMENT LOBBYING. To the extent this agreement is a "procurement contract" as defined by State Finance Law §§ 139-j and 139-k, by signing this agreement the contractor certifies and affirms that all disclosures made in accordance with State Finance Law §§ 139-j and 139-k are complete, true and accurate. In the event such certification is found to be intentionally false or intentionally incomplete, the State may terminate the agreement by providing written notification to the Contractor in accordance with the terms of the agreement.

25. CERTIFICATION OF REGISTRATION TO COLLECT SALES AND COMPENSATING USE TAX BY CERTAIN STATE CONTRACTORS, AFFILIATES AND SUBCONTRACTORS.

To the extent this agreement is a contract as defined by Tax Law § 5-a, if the contractor fails to make the certification required by Tax Law § 5-a or if during the term of the contract, the Department of Taxation and Finance or the covered agency, as defined by Tax Law § 5-a, discovers that the certification, made under penalty of perjury, is false, then such failure to file or false certification shall be a material breach of this contract and this contract may be terminated, by providing written notification to the Contractor in accordance with the terms of the agreement, if the covered agency determines that such action is in the best interest of the State.

26. IRAN DIVESTMENT ACT. By entering into this Agreement, Contractor certifies in accordance with State Finance Law § 165-a that it is not on the "Entities Determined to be Non-Responsive Bidders/Offerers pursuant to the New York State Iran Divestment Act of 2012" ("Prohibited Entities List") posted at: <https://ogs.ny.gov/list-entities-determined-be-non-responsive-biddersofferers-pursuant-nys-iran-divestment-act-2012>

Contractor further certifies that it will not utilize on this Contract any subcontractor that is identified on the Prohibited Entities List. Contractor agrees that should it seek to renew or extend this Contract, it must provide the same certification at the time the Contract is renewed or extended. Contractor also agrees that any proposed Assignee of this Contract will be required to certify that it is not on the Prohibited Entities List before the contract assignment will be approved by the State.

During the term of the Contract, should the state agency receive information that a person (as defined in State Finance Law § 165-a) is in violation of the above-referenced certifications, the state agency will review such information and offer the person an opportunity to respond. If the person fails to demonstrate that it has ceased its engagement in the investment activity which is in violation of the Act within 90 days after the determination of such violation, then the state agency shall take such action as may be appropriate and provided for by law, rule, or contract, including, but not limited to, imposing sanctions, seeking compliance, recovering damages, or declaring the Contractor in default.

The state agency reserves the right to reject any bid, request for assignment, renewal or extension for an entity that appears on the Prohibited Entities List prior to the award, assignment, renewal or extension of a contract, and to pursue a responsibility review with respect to any entity that is awarded a contract and appears on the Prohibited Entities list after contract award.

27. ADMISSIBILITY OF REPRODUCTION OF CONTRACT. Notwithstanding the best evidence rule or any other legal principle or rule of evidence to the contrary, the Contractor acknowledges and agrees that it waives any and all objections to the admissibility into evidence at any court proceeding or to the use at any examination before trial of an electronic reproduction of this contract, in the form approved by the State Comptroller, if such approval was required, regardless of whether the original of said contract is in existence.

GRANTEE CERTIFICATION
Mount Saint Mary College
Guzman Hall Renovation
Project ID: #24287

WE HEREBY WARRANT, REPRESENT AND CERTIFY TO DASNY that:

- The Mount Saint Mary College has applied for a Higher Education Capital Match Program Competitive Round Grant (“HECap-CR”) Grant in the amount of \$1,042,414. This Grant will be used for the Guzman Hall Renovation. We understand that the Grant funds may be used only for certain community improvement purposes as set forth in the enabling legislation and that the Grant Disbursement Agreement to be executed in connection with this Grant contains a provision that states that Grant funds may not be used to finance a program or project that will in any way promote or facilitate religious worship, instruction or proselytizing. We have been informed that this provision exists to ensure compliance with Federal and State law. Therefore, as Authorized Officers of the Mount Saint Mary College, we hereby certify the following in connection with the project to be financed by the Grant:
 - no religious purpose shall be advanced or promoted by the project or program funded by the Grant;
 - the project or program will provide no religious instruction or counseling, conduct no religious worship or services, engage in no religious proselytizing, and exert no other religious influence in the provision of services or the use of facilities or furnishings assisted in any way by public funds;
 - the project or program shall be open to all without regard to religion; and
 - the Grantee shall take affirmative steps to ensure that information is widely disseminated with respect to the following aspects of the project or program:
 - the project or program is publicly funded;
 - the project or program is open to all, regardless of religious affiliation; and
 - the project or program beneficiaries are not limited to any particular sect or group.
 - the Grantee shall exercise care to make sure the facilities and/or services to be supported in whole or in part by grant proceeds are available and accessible to all members of the public by ensuring project location(s) and/or service areas are in proximity to public transportation; sufficient parking; and by choosing project location(s) and/or service areas that do not restrict use to a certain subset of the population defined by religion;
- We understand that the State of New York, DASNY and other entities that may be involved in the Grant process are relying on the above information in making the determination whether to award a HECap-CR Grant to the Mount Saint Mary College.
- We have the authority to submit this certification on behalf of the Mount Saint Mary College.
- By signing these documents, I certify that I am an authorized officer for the Grantee.

Please sign and return these documents to DASNY at HECapRFPCoordinator@dasny.org. Please return them from the Grantee’s organizational email address and retain the original copies for production to DASNY if requested. By providing electronic signature(s), the Grantee’s designee will be providing validly binding legal documents, just the same as a pen-and-paper signature.

Authorized Officer Signature

Printed Name

Date

Title

Authorized Officer Signature

Printed Name

Date

Title

Mount Saint Mary College Community Engagement and Wellness Center

2020 Regional Grants Program

Grant #: FY20R7028

Mount Saint Mary College

Dr. Jason Norman Adsit
330 Powell Avenue
Newburgh, NY 12550

O: 845-569-3100
M: 845-670-3185

Dr. Jason Norman Adsit

330 Powell Ave.
Newburgh, NY 12550

jason.adsit@msmc.edu
O: 845-569-3202
M: 845-670-3185

FollowUp Form

Mother Cabrini Health Foundation, Inc.



Grant Agreement (the "Agreement")

Organization's Legal Name (the "Grantee")*

Mount Saint Mary College

Grant Number

FY20R7028

Grant Amount

\$425,000.00

Project Name

Mount Saint Mary College Community Engagement and Wellness Center

Grant Period Start

January 1, 2021

Grant Period End

December 31, 2021

Mother Cabrini Health Foundation, Inc. (the “Foundation”) has approved a grant (the “Grant”) to the Grantee in the amount set forth above. The Grant may be used solely for the grant purpose described in Section 1 below and in the Grantee’s Grant application, subject to such changes and addenda as requested or required by the Foundation to date (the “Proposal”). The term of the Grant is twelve (12) months, with one (1) interim report (including an interim progress report and an interim expenditure report), and a final report (including a final expenditure report) due on the dates set forth in Sections 11 and 12 hereof.

Grant Award Terms

1. Use of Funds.

Grantee agrees that it will use Grant funds solely in furtherance of the following purpose (“Grant Purpose”) to support the charitable program and activities detailed in the Proposal:

Grant Purpose:

Provide funding to establish a new Community Engagement and Wellness Center which would offer basic healthcare and other related programs to low-income residents of Newburgh while simultaneously providing students with hands-on real life experience.

Grantee shall use Grant funds only for allowable costs as agreed upon by the Foundation in accordance with the budget attached hereto as Exhibit A and the terms and conditions of this Agreement.

2. Timing of Payment.

Grantee will receive the full amount of the Grant following the Foundation’s receipt of a counter-signed Agreement.

3. Catholic Tenets and Teachings.

Grantee agrees to use the Grant funds in compliance with the ethical principles, tenets, and teachings of the Roman Catholic Faith including, but not limited to, the Ethical and Religious Directives for Catholic Health Care Services published by the United States Conference of Catholic Bishops, and other applicable guidelines promulgated by the United States Conference of Catholic Bishops, as directed by the Foundation.

4. Permissible Activities.

Grantee acknowledges and agrees to the following requirements on the use of Grant funds:

- The Grant will only be used for programs and activities that are within the scope of Section 501(c)(3) of the Internal Revenue Code of 1986, as amended (the “Code”).
- No part of the Grant shall be used to supplant existing government funding, although Grant funds may be used to augment services funded by government sources.
- The Grant shall not result in private inurement or personal benefit of any kind.
- No part of the Grant shall be used to fulfill a personal or corporate pledge of financial support.
- No part of the Grant shall be used in exchange for payment for tickets to benefit events, auction items or membership.
- No part of the Grant shall be used to: (i) carry on propaganda, or otherwise to attempt to influence any legislation; or (ii) influence the outcome of any specific election or to participate or intervene in any political campaign on behalf of, or in opposition to, any candidate for public office.

- Grant funds shall be used in accordance with all applicable local, state or federal laws, regulations, rules and ordinances. Without limiting the foregoing, no part of the Grant shall be used for the purpose of influencing any actions or decisions or bribing of any government official, or otherwise in violation of the Foreign Corrupt Practices Act or similar law.

5. Changes to Proposal.

Grantee agrees to promptly notify the Foundation in writing of any proposed modifications to its Proposal, including as to the purpose, character, or method of operation of the Proposal. Any such changes to the Proposal must be approved in writing by the Foundation prior to their implementation. With regard to budgetary line-items, Grantee must request prior written approval by the Foundation of any proposed reallocation of a budgetary line-item that reduces or increases the line item by 10% or \$10,000, whichever is greater, based on the approved itemized budget provided in Exhibit A hereto.

6. Reimbursement.

Grantee represents that it has not sought nor has it obtained reimbursement from any source, including any government agency or insurance company, for the amounts for which it is seeking Grant funds hereunder. Grantee further represents that it has not sought nor has it obtained any duplicative funding for the Grant Purpose from any other source, including any individual, foundation, corporation or government agency, for the amounts for which it is seeking Grant funds hereunder. Grantee will promptly notify the Foundation if it receives any such reimbursement or duplicative funding, and agrees that it will either return the applicable Grant funds to the Foundation or redirect an equivalent amount to another charitable purpose pre-approved in writing by the Foundation.

7. Re-Granting

Grantee shall not re-grant any Grant funds to other organizations without prior written approval of the Foundation. If such written approval has been provided by the Foundation, Grantee agrees to take all necessary steps satisfactory to the Foundation to ensure that the sub-grantee will be subject to the terms and conditions of this Agreement, including the requirements related to adherence with the ethical principles, tenets, and teachings of the Roman Catholic Faith and the Ethical and Religious Directives for Catholic Health Care Services published by the United States Conference of Catholic Bishops.

8. Notice of Key Developments.

Grantee shall notify the Foundation in a timely manner of changes in key personnel, significant difficulties in making use of the Grant funds in accordance with the Proposal, the inability to expend the Grant funds within the Grant term, or material changes to its overall financial position or solvency. Grantee agrees that it will notify the Foundation immediately of any actual or threatened change in its tax exempt status under Section 501(c)(3) of the Internal Revenue Code (the "Code").

9. Records and Licenses.

Grantee shall maintain all financial records and all records pertaining to the use of the Grant, including receipts and records of Grant expenditures, and make such records available to the Foundation upon request. Grantee also agrees to maintain documentation of current licensure for all professionally licensed staff, as applicable, and to make such records available to the Foundation upon request.

10. Evaluation.

Grantee agrees to permit the Foundation and/or its authorized representatives to conduct an evaluation of the Grantee and the progress of the Grant, which may require in-person or virtual site visits by the Foundation's representatives to observe Grantee's program procedures and operations as well as discussions with Grantee's personnel.

11. Interim Report.

Using the templates to be provided by the Foundation, Grantee shall submit an interim progress report to the Foundation detailing the progress made in accomplishing the Grant Purpose and an interim expenditure report detailing the expenditure of Grant funds. The interim reports shall be due by August 15, 2021 and cover the period from January 1, 2021 – June 30, 2021. Grantee agrees to provide the Foundation with such additional information concerning the Grant as may be requested by the Foundation.

12. Final Report.

Using the template to be provided by the Foundation, Grantee shall submit a final report to the Foundation concerning the Grantee's use of the Grant, along with a final expenditure report for the entire Grant period. The final report, including the final expenditure report, will detail the accomplishments achieved during the entire Grant period, any significant circumstances or problems encountered by the Grantee in administering the Grant, and efforts made to resolve them. The final report, including the final expenditure report, is due by February 15, 2022 and will cover the entire Grant period from January 1, 2021 – December 31, 2021. Grantee agrees to provide the Foundation with such additional information concerning the Grant as may be requested by the Foundation.

13. Nondiscrimination.

Grantee shall ensure that no person will, regardless of race, color, religion, national origin, sex, age or disability, be excluded from participation in, be denied benefits of, or be subjected to unlawful discrimination under any program or activity funded by the Foundation.

14. Compliance with Laws.

Grantee shall comply with all applicable local, state and Federal laws and regulations during the term of the Grant, as well as the terms and conditions set forth herein.

15. Publicity.

Grantee agrees to obtain written approval from the Foundation prior to using or referencing the name or emblem of the Foundation, including issuing any press releases or otherwise making any public statement referring to the Grant or the Foundation or using the Foundation's name, logo or emblem. Any approved publicity regarding the Grant or the Foundation must include an acknowledgement that the project was supported by a "Grant of the Mother Cabrini Health Foundation." Approved public announcements and releases about the Grant must be coordinated with the Foundation. To coordinate any such proposed announcements, please contact communications@cabrinihealth.org.

16. Recapture of Funds.

Grantee agrees to comply with the terms and conditions of this Agreement. If Grantee fails to comply with the terms and conditions set forth herein, including by using any portion of the Grant for anything other than the Grant Purpose, or if there is a change in Grantee's organizational structure or financial position which the Foundation determines in its sole discretion impedes Grantee's ability to carry out the Grant Purpose, the Foundation reserves the right to require immediate repayment of any expended or unexpended Grant funds.

17. Grantee Representations.

Grantee represents (i) that it is either a domestic public charity as described in section 509(a)(1) or (2) of the Code, a Type I or Type II supporting organization as described in section 509(a)(3) of the Code, or an exempt operating foundation as described in section 4940(d)(2) of the Code; (ii) that it maintains documentation from the Internal Revenue Service demonstrating its tax-exempt status under the Code, which Grantee agrees to provide to the Foundation at the Foundation's request; and (iii) the Grant will not result in private inurement or personal benefit of any kind.

Other Terms and Conditions

18. Additional Support.

By making this Grant, Grantee acknowledges that (i) the Foundation assumes no obligation to provide any other or additional support to Grantee, and (ii) this Grant does not establish, nor shall it be construed as establishing, a precedent for any future support of Grantee.

19. No Agency or Other Relationship.

This Agreement does not create, nor shall it be construed as creating, an agency, partnership, employment relationship, joint venture or any other form of association, for tax purposes or otherwise, between the parties, and Grantee shall not make any such representation to anyone. Neither party shall have any right or authority, express or implied, to assume or create any obligation of any kind, or to make any representation or warranty, on behalf of the other party or to bind the other party in any respect whatsoever.

20. Indemnification.

Grantee agrees to indemnify and hold harmless the Foundation, its officers, directors, members, agents, representatives, employees, volunteers and its invitees with respect to all damages, liabilities, costs, claims and causes of action (including without limitation, all expenses and settlement costs and any legal or other expenses for investigating or defending any actions or threatened actions), arising from or in connection with the Grant, including, but not limited to, the breach by Grantee of any of its obligations and responsibilities under this Agreement, the failure to comply with any applicable law, regulation, rule or ordinance, or the use by Grantee or any other individual or entity of any services, materials, supplies, equipment or technology provided by, through or in connection with the Grant.

The Foundation shall have no liability whatsoever for the acts, omissions to act, or negligence of Grantee, its agents, representatives, or employees, or any other individual or entity in connection with the Grant. This indemnification/hold harmless clause must be included in all re-grants or subcontracts entered into to fulfill the purposes of the Grant in accordance with the terms of this Agreement.

21. Applicable Law.

This Grant Agreement will be construed and governed by the laws of the State of New York.

22. Amendments.

This Agreement may be modified only by written agreement of the Foundation and Grantee.

23. Arbitration.

If the parties are unable to resolve any disputes, controversies, or claims arising out of or relating to this Agreement, such disputes, controversies, or claims shall be settled by binding arbitration according to the rules of JAMS. Such arbitration shall take place in a location selected by the Foundation. All parties shall have the right to discovery and the arbitrators shall be selected pursuant to the rules of the American Arbitration Association. Each party shall bear its own costs and expenses and an equal share of the arbitrators' and administrative fees of arbitration.

24. Notice.

Any notice, request, demand or other communication required or permitted hereunder shall be in writing, shall reference this Agreement and shall be deemed to be properly given: (i) when delivered personally; (ii) when sent by email, with email confirmation of receipt by the receiving party; (iii) when sent by facsimile, with written confirmation of receipt by the sending facsimile machine; (iv) five (5) business days after having been sent by registered or certified mail, return receipt requested, postage prepaid; or (v) two (2) business days after deposit with a private industry express courier, with written confirmation of receipt. All notices shall be sent to the address

set forth below (or to such other address as may be designated by a party by giving written notice to the other party pursuant to this Section).

To Foundation:

Mother Cabrini Health Foundation, Inc.
777 Third Avenue
23rd Floor
New York, NY 10017
Attn: Chief Programs and Grants Officer
Email: grantawardletters@cabrinihealth.org

To Grantee:

Dr. Jason Norman Adsit
Mount Saint Mary College
845-569-3202
330 Powell Ave.
Newburgh, NY 12550 United States

25. Counterparts.

This Agreement may be executed in two counterparts, which together shall constitute one and the same instrument.

26. Entire Agreement.

This Agreement constitutes the entire agreement and understanding of the Foundation and Grantee and supersedes all prior discussions, agreements and understandings.

Mother Cabrini Health Foundation, Inc.



Name: Rev. Msgr. Gregory Mustaciolo
Title: Chief Executive Officer
Date: December 10, 2020

GRANTEE AUTHORIZED SIGNATURE.

Agreed and Accepted by the following individual who certifies that he or she has the authority to bind and commit the Grantee to the terms and conditions of this Agreement:

Name*

Jason N Adsit

Title*

President

Date*

12/15/2020

File Attachment Summary

Applicant File Uploads

No files were uploaded



Mount Saint Mary College

330 Powell Avenue, Newburgh, New York 12550 • www.msmc.edu

New Vendor Setup Form

Name of MSMC Contact _____ Department/Phone _____

Ordering Address/Information

Company/Individual Name _____

DBA _____ US Citizen Yes ☐ NO ☐

Taxpayer ID Number (TIN) _____ OR SS # _____

DUNS# _____

Physical Address _____

City _____ State _____ Zip _____

E-mail _____ Country (if not U.S.) _____

Website Address _____ Phone # _____ Fax # _____

Remit to address if different from above

Address _____

City _____ State _____ Zip _____ Country (if not U.S.) _____

Category Designation – check all that apply

Merchandise ☐ Type of Merchandise _____

Services ☐ Type of Services _____

Company Status

Do you supply through any Group Purchasing Organizations contracts? (Please list) **Example:** E&I, NJPA, LHVCCUC, US Communities

Supplier Class (Check all that apply)

Status

Women Owned ☐ Not-For-Profit Association ☐

MBE ☐ Small Business ☐

Veteran Owned Business ☐ Foreign Business ☐

Minority ☐ Governmental Entity ☐

Please include copies of documentation from certifying authority.

Print, sign and fax the completed form, W-9, and Certificate of Insurances (requirements listed on back) to
(845) 569-3329 Attention: Finance & Administration OR e-mail to newvendors@msmc.edu

Sign Here

Form Completed By-Sign Name

Form Completed By-Print Name

Finance Approval

By signing this form, vendor is certifying that all information provided is correct and reliable and vendor is not suspended or expelled by the Federal Government or the State of New York from joining in Federal or State funded projects.

Standard payment terms are net 30 days. Do you offer a discount payment/term option? ☐ Credit Cards accepted? -American Express ☐ Visa ☐ MasterCard ☐

Standards of Conduct for Contractors

The academic environment, public buildings and residence halls of Mount Saint Mary College require that contractors and their subcontractors comply with certain standards of conduct while working on campus. These conditions, as outlined below, apply to all projects.

Scheduling Work

Services provided are to be scheduled in advance with the Facilities Department. Before starting work, the contractor must come to the Facilities Department and arrange for access to the job site or be issued appropriate keys. Upon commencement of work contractors must check in with Campus Security. It is essential that the College be informed of your activity on campus. The Facilities Department is located in at 317 Powell Ave.; Phone 845-569-3333. The Campus Security is located in Hudson Hall between 8 am and 8 pm. At other times on-duty security personnel are located at the first floor lobby of Guzman Hall. Phone 845-569-3200.

Compliance with Policy

All contractors who perform work on campus are required to comply with our lock-out/tag-out policy and our confined spaces entry policy. Contractors are required to wear identification when on site.

Use of College Conveniences

Areas such as Dining Facilities, gyms (including pool), libraries and campus phones are generally for use by the college community and are not available for the public. Restrooms may be provided by the project manager. Contractors should remain in the designated job site while on campus.

Parking

The campus has limited parking spaces. Therefore, we ask that all non-essential work vehicles be parked off campus. Our project manager assigned to your work will inform you of the lots you may use. Special arrangements for loading and unloading must be made in advance with Facilities and/or designated project manager.

Dress Code

We request that contractors dress appropriately. Shirts are to be worn at all times.

Clean-Up

You are to leave the job site swept clean and orderly. All debris and left-over material is to be removed by the contractor unless otherwise provided.

Noise

Due to its nature, Mount Saint Mary College is an institution of Higher Education and hosts classes and functions where any work that generates noise is a potential distraction. All work including the use of power tools and equipment or the use of cell phones or portable radios must be cleared with the Facilities Department or project manager.

Smoking, Alcohol, Drugs and Weapons

In compliance with local and state ordinances, smoking is not permitted inside campus buildings. The College requests that its employees and students abstain from the use of tobacco and alcohol. It is expected, therefore, that contractors, vendors, and all non-college service personnel will refrain from the use of alcoholic beverages while working on College property and will refrain from use of tobacco while working in College buildings. The use or possession of weapons or illegal drugs is expressly prohibited on campus. Non-compliance may constitute a crime under New York State law and will be prosecuted to the fullest extent of the law.

Sexual Harassment

Contractor employees are expected to be courteous and act in a safe and responsible manner while at the College. Unacceptable behavior includes the use of profanity, general harassment of students or employees, and sexual harassment of students and employees. Sexual harassment shall include unwelcome advances or requests for sexual favors and other verbal or physical conduct (such as whistling, cat calling or making comments to or about students / employees) which has the purpose or effect of creating an intimidating, hostile or offensive environment. Such behavior will not be tolerated and will be cause for the termination of the contract.

Insurance Requirements

Before commencing work, contractors must provide proof of Liability, Automobile Liability, and Workers' Compensation insurance, naming the College as additional insured, to read –

See Exhibit B for Insurance Requirements

ating General minimum),
der for both is

Mount Saint Mary College, 330 Powell Avenue, Newburgh, NY 12550.

In addition, IRS Form W-9, "Request for Taxpayer Identification Number and Certification" must be completed, signed and returned before any payment will be made. For payments made to vendors who do not furnish an identification number or who furnish an incorrect number, we are required to withhold and pay to the IRS 31% of all payments.

DRAFT AIA® Document A101® – 2017

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

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

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

« »

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

« »

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

« »

« »

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

« »

« »

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

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

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

TABLE OF ARTICLES

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

EXHIBIT A—INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, a modified AIA Document A201™–2017, General Conditions of the Contract for Construction, which is attached to this Agreement as Exhibit “A” and incorporated into this agreement (referred to in this Agreement as “A201-2017” or “AIA document A201-2017”). Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

If there is a conflict between this Agreement and any of the documents that make up the Contract Documents, as set forth in Article 16 below, the Contractor shall (i) provide the better quality or greater quantity of work or (ii) comply with the more stringent requirement; either or both in accordance with the Owner and Architect’s interpretation.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others and all work reasonably inferable by the Contractor as necessary to produce the results intended by the Contract Documents.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

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

(Check one of the following boxes.)

[☐] The date of this Agreement.

[☐] A date set forth in a notice to proceed issued by the Owner.

[☐] Established as follows:

(Insert a date or a means to determine the date of commencement of the Work.)

« »

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

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

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

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

[] By the following date: « »

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

Portion of Work

« »

Substantial Completion Date

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

ARTICLE 4 CONTRACT SUM

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

§ 4.2 Alternates

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

Item

« »

Price

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

Item

« »

Price

Conditions for Acceptance

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

Item

Price

§ 4.4 Unit prices, if any:

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

Item

Units and Limitations

Price per Unit (\$0.00)

§ 4.5 Liquidated damages, if any:

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

§ 4.6 Other:

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

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

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

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the «Thirtieth» day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the «Thirtieth» day of the «following» month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than «Thirty-five» («35») days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

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

(i) A current Sworn Statement from the Contractor setting forth all Subcontractors and any material suppliers with whom the Contractor has subcontracted, the amount of each such subcontract, the amount requested for any Subcontractor or material supplier in the application for payment, and the amount to be paid to the Contractor from such progress payment, together with a current, duly executed waiver of mechanics' s liens from the Contractor establishing receipt of payment or satisfaction of the payment requested by the Contractor in the current Application for Payment.

(ii) Duly executed conditional waivers of mechanics' liens from all Subcontractors, material suppliers, and, where appropriate, lower tier subcontractors, and

(iii) Such other information, documentation, and materials as the Owner or the Architect, may require.

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

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

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

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

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

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

§ 5.1.7 Retainage

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

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

10%

§ 5.1.7.1.1 The following items are not subject to retainage:

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

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

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

The Owner shall have the option, but not the obligation, to reduce the retainage requirements of this Agreement or release any portion of retainage prior to the date specified in the Contract Documents. Any reduction or release of retainage, or portion thereof, however, shall not be a waiver of (i) any of the Owner's rights to retainage in connection with other payments to the Contractor or (ii) any other right or remedy that the Owner has under the Contract Documents, at law or in equity.

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

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

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

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

§ 5.2 Final Payment

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

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

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

§ 5.3 Interest

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

~~-% 3 % «per annum»~~

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

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

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

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201-2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

☒ Arbitration pursuant to Section 15.4 of AIA Document A201-2017

☐ Litigation in a court of competent jurisdiction

☐ Other (Specify)

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

ARTICLE 7 TERMINATION OR SUSPENSION

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

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

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

Upon such termination, the Contractor shall recover as its sole remedy payment for Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits. The Owner shall be credited for (i) payments previously made to the Contractor for the terminated portion of the Work, (ii) claims that the Owner has against Contractor under the Contract, and (iii) the value of the materials, supplies, equipment, or other items that are to be disposed of by the Contractor that are part of the Contract Sum. The Contractor shall further be entitled to recover reasonable demobilization costs.

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

ARTICLE 8 MISCELLANEOUS PROVISIONS

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

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

[Redacted]

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

[Redacted]

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

§ 8.5 Insurance and Bonds

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

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

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

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

[Redacted]

§ 8.7 Other provisions:

§ 8.7.1 This project has an overall goal of 30% for MWBE participation, 18% for Minority-Owned Business Enterprises ("MBE") participation and 12% for Women-Owned Business Enterprises ("WBE") participation. The Contractor acknowledges that failure to comply with these MWBE participation goals shall constitute a material breach of contract.

§ 8.7.2 Within 10 days of execution of this Agreement, Contractor shall supply Owner with a MWBE utilization plan evidencing how it intends to meet the MBE goals for this project.

§ 8.7.3 Building Permit

Contractor shall be responsible for the filing and payment of the building permit. The cost of the building permit shall be added to the contract sum via a change order. This change order will not, however, be subject to any overhead or profit nor will it be subject to any retainage.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- 1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
- 2 ~~AIA Document A101™–2017, Exhibit A, Insurance and Bonds~~
- 3 ~~Modified~~ AIA Document A201™–2017, General Conditions of the Contract for Construction (with modifications)
- 2 Exhibit B, Schedule of Insurance
- 3 Exhibit C, Standard Clauses for Higher Education Capital Matching Grant Program Contracts
- 4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

5 Drawings

Number	Title	Date
<<>		

Number	Title	Date
—		

6 Specifications

Section	Title	Date	Pages
<< >>			

7 Addenda, if any:

Number	Date	Pages

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

8 Other Exhibits:

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

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

☐ The Sustainability Plan:

Title	Date	Pages
<< >>		

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
« »			

.9 Other documents, if any, listed below:

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

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

« »
OWNER (Signature)
 « »« »
 (Printed name and title)

« »
CONTRACTOR (Signature)
 « »« »
 (Printed name and title)

DRAFT AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

<< >>
<< >>

THE OWNER:

(Name, legal status and address)

<< >><< >>
<< >>

THE ARCHITECT:

(Name, legal status and address)

<< >><< >>
<< >>

TABLE OF ARTICLES

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

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

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14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES



INDEX

(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, **12.3**

Access to Work

3.16, 6.2.1, **12.1**

Accident Prevention

10

Acts and Omissions

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

Addenda

1.1.1

Additional Costs, Claims for

3.7.4, 3.7.5, 10.3.2, **15.1.5**

Additional Inspections and Testing

9.4.2, 9.8.3, **12.2.1**, **13.4**

Additional Time, Claims for

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

Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.13

Allowances

3.8

Applications for Payment

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

Approvals

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

3.12.10.1, 4.2.7, 9.3.2, **13.4.1**

Arbitration

8.3.1, **15.3.2**, **15.4**

ARCHITECT

4

Architect, Definition of

4.1.1

Architect, Extent of Authority

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

Architect, Limitations of Authority and Responsibility

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

Architect's Additional Services and Expenses

2.5, **12.2.1**, **13.4.2**, **13.4.3**, **14.2.4**

Architect's Administration of the Contract

3.1.3, 3.7.4, **15.2**, 9.4.1, 9.5

Architect's Approvals

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

Architect's Authority to Reject Work

3.5, 4.2.6, **12.1.2**, **12.2.1**

Architect's Copyright

1.1.7, **1.5**

Architect's Decisions

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

Architect's Inspections

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

Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, **13.4.2**

Architect's Interpretations

4.2.11, 4.2.12

Architect's Project Representative

4.2.10

Architect's Relationship with Contractor

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

Architect's Relationship with Subcontractors

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

Architect's Representations

9.4.2, 9.5.1, 9.10.1

Architect's Site Visits

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

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.6.8, 9.10.2, **10.3.3**

Award of Separate Contracts

6.1.1, 6.1.2

Award of Subcontracts and Other Contracts for Portions of the Work

5.2

Basic Definitions

1.1

Bidding Requirements

1.1.1

Binding Dispute Resolution

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

Bonds, Lien

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

Bonds, Performance, and Payment

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

Building Information Models Use and Reliance

1.8

Building Permit

3.7.1

Capitalization

1.3

Certificate of Substantial Completion

9.8.3, 9.8.4, 9.8.5

Certificates for Payment

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

Certificates of Inspection, Testing or Approval

13.4.4

Certificates of Insurance

9.10.2

Change Orders

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

Change Orders, Definition of

7.2.1

CHANGES IN THE WORK

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

Claims, Definition of

15.1.1

Claims, Notice of

1.6.2, 15.1.3

CLAIMS AND DISPUTES

3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4

Claims and Timely Assertion of Claims

15.4.1

Claims for Additional Cost

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

Claims for Additional Time

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

Concealed or Unknown Conditions, Claims for

3.7.4

Claims for Damages

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

Claims Subject to Arbitration

15.4.1

Cleaning Up

3.15, 6.3

Commencement of the Work, Conditions Relating to

2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**

Commencement of the Work, Definition of

8.1.2

Communications

3.9.1, **4.2.4**

Completion, Conditions Relating to

3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2

COMPLETION, PAYMENTS AND

9

Completion, Substantial

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

Compliance with Laws

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

Concealed or Unknown Conditions

3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract

1.1.1, 6.1.1, 6.1.4

Consent, Written

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

Consolidation or Joinder

15.4.4

CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

1.1.4, **6**

Construction Change Directive, Definition of

7.3.1

Construction Change Directives

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

Construction Schedules, Contractor's

3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Contingent Assignment of Subcontracts

5.4, 14.2.2.2

Continuing Contract Performance

15.1.4

Contract, Definition of

1.1.2

CONTRACT, TERMINATION OR SUSPENSION OF THE

5.4.1.1, 5.4.2, 11.5, **14**

Contract Administration

3.1.3, 4, 9.4, 9.5

Contract Award and Execution, Conditions Relating to

3.7.1, 3.10, 5.2, 6.1

Contract Documents, Copies Furnished and Use of

1.5.2, 2.3.6, 5.3

Contract Documents, Definition of

1.1.1

Contract Sum

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

Contract Sum, Definition of

9.1

Contract Time

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

Contract Time, Definition of

8.1.1

CONTRACTOR

3

Contractor, Definition of

3.1, **6.1.2**

Contractor's Construction and Submittal Schedules

3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2

Contractor's Employees

2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.3, 14.1, 14.2.1.1

Contractor's Liability Insurance

11.1

Contractor's Relationship with Separate Contractors and Owner's Forces

3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4

Contractor's Relationship with Subcontractors
1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7,
9.10.2, 11.2, 11.3, 11.4
Contractor's Relationship with the Architect
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2,
7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3,
11.3, 12, 13.4, 15.1.3, 15.2.1
Contractor's Representations
3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2
Contractor's Responsibility for Those Performing the
Work
3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8
Contractor's Review of Contract Documents
3.2
Contractor's Right to Stop the Work
2.2.2, 9.7
Contractor's Right to Terminate the Contract
14.1
Contractor's Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2,
9.8.3, 9.9.1, 9.10.2, 9.10.3
Contractor's Superintendent
3.9, 10.2.6
Contractor's Supervision and Construction
Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3,
7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4
Coordination and Correlation
1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1
Copies Furnished of Drawings and Specifications
1.5, 2.3.6, 3.11
Copyrights
1.5, **3.17**
Correction of Work
2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3,
15.1.3.1, 15.1.3.2, 15.2.1
Correlation and Intent of the Contract Documents
1.2
Cost, Definition of
7.3.4
Costs
2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3,
7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2,
12.1.2, 12.2.1, 12.2.4, 13.4, 14
Cutting and Patching
3.14, 6.2.5
Damage to Construction of Owner or Separate
Contractors
3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damage to the Work
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damages, Claims for
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2,
11.3, 14.2.4, 15.1.7
Damages for Delay
6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2
Date of Commencement of the Work, Definition of

8.1.2
Date of Substantial Completion, Definition of
8.1.3
Day, Definition of
8.1.4
Decisions of the Architect
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4,
7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2,
14.2.2, 14.2.4, 15.1, 15.2
Decisions to Withhold Certification
9.4.1, **9.5**, 9.7, 14.1.1.3
Defective or Nonconforming Work, Acceptance,
Rejection and Correction of
2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3,
9.10.4, 12.2.1
Definitions
1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1,
6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1
Delays and Extensions of Time
3.2, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, 9.5.1, **9.7**,
10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5
Digital Data Use and Transmission
1.7
Disputes
6.3, 7.3.9, 15.1, 15.2
Documents and Samples at the Site
3.11
Drawings, Definition of
1.1.5
Drawings and Specifications, Use and Ownership of
3.11
Effective Date of Insurance
8.2.2
Emergencies
10.4, 14.1.1.2, **15.1.5**
Employees, Contractor's
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2,
10.3.3, 11.3, 14.1, 14.2.1.1
Equipment, Labor, or Materials
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3,
9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2
Execution and Progress of the Work
1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1,
3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1,
9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4
Extensions of Time
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2,
10.4, 14.3, 15.1.6, **15.2.5**
Failure of Payment
9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2
Faulty Work
(See Defective or Nonconforming Work)
Final Completion and Final Payment
4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3
Financial Arrangements, Owner's
2.2.1, 13.2.2, 14.1.1.4
GENERAL PROVISIONS

1

Governing Law

13.1

Guarantees (See Warranty)

Hazardous Materials and Substances

10.2.4, 10.3

Identification of Subcontractors and Suppliers

5.2.1

Indemnification

3.1.7, 3.18, 9.6.8, 9.10.2, 10.3.3, 11.3

Information and Services Required of the Owner

2.1.2, 2.2, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5,

9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2,

14.1.1.4, 14.1.4, 15.1.4

Initial Decision

15.2

Initial Decision Maker, Definition of

1.1.8

Initial Decision Maker, Decisions

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Initial Decision Maker, Extent of Authority

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Injury or Damage to Person or Property

10.2.8, 10.4

Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,

9.9.2, 9.10.1, 12.2.1, 13.4

Instructions to Bidders

1.1.1

Instructions to the Contractor

3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2

Instruments of Service, Definition of

1.1.7

Insurance

6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5,

11

Insurance, Notice of Cancellation or Expiration

11.1.4, 11.2.3

Insurance, Contractor's Liability

11.1

Insurance, Effective Date of

8.2.2, 14.4.2

Insurance, Owner's Liability

11.2

Insurance, Property

10.2.5, 11.2, 11.4, 11.5

Insurance, Stored Materials

9.3.2

INSURANCE AND BONDS

11

Insurance Companies, Consent to Partial Occupancy

9.9.1

Insured loss, Adjustment and Settlement of

11.5

Intent of the Contract Documents

1.2.1, 4.2.7, 4.2.12, 4.2.13

Interest

13.5

Interpretation

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

Interpretations, Written

4.2.11, 4.2.12

Judgment on Final Award

15.4.2

Labor and Materials, Equipment

1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,

5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1,

10.2.4, 14.2.1.1, 14.2.1.2

Labor Disputes

8.3.1

Laws and Regulations

1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4,

9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8,

15.4

Liens

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

Limitations, Statutes of

12.2.5, 15.1.2, 15.4.1.1

Limitations of Liability

3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6,

4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3,

11.3, 12.2.5, 13.3.1

Limitations of Time

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,

5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,

9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15,

15.1.2, 15.1.3, 15.1.5

Materials, Hazardous

10.2.4, 10.3

Materials, Labor, Equipment and

1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,

5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2,

10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2

Means, Methods, Techniques, Sequences and

Procedures of Construction

3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2

Mechanic's Lien

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

Mediation

8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, 15.3, 15.4.1,

15.4.1.1

Minor Changes in the Work

1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, 7.4

MISCELLANEOUS PROVISIONS

13

Modifications, Definition of

1.1.1

Modifications to the Contract

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

10.3.2

Mutual Responsibility

6.2

Nonconforming Work, Acceptance of

9.6.6, 9.9.3, 12.3

Nonconforming Work, Rejection and Correction of

2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2

Notice

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

Notice of Cancellation or Expiration of Insurance
11.1.4, 11.2.3

Notice of Claims

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

Notice of Testing and Inspections
13.4.1, 13.4.2

Observations, Contractor's
3.2, 3.7.4

Occupancy
2.3.1, 9.6.6, 9.8

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

OWNER

2

Owner, Definition of

2.1.1

Owner, Evidence of Financial Arrangements

2.2, 13.2.2, 14.1.1.4

Owner, Information and Services Required of the
2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4

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

Owner's Insurance

11.2

Owner's Relationship with Subcontractors
1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

Owner's Right to Carry Out the Work
2.5, 14.2.2

Owner's Right to Clean Up
6.3

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

6.1

Owner's Right to Stop the Work
2.4

Owner's Right to Suspend the Work
14.3

Owner's Right to Terminate the Contract
14.2, 14.4

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

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

Partial Occupancy or Use

9.6.6, **9.9**

Patching, Cutting and
3.14, 6.2.5

Patents

3.17

Payment, Applications for

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

Payment, Certificates for

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

Payment, Failure of

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Payment, Final

4.2.1, 4.2.9, **9.10**, 12.3, 14.2.4, 14.4.3

Payment Bond, Performance Bond and
7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Payments, Progress

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

PAYMENTS AND COMPLETION

9

Payments to Subcontractors

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

PCB

10.3.1

Performance Bond and Payment Bond

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Permits, Fees, Notices and Compliance with Laws

2.3.1, **3.7**, 3.13, 7.3.4.4, 10.2.2

PERSONS AND PROPERTY, PROTECTION OF

10

Polychlorinated Biphenyl

10.3.1

Product Data, Definition of

3.12.2

Product Data and Samples, Shop Drawings

3.11, **3.12**, 4.2.7

Progress and Completion

4.2.2, **8.2**, 9.8, 9.9.1, 14.1.4, 15.1.4

Progress Payments

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

Project, Definition of

1.1.4

Project Representatives

4.2.10

Property Insurance

10.2.5, **11.2**

Proposal Requirements

1.1.1

PROTECTION OF PERSONS AND PROPERTY

10

Regulations and Laws

1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4

Rejection of Work
4.2.6, 12.2.1
Releases and Waivers of Liens
9.3.1, 9.10.2
Representations
3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1
Representatives
2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1
Responsibility for Those Performing the Work
3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10
Retainage
9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3
Review of Contract Documents and Field Conditions by Contractor
3.2, 3.12.7, 6.1.3
Review of Contractor's Submittals by Owner and Architect
3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2
Review of Shop Drawings, Product Data and Samples by Contractor
3.12
Rights and Remedies
1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1, 6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2, 12.2.4, **13.3**, 14, 15.4
Royalties, Patents and Copyrights
3.17
Rules and Notices for Arbitration
15.4.1
Safety of Persons and Property
10.2, 10.4
Safety Precautions and Programs
3.3.1, 4.2.2, 4.2.7, 5.3, **10.1**, 10.2, 10.4
Samples, Definition of
3.12.3
Samples, Shop Drawings, Product Data and
3.11, **3.12**, 4.2.7
Samples at the Site, Documents and
3.11
Schedule of Values
9.2, 9.3.1
Schedules, Construction
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Separate Contracts and Contractors
1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2
Separate Contractors, Definition of
6.1.1
Shop Drawings, Definition of
3.12.1
Shop Drawings, Product Data and Samples
3.11, **3.12**, 4.2.7
Site, Use of
3.13, 6.1.1, 6.2.1
Site Inspections
3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4
Site Visits, Architect's
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4
Special Inspections and Testing

4.2.6, 12.2.1, 13.4
Specifications, Definition of
1.1.6
Specifications
1.1.1, **1.1.6**, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14
Statute of Limitations
15.1.2, 15.4.1.1
Stopping the Work
2.2.2, 2.4, 9.7, 10.3, 14.1
Stored Materials
6.2.1, 9.3.2, 10.2.1.2, 10.2.4
Subcontractor, Definition of
5.1.1
SUBCONTRACTORS
5
Subcontractors, Work by
1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2, 9.6.7
Subcontractual Relations
5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1
Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8, 9.9.1, 9.10.2, 9.10.3
Submittal Schedule
3.10.2, 3.12.5, 4.2.7
Subrogation, Waivers of
6.1.1, **11.3**
Substances, Hazardous
10.3
Substantial Completion
4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, **9.8**, 9.9.1, 9.10.3, 12.2, 15.1.2
Substantial Completion, Definition of
9.8.1
Substitution of Subcontractors
5.2.3, 5.2.4
Substitution of Architect
2.3.3
Substitutions of Materials
3.4.2, 3.5, 7.3.8
Sub-subcontractor, Definition of
5.1.2
Subsurface Conditions
3.7.4
Successors and Assigns
13.2
Superintendent
3.9, 10.2.6
Supervision and Construction Procedures
1.2.2, **3.3**, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4
Suppliers
1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6, 9.10.5, 14.2.1
Surety
5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2, 15.2.7
Surety, Consent of

9.8.5, 9.10.2, 9.10.3

Surveys

1.1.7, 2.3.4

Suspension by the Owner for Convenience

14.3

Suspension of the Work

3.7.5, 5.4.2, 14.3

Suspension or Termination of the Contract

5.4.1.1, 14

Taxes

3.6, 3.8.2.1, 7.3.4.4

Termination by the Contractor

14.1, 15.1.7

Termination by the Owner for Cause

5.4.1.1, **14.2**, 15.1.7

Termination by the Owner for Convenience

14.4

Termination of the Architect

2.3.3

Termination of the Contractor Employment

14.2.2

TERMINATION OR SUSPENSION OF THE CONTRACT

14

Tests and Inspections

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

TIME

8

Time, Delays and Extensions of

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

Time Limits

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

Time Limits on Claims

3.7.4, 10.2.8, 15.1.2, 15.1.3

Title to Work

9.3.2, 9.3.3

UNCOVERING AND CORRECTION OF WORK

12

Uncovering of Work

12.1

Unforeseen Conditions, Concealed or Unknown

3.7.4, 8.3.1, 10.3

Unit Prices

7.3.3.2, 9.1.2

Use of Documents

1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

Use of Site

3.13, 6.1.1, 6.2.1

Values, Schedule of

9.2, 9.3.1

Waiver of Claims by the Architect

13.3.2

Waiver of Claims by the Contractor

9.10.5, 13.3.2, **15.1.7**

Waiver of Claims by the Owner

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

Waiver of Consequential Damages

14.2.4, 15.1.7

Waiver of Liens

9.3, 9.10.2, 9.10.4

Waivers of Subrogation

6.1.1, **11.3**

Warranty

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

Weather Delays

8.3, 15.1.6.2

Work, Definition of

1.1.3

Written Consent

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

Written Interpretations

4.2.11, 4.2.12

Written Orders

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

-ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a written Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, except as set forth in Section 5.3 and Section 5.4, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as

binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. In the event of inconsistencies within or between parts of the Contract Documents, the Contractor shall (i) provide the better quality or greater quantity of Work or (ii) comply with the more stringent requirement; either or both in accordance with the interpretation. The terms and conditions of this Section 1.2.1, however, shall not relieve the Contractor of any of the obligations set forth in Sections 3.2 and 3.7.

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™-2013, Building

Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements,

assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

§ 2.5 Extent of Owner Rights

The rights stated in this Article 2 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner (i) granted in the Contract Documents, (ii) at law, or (iii) in equity. 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.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents. Prior to execution of the Agreement, the Contractor and each Subcontractor have evaluated and satisfied themselves as to the conditions and limitations under which the Work is to be performed, including, without limitation, (i) the location, condition, layout, and nature of the Project site and surrounding areas, (ii) generally prevailing climatic conditions, (iii) anticipated labor supply and costs, (iv) availability and cost of materials, tools, and equipment, and (v) other similar issues. The Owner assumes no responsibility or liability for the physical condition or safety of the Project site or any improvements located on the Project site. Except as set forth in Section 10.3, 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 the Contract Time in connection with any failure by the Contractor or any Subcontractor to have complied with the requirements of this Section 3.2.1.

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

§ 3.2.2.1 The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other contractors, is not guaranteed by the Architect or the Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, dimensions, or locations shall be promptly rectified by the Contractor without any additional cost to the Owner.

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

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

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give

specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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

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

§ 3.4 Labor and Materials

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

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive. In addition, if the Contractor desires to submit an alternate product or method in lieu of what has been specified or shown in the Contract Documents, the following provisions apply:

The Contractor must submit to the Architect and the Owner (i) a full explanation of the proposed substitution and submittal of all supporting data, including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, and other like information necessary for a complete evaluation of the substitution; (ii) a written explanation of the reasons the substitution is advantageous and necessary, including the benefits to the Owner and the Work in the event the substitution is acceptable; (iii) the adjustment, if any, in the Contract Sum, in the event the substitution is acceptable; (iv) the adjustment, if any, in the time of completion of the Contract and the construction schedule in the event the substitution is acceptable; and (v) an affidavit stating that (a) the proposed substitution conforms to and meets all the requirements of the pertinent Specifications and the requirements shown on the Drawings, and (b) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Architect. Proposals for substitutions shall be submitted in triplicate to the Architect in sufficient time to allow the Architect no less than ten (10) working days for review. No substitutions will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated hereinbefore.

Substitutions and alternates may be rejected without explanation and will be considered only under one or more of the following conditions: (i) the proposal is required for compliance with interpretation of code requirements or insurance regulations then existing; (ii) specified products are unavailable through no fault of the Contractor; (iii) subsequent information discloses the inability of specified products to perform properly or to fit in the designated space; (iv) the manufacturer/fabricator refuses to certify or guarantee the performance of the specified product as required; and (v) when in the judgment of the Owner or the Architect, a substitution would be substantially in the Owner's best interests, in terms of cost, time, or other considerations.

Whether or not any proposed substitution is accepted by the Owner or the Architect, the Contractor shall reimburse the Owner for any fees charged by the Architect or other consultants for evaluating each proposed substitute.

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

§ 3.5 Warranty

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

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

§ 3.5.3 The Contractor agrees to assign to the Owner at the time of final completion of the Work any and all manufacturer's warranties relating to materials and labor used in the Work and further agrees to perform the Work in such manner so as to preserve any and all such manufacturer's warranties. If necessary as a matter of law, the Contractor may retain the right to enforce directly any such manufacturers' warranties during the one-year period following the date of Substantial Completion, referred to in Section 12.2.2.

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

~~§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for~~ Except as set forth in Section 2.3.1, the Contractor shall secure, pay for, and, as soon as practicable, furnish the Owner with copies or certificates of all permits and fees, licenses, and inspections necessary for the proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded. Work, including, without limitation, all building permits, [insert other similar items]. All connection charges, assessments, or inspection fees as may be imposed by any municipal agency or utility company are included in the Contract Sum and shall be the Contractor's responsibility.

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice,

the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

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

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

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

§ 3.10.4 In the event the Owner determines that the performance of the Work, as of a Milestone Date, has not progressed or reached the level of completion required by the Contract Documents, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (i) working additional shifts or overtime, (ii) supplying additional manpower, equipment, and facilities, and (iii) other similar measures (hereinafter referred to collectively as “Extraordinary Measures”). Such Extraordinary Measures shall continue until the progress of the Work complies with the stage of completion required by the Contract Documents. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule.

1. The Contractor shall not be entitled to an adjustment in the Contract Sum in connection with Extraordinary Measures required by the Owner under or pursuant to this Section 3.10.4.

2. The Owner may exercise the rights furnished the Owner under or pursuant to this Section 3.10.4 as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with any Milestone Date or completion date set forth in the Contract Documents.

§ 3.11 Documents and Samples at the Site

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

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

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

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

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste

materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

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

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

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

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

§ 4.2.4 Communications

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

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

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

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

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

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

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

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

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor,

prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

§ 5.4.4 Each subcontract shall specifically provide that the Owner shall only be responsible to the Subcontractor for those obligations that accrue subsequent to the Owner's exercise of any rights under this conditional assignment.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.1.4 Except as permitted in Section 7.3 and Section 9.7.2, a change in the Contract Sum or the Contract Time shall be accomplished only by Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, and no claim that Owner has been unjustly enriched by any alteration of or addition to the Work, whether or not there is, in fact, any unjust enrichment to the Work, shall be the basis of any claim to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, all direct and indirect costs and consequential damages associated with such change and any and all adjustments to the Contract Sum and the construction schedule.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be

reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work for more than 3 days for any single scheduled impact or more than 7 days cumulative schedule impacts beyond the Contractor's control caused by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 ~~This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions. Notwithstanding anything to the contrary in the Contract Documents, an extension in the Contract Time, to the extent permitted under Section 8.3.1, shall be the sole remedy of the Contractor for any (i) delay in the commencement, prosecution, or completion of the Work, (ii) hindrance, interference, suspension or obstruction in the performance of the Work, (iii) loss of productivity, or (iv) other similar claims (items i through iv herein collectively referred to in this Section 8.3.3 as "Delays") whether or not such Delays are foreseeable, unless a Delay is caused by acts of the Owner constituting intentional interference with the Contractor's performance of the Work, and only to the extent such acts~~

continue after the Contractor furnishes the Owner with notice of such interference. In no event shall the Contractor be entitled to any compensation or recovery of any damages, in connection with any Delay, including, without limitation, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, without limitation, ordering changes in the Work, or directing suspension, rescheduling, or correction of the Work), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be construed as intentional interference with the Contractor's performance of the Work.

~~of the Contract Documents.~~ § 8.3.4 If the Contractor submits a progress report indicating, or otherwise expresses an intention to achieve, completion of the Work prior to any completion date required by the Contract Documents or expiration of the Contract Time, no liability of the Owner to the Contractor for any failure of the Contractor to so complete the Work shall be created or implied.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 Each Application for Payment shall be accompanied by the following, all in form and substance satisfactory to the Owner: (i) a current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and material suppliers with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any Subcontractor and material supplier in the requested progress payment, and the amount to be paid to the Contractor from such progress payment, together with similar sworn statements from all such Subcontractors and material suppliers; (ii) duly executed waivers of mechanics' liens from all Subcontractors and, when appropriate, from material suppliers and lower tier Subcontractors establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or persons in any previous Application for Payment; and (iii) all information and materials required to comply with the requirements of the Contract Documents or reasonably requested by the Owner or the

§ Architect.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

.1 The Contractor further expressly undertakes to defend the Indemnitees, at the Contractor's sole expense, against any actions, lawsuits, or proceedings brought against the Indemnitees as a result of liens filed against the Work, the site of any of the Work, the Project site and any improvements thereon, payments due the Contractor, or any portion of the property of any of the Indemnitees (referred to collectively as "liens" in this Section 9.3.3). The Contractor hereby agrees to indemnify and hold the Indemnitees harmless against any such liens or claims of lien and agrees to pay any judgment or lien resulting from any such actions, lawsuits, or proceedings.

.2 The Owner shall release any payments withheld due to a lien or claim of lien if the Contractor obtains security acceptable to the Owner or a lien bond that is (i) issued by a surety acceptable to the Owner, (ii) in form and substance satisfactory to the Owner, and (iii) in an amount not less than Two Hundred percent (200%) of such lien claim or such other amount as required by applicable law. By posting a lien bond or other acceptable security, however, the Contractor shall not be relieved of any responsibilities or obligations under this Section 9.3.3, including, without limitation, the duty to defend and indemnify the Indemnitees. The cost of any premiums incurred in connection with such bonds and security shall be the responsibility of the Contractor and shall not be part of, or cause any adjustment to, the Contract Sum.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

§ 9.7.1 If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.7.2 If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract Documents, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained in the Contract Documents to the contrary, if the Contractor fails to promptly make any payment due the Owner, or if the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective Work, the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to (i) deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (ii) issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that which the Owner is entitled.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use; provided, however, that as a condition precedent to Substantial Completion, the Owner has received all certificates of occupancy and any other permits, approvals, licenses, and other documents from any governmental authority having jurisdiction thereof necessary for the beneficial occupancy of the Project.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the

Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. All warranties and guarantees required under or pursuant to the Contract Documents shall be assembled and delivered by the Contractor to the Architect as part of the final Application for Payment. The final Certificate for Payment will not be issued by the Architect until all warranties and guarantees have been received and accepted by the Owner.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner

shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.2.9 When all or a portion of the Work is suspended for any reason, the Contractor shall securely fasten down all coverings and fully protect the Work, as necessary, from injury or damage by any cause.

§ 10.2.10 The Contractor shall promptly report in writing to the Owner and Architect all accidents arising out of or in connection with the Work that cause death, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner and the Architect.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

~~**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.~~

~~**§ 10.3.4**~~ **10.3.3** The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5-10.3.4 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6-10.3.5 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in ~~the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.~~ Exhibit B of this Agreement.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or

maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are ~~covered by~~ actually recovered from insurance proceeds under any property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the

proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time. If prior to the date of Substantial Completion the Contractor, a Subcontractor, or anyone for whom either is responsible uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner. In addition, the Contractor shall promptly remedy damage and loss arising in conjunction with the Project caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or anyone for whose acts they may be liable and for which the Contractor is responsible.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. ~~During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty.~~ If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed ~~by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules, and construed under the laws of the State of New York.~~ If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender ~~or other entity~~ providing construction financing ~~for the Project, if the lender assumes the Owner's rights or credit enhancement for the Project.~~

~~and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.~~ **§ 13.2.3** The Contractor agrees and represents that the Contractor shall make no claim and shall bring no action against any official or employee of the Owner in his or her individual, personal capacity for any act, omission, or statement made or done relating to or arising out of the Contract.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.3.3 Any finding, ruling or determination that one or more of the provisions, terms or conditions of this Contract may be illegal or void shall not affect the validity of the remaining provisions, terms and conditions, which shall be severable and which shall be given their full force and effect.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense. The Contractor also agrees that the cost of testing services required for the convenience of the Contractor and his scheduling the performance of the Work, and the cost of testing services related to remedial operations performed to correct deficiencies in the Work, shall be borne by the Contractor.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

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

§ 13.6 General Provisions

§ 13.6.1 Titles of articles, sections, and subsections are for the convenience only and neither limit nor amplify the provisions of this Contract. The usage of the word "including" or following any general statement, term, or matter, shall not be construed to limit such statement, term or matter to the specific items or matters set forth immediately following such a word or to similar items or matters, whether or not non-limiting language (such words as "without limitation" or "but not limited to" or words of similar import) is used with reference thereto, but rather shall be deemed to refer to all other items or matters that can reasonably fall within the broadest possible scope of such general statement, term, or matter.

§ 13.6.2 Wherever possible, each provision of this Agreement shall be interpreted in a manner as to be effective and valid under applicable law. If, however, any provision of this Agreement, or portion thereof, is prohibited by law or found invalid under any law, only such provision or portion thereof shall be ineffective, without in any manner invalidating or effecting the remaining provisions of this Agreement or valid portions of such provision, which are hereby deemed severable.

§ 13.6.3 This Contract embodies the entire agreement of the parties and supersedes all prior and contemporaneous representations, agreements and understandings relating to the subject matter hereof, and any and all such prior and contemporaneous representations, agreements or understandings are deemed to be merged herein.

§ 13.6.4 Contractor hereby represents, promises and warrants to Owner that it is financially solvent and possesses sufficient experience, licenses, authority to perform the Work.

§ 13.6.5 Any specific requirement in this Contract that the responsibilities or obligations of the Contract are also applied to a Subcontractor is added for emphasis and is also hereby deemed to include a Subcontractor of any tier. The omission of a reference to a Subcontractor in connection with any of the Contractor's responsibilities or obligations shall not be construed to diminish, aggregate, or limit any responsibilities or obligations of a Subcontractor of any tier under this Contract Documents or the applicable Subcontract.

§ 13.6.6 No Oral Wavier.

The provisions of the Contract Documents shall not be changed, amended, waived, or otherwise modified in any respect except by a writing signed Owner. No person is authorized on behalf of Owner to orally change, amend, waive, or otherwise modify the terms of the Contract Documents or any of the Contractor's duties or obligations under or arising out of the Contract Documents. Any change, waiver, approval, or consent granted to the Contractor shall be related to specific matters stated in writing signed by Owner, and shall not relieve Contractor of any other of the duties and obligations under the Contract Documents. No "constructive" changes shall be allowed.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work ~~executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination, executed.~~ Contractor may not recover lost profits or overhead for Work not performed or for other termination related expenses and costs but may recover reasonable costs associated with demobilization. Contractor further may not recover for material, furniture, fixtures, furnishings, or equipment which, as of the date of the termination, has not been delivered to the Project, whether identifiable to the Agreement or not.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 ~~repeatedly~~ refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 ~~repeatedly~~ disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and

- 3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 ~~In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement. Upon such termination, the Contractor shall recover as its sole remedy payment for Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits. The Owner shall be credited for (i) payments previously made to the Contractor for the terminated portion of the Work, (ii) claims that the Owner has against Contractor under the Contract, and (iii) the value of the materials, supplies, equipment, or other items that are to be disposed of by the Contractor that are part of the Contract Sum.~~

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements

of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision

shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution. The Owner may, at its sole discretion, forego mediation by notifying the Contractor in writing it is elected to forego mediation pursuant to this paragraph.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending

mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall ~~be held in the place where the Project is located, unless another location is mutually agreed upon, take place in Newburgh, New York at the Owner's facility or, at Owner's sole option, at a location within a thirty (30) mile radius of the Owner's facility.~~ Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§15.4.4 Venue. Any legal proceeding or action arising out of, or relating to the Contract, shall be commenced in Orange County, Supreme Court, State of New York.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 ~~Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s). No arbitration arising out of or relating to the Contract shall include, by consolidation or joinder or in any other manner, an additional person or entity not a party to this Agreement except at the Owner's option or with the~~

~~Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Owner's written consent. The Contractor consents to the consolidation and/or joinder of the Architect, Contractor, subcontractor and any other contractor, professional design and/or engineer entity or person or entity at the Owner's option. Consent to arbitration involving an additional person~~

or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written ~~consent~~.

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~~§ 15.4.4.3~~ The Owner and Contractor grant to any ~~person or entity~~ made a party to an arbitration conducted under this Section 15.4, whether by joinder ~~or~~ consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement. consent or with the person or entity not named or described therein.



SECTION 00 60 00 - PROJECT FORMS

I.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:
1. AIA Document A101, "Standard Form of Agreement between Owner and Contractor, Stipulated Sum."
 - a. The General Conditions for Project are AIA Document A201, "General Conditions of the Contract for Construction."
 2. AIA Document A102, "Standard Form of Agreement between Owner and Contractor, Cost Plus Fee, Guaranteed Maximum Price."
 - a. The General Conditions for Project are AIA Document A201, "General Conditions of the Contract for Construction."
 3. AIA Document A103, "Standard Form of Agreement between Owner and Contractor, Cost Plus Fee."
 - a. The General Conditions for Project are AIA Document A201, "General Conditions of the Contract for Construction."
 4. AIA Document A105, "Standard Form of Agreement between Owner and Contractor for a Small Project, Where the Basis of Payment Is a Stipulated Sum."
 5. AIA Document A132, "Standard Form of Agreement between Owner and Contractor, Construction Manager as Adviser Edition."
 - a. The General Conditions for Project are AIA Document A232, "General Conditions of the Contract for Construction, Construction Manager as Adviser Edition."
 6. AIA Document A133, "Standard Form of Agreement between Owner and Contractor, Construction Manager as Constructor, Guaranteed Maximum Price."
 - a. The General Conditions for Project are AIA Document A201, "General Conditions of the Contract for Construction."
 7. AIA Document A133, "Standard Form of Agreement between Owner and Contractor for Integrated Project Delivery."
 - a. The General Conditions for Project are AIA Document A295, "General Conditions of the Contract for Integrated Project Delivery."
 8. The General Conditions are included in the Project Manual
 9. Requirements for WBE/MBE as required by financial institutions & Owner must be strictly adhered to.

10. Owner's document(s) bound and referenced in Section 00 01 16.

I.2 ADMINISTRATIVE FORMS

- A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.
- B. Copies of AIA standard forms may be obtained from the American Institute of Architects; <http://www.aia.org/contractdocs/purchase/index.htm>; docspurchases@aia.org; (800) 942-7732.
- C. Preconstruction Forms:
 - 1. Form of Performance Bond and Labor and Material Bond: AIA Document A312, "Performance Bond and Payment Bond."
 - 2. Form of Certificate of Insurance: AIA Document G715, "Supplemental Attachment for ACORD Certificate of Insurance 25-S."
- D. Information and Modification Forms:
 - 1. Form for Requests for Information (RFIs): AIA Document G716, "Request for Information (RFI)." Or RFI form included at end of this section.
 - 2. Form of Request for Proposal: AIA Document G709, "Work Changes Proposal Request."
 - 3. Change Order Form: AIA Document G701, "Change Order."
 - 4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G707, "Architect's Supplemental Instructions."
 - 5. Form of Change Directive: AIA Document G714, "Construction Change Directive."
- E. Payment Forms:
 - 1. Schedule of Values Form: AIA Document G703, "Continuation Sheet."
 - 2. Payment Application: AIA Document G702/703, "Application and Certificate for Payment and Continuation Sheet."
 - 3. Form of Contractor's Affidavit: AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 - 4. Form of Affidavit of Release of Liens: AIA Document G706A, "Contractor's Affidavit of Payment of Release of Liens."
 - 5. Form of Consent of Surety: AIA Document G707, "Consent of Surety to Final Payment."

END OF DOCUMENT 006000

RFI



482 Norristown Road, Suite 200
Blue Bell, PA 19422
610.834.7805
Kimmel-Bogrette.com

Project Name: MSMC – Guzman Hall

RFI #:

Date:

Company:

Name:

Question:

Drawing/Spec Reference:

Answer:

Answered by:

Attachments:

SECTION 01-3400 - COORDINATION DRAWINGS

PART I – GENERAL

I.1 RELATED DOCUMENTS

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

I.2 SUMMARY

- A. Where space for installation of essential building services is limited, and to avoid conflicts among the building trades, it is necessary for the Prime Contractors to coordinate the use of “shared” space, and prepare Coordination Drawings, before commencing the Work. All Prime Contractors and their associated subcontractors, during the coordination process, shall harmoniously plan and/or adjust the location of items as necessary, to avoid such conflicts and to ensure future access to critical items of equipment. All Prime Contractors shall also coordinate the installation sequence as necessary.
- B. Coordination of the Work, and production of Coordination Drawings, are contractual obligations of all Prime Contractors and led by the Project Coordinator and Coordinators for the other Primes. The Owner will not compensate any Prime Contractor for conflicts arising during installation, should they be the result of improper coordination between Prime Contractors. Nor will the Owner extend the Contract duration, due to delays caused by improper coordination. Each Contractor shall be solely responsible to recover any and all construction time lost as a result of such delays.
- C. Coordination drawings are in addition to separate shop drawings to be submitted at the conclusion of the coordination process by each Prime Contractor (as required by other specification sections).

I.3 SUBMITTALS

- A. Time of submission of Coordination Drawings shall be determined at the initial job conference, and shall be included as a milestone on the Construction Schedule. The General Construction Contractor (Project Coordinator) shall initiate this action and acquire the necessary dates from the other Prime Contractors as part of their overall scheduling responsibilities.
- B. All Prime Contractor{s} shall jointly develop and submit dimensioned Coordination Drawings indicating the arrangement of General Construction, Mechanical (HVAC), Plumbing, Electrical and Fire Protection work, including but not limited to: all ducts, air-handling equipment, control equipment, piping, conduits, raceways, junction boxes, fixtures, panels, and all associated equipment, which must be coordinated with the General Construction and other equipment or distribution lines. The Coordination Drawings must be signed and dated by all Prime Contractors, indicating concurrence, and transmitted to the Project Coordinator (in accordance with the construction schedule), for submission.
- C. The Owner’s receipt of Coordination Drawings does not in any way constitute approval, or relieve the Prime Contractors of the responsibility to accurately coordinate and install their work.
- D. The Project Coordinator shall submit completed, signed, and dated Coordination Drawings as follows:

1. The Architect – one (1) copy of each Coordination Drawing and one (1) PDF file containing each drawing.
 2. Prime Contractors - one (1) copy of each Coordination Drawing and one (1) PDF file containing each drawing.
- E. Note: If determined necessary, Coordination Drawings may be formulated and submitted in partial submittals to facilitate the construction schedule and sequence of work within the Project. This must be jointly discussed and agreed to by all Prime Contractors at the initial job conference, and a priority of sequence must be established that has the concurrence of all parties (including the Owner).
- F. The Project Coordinator shall keep all coordination drawings on-site at all times and updated regularly through the entire construction duration. These drawings will become part of the as-built drawing package.

I.4 COORDINATION OF WORK

- A. Each Prime Contractor shall coordinate its construction operations with those of other Prime Contractors and entities to ensure efficient and orderly installation for each part of the Work. Each Prime Contractor shall coordinate its operations with other operations, included in different Sections that depend on each other for proper installations, connection, and operation. All Prime Contractors shall:
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 all components with other Prime Contractors to ensure adequate accessibility/clearance for required maintenance and service.
 3. Make provisions to accommodate items scheduled for later installation.
- B. Each Prime Contractor shall clearly show, and coordinate with the other Prime Contractors, the following:
1. Arrange for pipe spaces, chases, slots, sleeves, and openings with general construction work, and arrange in building structure during progress of the Work, to allow for and facilitate distribution line and equipment installation.
 2. Coordinate installation of required supporting devices for ductwork, piping, and conduit, as well as sleeves, and other structural components, as they are constructed.
 3. Coordinate requirements for access panels and doors for HVAC, Plumbing, Fire Protection and Electrical items requiring access where concealed behind finished surfaces.
 4. Coordinate electrical connections to equipment provided by all Contractors.
 5. Sequence, coordinate, and integrate installing materials and equipment for efficient flow of the Work. Coordinate installing large items of equipment requiring positioning before closing in the building.

I.5 COORDINATION DRAWINGS

- A. Format: All Coordination Drawings shall include “X, Y & Z” coordinates for all distribution and equipment, which will allow a three-dimensional coordination plan to be created.
1. Indicate ducts, pipes and conduits of dimensions greater than 6” by double lines.
 2. Circle and clearly note all deviations from the Contract Documents, with reason for deviation stated.
 3. Use scale not less than $\frac{1}{4}'' = 1'-0''$. Detail complex areas at larger scale.
 4. Each different system shall be drawn in a different color.
 5. The MEPFP Coordinator shall prepare a title box on each drawing which allows space for the signature of the authorized individual from the Prime Contractor’s firms, with the statement below:

“The undersigned individuals certify by their signatures that they have coordinated their work with all other work noted on this drawing and the contract documents and shall be held responsible for any costs arising out of their respective inability to fully coordinate their work.”
- B. Coordination Procedure:
1. The MEPFP Coordinator is responsible for acquiring from all the other Prime Contractors and assembling scaled coordination drawings indicating all new and existing architectural finishes, as well as the locations of all ductwork, piping, conduit, system devices, associated equipment, etc. for this Project.
 2. The MEPFP Coordinator shall prepare the basic background drawings, showing the existing conditions as well as the new construction items to be installed by this Contractor. The MEPFP Coordinator may either:
 - a. Produce the required base drawings itself,
 - b. Obtain them from the Architect, at a cost not to exceed 1.2 times the cost of reproduction, or
 - c. Via e-mail, obtain electronic files from the Architect of the floor plans and reflected ceiling plans for a fee of \$250.00, payable to the Architect. A Letter of Indemnification will need to be signed by any contractor using the electronic files.
 3. After producing its own background drawings or obtaining background drawings from the Architect, the MEPFP Coordinator shall put the following information on the Coordination Drawings: Architectural backgrounds, structural work, ceiling systems, and any special work, such as pools construction. The Project Contractor shall call attention on the Coordination Drawings to particular areas of conflict, which may affect the architecture or the structure.
 4. After adding its specific requirements to these reproducible background drawings, the MEPFP Coordinator shall place his signature on each sheet and give the Coordination Drawings to the Plumbing Contractor.
 5. The Plumbing Contractor shall put the following information on the Coordination Drawings: Plumbing Contract Work.
 6. After adding its specific requirements to these reproducible background drawings, the Plumbing Contractor shall place his signature on each sheet and give the Coordination Drawings to the Fire Protection Contractor.

7. The Fire Protection Contractor shall put the following information on the Coordination Drawings: Fire Protection Contract Work, including Sprinkler/ Fire Protection Systems.
8. After adding its specific requirements to these reproducible background drawings, the Fire Protection Contractor shall place his signature on each sheet and give the Coordination Drawings to the Electrical Contractor.
9. The Electrical Contractor shall put the following information on the Coordination Drawings: Electrical Contract Work, including fire alarm, telecommunications and security systems, major conduit runs, lighting and panel locations, and conduit embeds in floor slabs and underground.
10. After adding its specific requirements to these reproducible background drawings, the Electrical Contractor shall place his signature on each sheet and give the Coordination Drawings to the General Contractor.
11. The General Contractor shall put the following information on the Coordination Drawings: Any general construction items not shown on the coordination drawings.
12. The General Contractor shall place his signature on each sheet and give the Coordination Drawings to the next Prime Contractor (if there are other Prime Contractors not mentioned here), or otherwise return the Coordination Drawings to the Project Coordinator, for Submission to the Owner and Architect.
13. Discrepancies between the Prime Contractors shall be settled by the Project Coordinator, if no design modifications are required. Where design modifications are required, affected Contractor(s) shall submit them to the Architect for review and resolution, or initiate a Request For Information (RFI).
14. The Prime Contractors, together, are solely responsible for the accuracy and completeness of all Coordination Drawings.
15. The MEPFP Coordinator shall lead in the resolution of the final coordination drawing to be initialed (certifying that they have met, reviewed and agreed) by all contractors and submitted to the Architect within 65 days after the start of construction for review. Other contractors shall finalize their shop drawings and submittals in accordance with the coordination drawings.

D. Distribution:

- I. Upon receipt of all fully-coordinated and signed Coordination Drawings from the other Prime Contractors, the Project Coordinator shall make proper distribution, as defined above

E. Review:

- I. Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

I.06 SPECIFIC REQUIREMENTS

A. General Construction/Structural Work Information Required:

1. Openings and sleeve locations required in slabs, walls, beams, and other structural elements, including required openings not indicated on the Contract Documents.
2. Slab edge locations.
3. Embed locations, as described above. Note embedded steel angles at edges of sump and sewage ejector pits, to accept basin covers.
4. Wall and chase spaces for housing HVAC, Plumbing, Fire Protection, or Electrical items.
5. All site work and utilities
6. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

B. HVAC Work Information Required:

1. Sizes and bottom elevations of rectangular ductwork, including angle bracing, flanges, and support systems.
2. Sizes and centerline elevations of round ductwork, piping and conduit runs
3. Acoustical lining in ductwork.
4. Identification of ductwork pressure class.
5. Dimensions of major components, such as dampers, valves, diffusers, registers, cleanouts, coils, VAV boxes, HVAC equipment, and electrical distribution equipment.
6. Fire-rated enclosures around ductwork.
7. Access panels required.
8. Geothermal well field
9. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

C. Plumbing and Fire Protection Information Required:

1. Sizes and centerline elevations of piping runs.
2. Locations of plumbing valves, equipment, and fixtures.
3. Locations of standpipes, floor control assemblies, fire hose valves, mains, piping, branch lines, pipe drops, sprinkler heads, fire pumps/controllers, and jockey pumps.
4. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

D. Electrical Work Information Required:

1. Runs of vertical and horizontal conduit, 1 ¼" diameter and larger.
2. Light fixture locations.
3. Exit light locations.
4. Smoke detector and other fire alarm locations.
5. Panelboards, switchboards, switchgear, transformers, busways, generators and motor control center, exit signs, and emergency battery pack locations.
6. Locations of pull boxes and junction boxes, dimensioned from column centerlines.
7. Access panels required.
8. Site electric
9. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

E. Ceiling Systems and Plenum Space Information Required:

1. For HVAC, plumbing, fire protection, fire alarm, electrical, controls, and telecommunications Work penetrating acoustical ceilings, show locations of each item (including sprinkler heads, diffusers, grilles, access doors, light fixtures, smoke detectors, exit signs, speakers, and other visible ceiling-mounted devices) relative to the acoustical ceiling grid.
2. Locate components within ceiling plenums to accommodate layout of light fixtures indicated on Drawings. Clearly indicate areas of conflict between light fixtures and other components on Coordination Drawings.
3. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

I.07 ORGANIZATION OF DRAWINGS

- A. Organize Coordination Drawings into a set, as follows: Floor Plans, Wall and Building Sections, Mechanical/Plumbing/Electrical Rooms, Structural Penetrations, Imbeds, Curbs, Pads, and Floor Depressions.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01-3400

SECTION 011000 - SUMMARY

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Work covered by Contract Documents.
 - 2. Work by Owner.
 - 3. Work under separate contracts.
 - 4. Owner-furnished products.
 - 5. Contractor-furnished, Owner-installed products.
 - 6. Access to site.
 - 7. Coordination with occupants.
 - 8. Work restrictions.
 - 9. Specification and Drawing conventions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

I.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. The existing Guzman Hall, originally built in 1962 as a dormitory, is 45,730 sf. It is a 4 story concrete and steel framed structure clad in brick. It has been underutilized for quite some time, but still houses a few classrooms, security, Founder's Chapel and Health Services. The repurposing of much of the bottom 2 levels will require some modification to existing mechanical, electrical, plumbing and fire protection systems. The building is centrally located on the campus with existing parking to support the use of the facility. As described in the conceptual presentation dated 03/19/2021. The ground floor of existing Guzman Hall will be repurposed as a new Center for Community Engagement & Wellness, appx 8,000 sf of the ground floor will be renovated for this new program. The first floor level of Guzman Hall will be converted from a chapel to a multi-purpose, flexible campus community space with supportive pre-function space at appx. 7,576 sf. In addition, our design and documentation will include a small addition (~1,000 sf) off the re-designed courtyard for main entry to the ground floor and monumental stair to the first floor, and other Work indicated in the Contract Documents.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

I.4 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

I.5 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

I.6 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.
- B. Owner-Furnished Products:
 - I. Furniture.

I.7 CONTRACTOR-FURNISHED, OWNER-INSTALLED PRODUCTS

- A. Contractor shall furnish products indicated. The Work includes unloading, handling, storing, and protecting Contractor-furnished products as directed and turning them over to Owner at Project closeout.
- B. Contractor-Furnished, Owner-Installed Products:
 - I. Cores for door hardware.

I.8 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Use of Site: Limit use of Project site to **areas within the Contract limits** indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to **<Insert description of areas where work is permitted>**.
 - 2. Driveways, Walkways and Entrances: Keep driveways[**parking garage,**] [**loading areas,**] and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

- b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

I.9 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site, upper floors of Project and **existing adjacent** building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than **[72]** hours in advance of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

I.10 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours as dictated by the Owner.
 - 1. Weekend Hours: Per Owner's restrictions.

2. Early Morning Hours: **Refer to regulations by authorities having jurisdiction for restrictions on noisy work.**
 3. Hours for Utility Shutdowns: Per **Owner's restrictions.**
 4. Hours for **especially noisy activity**: Per **Owner's restrictions.**
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Notify **[Architect] [Construction Manager] [Owner]** not less than **[two]** days in advance of proposed utility interruptions.
 2. Obtain **[Architect's] [Construction Manager's] [Owner's]** written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify **[Architect] [Construction Manager] [Owner]** not less than **[two]** days in advance of proposed disruptive operations.
 2. Obtain **[Architect's] [Construction Manager's] [Owner's]** written permission before proceeding with disruptive operations.
- E. Restricted Substances: Use of tobacco products and other controlled substances is not permitted within the building and as posted.
- F. Employee Identification: **Provide** identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- G. Employee Screening: Comply with Owner's requirements for **[drug] [and] [background]** screening of Contractor personnel working on Project site.
1. Maintain list of approved screened personnel with Owner's representative.

I.11 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations [**published as part of the U.S. National CAD Standard**] [**and**] [**scheduled on Drawings**].
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 11 50 - SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The following requirements set forth obligations and duties to be upheld during construction in addition to the contract requirements set forth in the front end specifications.
- B. See A201 General Conditions for additional clarifications.

1.2 CONTRACT DOCUMENTS

- A. In the event of conflict or discrepancies among the Contract Documents, the document priorities shall be as listed below:
 - 1. Highest Priority: Change Order
 - 2. Second: Owner-Contractor Agreement
 - 3. Third: Addenda (later date to take precedence)
 - 4. Fourth: Supplemental Conditions
 - 5. Fifth: General Conditions
 - 6. Sixth: Specifications
 - 7. Seventh: Drawings
- B. The Contractor acknowledges and agrees that the Contract Documents are sufficient to provide for the completion of the Work and include Work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the Work in accordance with applicable laws, codes, and customary standards of the industry.
- C. Correlation and Intent of the Contract Documents
 - 1. The Sections of the Contract Documents are separated for the convenience of reference. Such separations shall not operate to make the Architect an arbiter to establish sub-contract limits between the Contractor and Subcontractors, nor shall they relieve the Contractor of his responsibility to supply and install all the items noted herein and called for in the Contract Documents.
 - 2. Errors, conflict, or omissions found in the Contract Documents, after award of the Contract shall be brought to the Architect's attention before any affected work is started for clarification before proceeding with the work. The Architect's decision shall be binding.
 - 3. Should the work proceed after the discovery of errors, conflict or omissions by the Contractor and clarification has not been received from the Architect, the Contractor will be held fully responsible for replacement or correction of the affected area as directed by the Architect at the Contractor's expense.
 - 4. All Drawings and Specifications are intended to be cooperative with no variances or conflicts occurring between them or within either document itself. Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called for by all. Anything not expressly set forth in the Contract Documents, but which is reasonably implied therefrom shall be of like effect as if required or called for. In case of discrepancies between the Contract Documents, the material system or equipment of greater cost shall take precedence. Any discrepancies between Contract Documents shall be called to the attention of the Architect before proceeding with work affected thereby. Upon such

notification, the Architect will issue his interpretation to all interested parties at once. The Architect's interpretation shall be final and shall be adhered to by the Contractor at no additional cost to the Owner.

5. Before ordering any material or doing any work, each trade shall verify all measurements at this project and shall be responsible for the corrections of same. No extra charge or compensation will be allowed on account of difference between actual dimensions and the measurements indicated on the drawings; any difference which may be found shall be reported to the Architect for consideration before proceeding with the work.
6. Whenever any item is specified and/or shown on the drawings by detail or reference, it shall be considered typical for other items which are obviously considered intended to be the same even though not so designated or specifically named but do serve the same function for this project.
7. Wherever the terms "necessary," "suitable," "as directed," "satisfactory," "good and sufficient," "approved," or other general qualifying terms are used on the drawings, they are deemed to be followed by the words "in the opinion of the Architect," or "by the Architect," as the case may be.
8. The terms "approval," "approved," "approved equal," or "equal," or "other approved" mean approved by the Architect.

I.3 OWNER

- A. The Owner shall not be responsible for furnishing surveys or other information as to the physical characteristics of the utility locations for the Project site. Contractor shall confirm the location of each utility. The Contractor shall have no claims for surface or subsurface conditions, whether unforeseen, foreseen or foreseeable. The Contractor shall exercise special care in executing subsurface work in proximity of subsurface utilities, improvements and easements.
- B. If the Contractor defaults or neglects to carry out the Work in any respect in accordance with the Contract Documents and fails to commence to correct such default or neglect within 48 hours after written notice thereof from the Architect or the Owner (except such period shall be 7 days if the notice is given after final payment), thereafter fails to use its best efforts to correct such default or neglect to the satisfaction of the Owner and Architect, or except where an extension of time is granted in writing by the Owner, fails to correct such default or neglect within 30 days of such notice to the satisfaction of the Architect and the Owner, then the Owner may, upon written notice to the Contractor and without prejudice to other remedies the Owner may have, make good such deficiencies. However, if such default or neglect results in a threat to the safety of persons or property, the Contractor shall immediately commence to correct such default or neglect upon receipt of written or oral notice thereof. If the notice is given before final payment, an appropriate Change Order shall be issued deducting from the payments then or thereafter due the Contractor the costs of correcting such deficiencies, including compensation for the Architect's additional services made necessary by such default, neglect, or failure and the Owner's administrative and legal expense, including the time of the Owner's personnel in dealing with such default. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

I.4 CONTRACTOR

- A. Contractor warrants that it has carefully studied and reviewed the Contract Documents and that it has reported any errors, inconsistencies or omissions to the Architect. The Contractor hereby acknowledges and declares that to its knowledge the Contract Documents are full and complete, are sufficient to have enabled it to determine the cost of the Work and to fulfill all of its obligations under the Contract Documents. If the Contractor encounters an inconsistency in the construction documents, he shall immediately submit it to the Architect for resolution, said resolution to be based on

functional requirements. In addition, if the Contractor performs any construction activity knowing or having reason to know that it involves a recognized error, inconsistency or omission in the Contract Documents, the Contractor shall be responsible for such performance and shall bear the costs for correction.

- B. The Contractor shall be responsible to assign a full-time on-site Superintendent to the project. The Owner shall have the right to review any proposed Superintendent's qualifications and have the right to accept or reject such proposed superintendent. The Owner shall have the right, upon proper notice, to have any superintendent replaced at no additional cost to the Owner.
 - I. The Contractor shall ensure that the on-site superintendent remains the same employee throughout the entire project with the following exceptions: injury, illness, dismissal, or employee resignation.
- C. If any of the Work is required to be inspected or approved by any public authority, the Contractor shall cause such inspection or approval to be performed. No inspection performed or failed to be performed shall be a waiver of any of the Contractor's obligations hereunder or be construed as an approval or acceptance of the Work or any part thereof.
- D. Wherever any item, device, or part of equipment is referred to in the Contract Documents in singular number, as many items, devices or parts as are required for a complete installation shall be installed.
- E. Directions, specifications and recommendations by manufacturers for installation, handling, storage, adjustment, and operation of their materials or equipment shall be complied with; but the Contractor shall nonetheless have the responsibility for determining whether such directions, specifications, and recommendations may safely and suitable be employed in the work and of notifying the Architect in advance in writing of any deviation or modification necessary for installation safety or proper operation of item.
- F. The Contractor shall take all necessary steps to ensure labor harmony in the Project. Perform work in accordance with local labor regulations; no extra payment shall be due for doing work under this provision, or for delays or damages for failure to observe such requirements.
- G. The Contractor and Owner shall agree upon a schedule for the progress of the Work (hereinafter "Progress Schedule") within fifteen (15) days of the Notice to Proceed, which schedule shall designate the commencement date and date of substantial completion for the work. The Progress Schedule shall be binding, time being of the essence.
- H. The Contractor shall prepare and submit CPM construction schedules as required by the Contract Documents and must include the owner's required milestones. The schedules shall not exceed time limits current under the Contract Documents, shall be revised at intervals identified, and related to the entire Project to the extent required by the Contract Documents.
- I. Project Record Documents: Throughout the progress of construction, the Contractor shall keep a set of current, detailed, field record drawings indicating significant deviations from the Contract Drawings, shop drawings, and/or installation drawings, and exact locations of concealed work, including underground utilities and major mechanical and electrical services and features.. This requirement does not authorize any deviations without approval of the Architect.
- J. Cutting and Patching: A Contractor, subcontractor, or sub-subcontractor requiring the cutting of openings in new work installed by others shall have such openings cut and patched by the trade which installed the work and such cutting and patching shall be at the expense of the Contractor, subcontractor or sub-subcontractor requiring the opening. Approval to do such cutting and patching shall be received from the Architect prior to proceeding with the work and shall include installation of

such reinforcement of the work as the Architect may direct. All blocking, bracing, reinforcement, or structural enhancement required due to cutting and patching shall be provided at no additional cost to Owner. All patching work shall match adjacent existing work unless otherwise noted.

I.5 SUBCONTRACTORS

- A. Should the Contractor cause damage to the work or property of any separate contractor, the Contractor shall upon due notice, promptly attempt to settle with such other contractor by agreement, or otherwise to resolve the dispute. If such separate contractor sues or initiates dispute resolution proceedings against the Owner and Architect on account of any damage alleged to have been caused by the Contractor, the Owner and Architect shall notify the Contractor who shall defend such proceedings at the Contractor's expense, and if any judgment or award against the Owner or Architect arises therefrom the Contractor shall pay or satisfy it and shall reimburse the Owner and Architect for all costs including but not limited to attorneys' fees, court or mediation or arbitration costs which the Owner or Architect has incurred.

I.6 WARRANTY

- A. In addition to other warranties, guarantees, or obligations set forth in the Contract Documents or applicable as a matter of law and not in limitation of the terms of the Contract Documents, the Contractor warrants and guarantees the following:
 - 1. The Owner will have good title to the Work and materials and equipment incorporated into the Work will be new.
 - 2. The Work and materials and equipment incorporated into the Work will be free from defects, including defects in the workmanship or materials.
 - 3. The Work and equipment incorporated into the Work will be fit for the purpose for which they are intended.
 - 4. The Work and materials and equipment incorporated into the Work will be merchantable.
 - 5. The Work and materials and equipment incorporated into the Work will conform to the Contract Documents.
- B. Upon notice of the breach of the foregoing warranties or guarantees or other warranties or guarantees under the Contract Documents, the Contractor, in addition to other requirements in the Contract Documents, will commence to correct such breach and damage resulting therefrom within 48 hours after written notice thereof, thereafter will use its best efforts to correct such breach and damage to the satisfaction of the Owner and, except where an extension of time is granted in writing by the Owner, correct such breach and damage to the satisfaction of the Owner within 30 days of such notice; provided that if such notice is given after final payment hereunder, such 48 hour period shall be extended to 7 days. If the Contractor fails to commence to correct such breach and damage, or correct such breach and damage as provided above, the Owner, upon written notice to the Contractor and without prejudice to its other written notice to the Contractor and without prejudice to his other rights or remedies, may correct the deficiencies. The Contractor upon written notice to the Owner shall pay the Owner, within 10 days after the date of such notice, the Owner's costs and expenses incurred in connection with such correction, including without limitation the Owner's administrative and legal expenses. The foregoing warranties and obligations of the Contractor shall survive the final payment and termination of the Contract.

I.7 TAXES

- A. The Owner expects the Contractor to claim tax exemptions for items which are tax exempt.

- B. The Owner expects the exemption to be reflected in bids.
- C. The Owner will cooperate with the Contractor's obtaining the exemption.
- D. The Contractor shall check all materials, equipment, and labor entering into the Work and shall keep such full and detailed accounts as may be necessary for proper financial management under this Contract, and the system shall be satisfactory to Owner. Such accounts shall be sufficient to support a request for refund of sales and use tax. The Owner or its representative shall be afforded access to all of the Contractor's records, books, correspondence, instructions, drawings, receipts, vouches, memoranda, and similar data relating to this Contract, and the Contractor shall preserve all such records for a period of 3 years, or for such longer period as may be required by law, after the final payment.
- E. The Contractor agrees to assign and transfer to the Owner all of its rights to sales and use tax which may be refunded as a result of a claim against Owner for refund for materials purchased in connection with this Contract. The Contractor further agrees that it will not file a claim against Owner for refund for any sales or use tax which is subject to this Agreement. The Contractor shall cooperate with and assist the Owner in obtaining any refund of sales and use tax for the Owner's benefit

I.8 CHANGES IN THE WORK

- A. Changes in the work shall require the following approvals:
 - 1. Owner
 - 2. Architect
- B. Change Orders
 - 1. It will be the Contractor's responsibility to provide complete breakdown of the labor and materials, subcontractor's and sub-subcontractor's cost spent on Change Orders or Construction Change Directives.
 - 2. All changes in the work shall be approved before the start of any work through written consent of the Owner in accordance with the procedure above. Changes not approved in writing by the Owner in advance shall not be recognized as a valid claim at a later date, except where the Owner agrees in writing that the change shall be started, subject to an equitable price adjustment at a later date in the interest of the job progress.

I.9 PROTECTION OF PERSONS AND PROPERTY

- A. The Contractor shall protect and maintain in operation all pipe lines, conduits, sewers, drains, poles, wiring and the like that in any way interfere with the work, whether or not they are specifically shown on the drawings. The Contractor shall see that all items to be abandoned are abandoned in a proper manner and that other items are protected, supported and/or moved as necessary to accommodate the new work.

I.10 UNCOVERING AND CORRECTION OF WORK

- A. Within 48 hours after written notice from the Architect or the Owner (except such period shall be 7 days when notice is given after final payment) that the work does not conform to the Contract Documents, or immediately upon oral notice, if the nonconformance constitutes a threat to the safety of persons or property, the Contractor, without waiting for the resolution of disputes that may exist, shall commence to correct such nonconformance, shall thereafter use its best efforts to correct such

nonconformance to the satisfaction of the Architect and the Owner, and except where an extension of time is granted in writing by the Owner, shall complete necessary corrections so that the nonconformance is eliminated to the satisfaction of the Architect and the Owner within 30 days of such notice. The Contractor shall bear the costs of correcting the nonconformance, including additional testing and inspections and additional service fees of the Architect.

- B. Work that is rejected or fails to conform to the requirements of the Contract Documents that requires any review, research, recommendation, meetings or direction by the Architect in order to substantiate or to approve remedies, the Architect will be compensated for such additional work at standard prevailing rates by the Owner. The Owner will duly back-charge the Contractor for such additional costs and deduct costs from retainage or Application for Payment.

I.11 COOPERATION AND COORDINATION

- A. Where any job condition arises and no detailed Drawings exist to give Architect's intent, Contractor shall consult with Architect for proper manner of doing work, so that aesthetic effect is not compromised.
- B. Observation of Work by the Architect or by employees of the Architect shall not be interpreted as relieving Contractor from his responsibility for coordination of all work, his Superintendence of the work, and his scheduling of the work.
- C. The General Contractor shall arrange, during progress of the Work, for necessary openings (temporary and permanent), chases, sleeves in walls, floors, ceilings, roof and partitions as required by his subcontractors.

I.12 EXCLUSIONS

- A. Certain items are not included in the scope of the General Contractor's work. These items will be furnished and installed by others through arrangements made by the Owner and Architect. These items are identified on the plans as "NIC" (not in contract), "future", or "by Owner". Refer to the drawings and specifications, including the equipment schedules.

I.13 WRITTEN INTERPRETATIONS REQUIRED

- A. Neither the price bid for the Work of any Contractor, nor the Contract Sum shall be based in any manner upon oral opinions, or real or alleged instructions of an oral nature, regardless of whether such opinions or instructions are expressed by the Owner, the Architect, the Contractor or agents or representatives of any of them.
- B. These provisions do not intend to deny normal discussion, recommendations, explanations, suggestions, approvals, rejections, and similar activity in pursuit of the work of the Project on an oral basis, such as at Job Conferences and otherwise at the Site. In such instances the written minutes, correspondence, Shop Drawings Records, written Field Orders and other written data shall control over claims regarding statements made contrary to the written data.
- C. Interpretations of Contract Documents, to be effective for claim purposes or for justification as to proper procedure in performing the Work, must be obtained in writing before such claim is made or such work begun.

- D. Written or graphic interpretations by the Architect will be considered as minor changes in the Work. No claims for additional time or money will be honored due to such interpretation. Any interpretations offered by the Architect that Contractor determines to affect Contract Sum or time shall be returned to the Architect within 5 days and will be treated as a Change Proposal Request. Provide complete substantiation of changes in contract time or money as required for a Change Proposal Request.

I.14 PROJECT BID ALTERNATES

- A. Except as noted otherwise, bid prices for alternates not included in Contract at time of execution shall be held by Contractor for a period of no less than ninety (90) days thereafter. During this time and at the discretion of the Owner, any of these alternates may be incorporated into the Contract by Change Order for the Bid price(s).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 11 50

SECTION 01 12 01 – PRIME CONTRACTOR CHECKLIST

PART I - GENERAL

I. 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.

2. SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.
 - 2. Section 01 50 00 "Temporary Facilities".

3. DEFINITIONS

- A. General Contractor designation (GC)
- B. Mechanical (HVAC) contractor designation (MC)
- C. Electrical Contractor designation (EC)
- D. Plumbing Contractor designation (PC)
- E. 'X' under "Furnish Trade" or "Install Trade" indicates the MC, EC or PC as delineated in other specification sections, the "Related Requirements", technical specifications or drawings.
- F. Owner designation (O)
- G. Utility designation (U)

PART II - PRODUCTS

PART III – EXECUTION

I. PRIME CONTRACTOR CHECKLIST

- A. Divisions of Responsibilities between the prime contracts should be mutually determined prior to construction commencement.

END OF SECTION 01 12 01

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
 - I. Quantity allowances.
- C. Related Requirements:
 - I. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.3 DEFINITIONS

- A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.4 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
- B. At Architect'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 Architect from the designated supplier.

1.5 ACTION SUBMITTALS

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

I.6 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

I.7 QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include **[taxes,]**freight[,] and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

I.8 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
 - 3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

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. Allowance No. 1: Quantity Allowance: Include replacement of 200 sq. ft. of water-damaged gypsum wallboard and insulation to be installed in the Multi-purpose Room.
- B. Allowance No. 2: Quantity Allowance: Owner's A/V consultant has provided a budget of \$116,000 for video, audio, control, lighting and the window shading devices, programming, project management and training, and misc racks, etc. Refer to Electrical Drawings for additional effort of coordination required of the Electrical Contractor.
- C. Allowance No. 3: Contingency Allowance: Include a contingency allowance if stipulated by Owner for use according to Owner's written instructions.

END OF SECTION 012100

SECTION 01 23 00 - ALTERNATES

PART I - GENERAL

I. 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.

2. SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

3. DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

4. PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into 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 indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART II - PRODUCTS (Not Used)

PART III - EXECUTION

5. SCHEDULE OF ALTERNATES

6. GENERAL CONSTRUCTION CONTRACT

- A. Re-roof of Multi-Purpose Space and corridor leading to it, as indicated on drawings.
- B. Façade removal of granite & marble from health center & installation of new composite façade, as indicated on drawings.
- C. Replacement of all ground floor punched openings, as indicated on drawings.
- D. Toilet Room demo to become storage closet (026B), as indicated on drawings.
- E. Reception Desk is intended to be furniture matching details included within Contract Documents, as an alternate it will be casework.
- F. Waiting Area/Reception Ceiling alternate to the metal linear look is the scheduled 2x2 ACT, as indicated on drawings.

END OF SECTION 01 23 00

SECTION 012500 - SUBSTITUTION PROCEDURES

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012300 "Alternates" for products selected under an alternate.
 - 3. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

I.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

I.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

- c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from [ICC-ES] or other reputable agency.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within [seven] <Insert number> days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within [15] <Insert number> days of receipt of request, or [seven] <Insert number> days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

I.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

I.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

I.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than [15] <Insert number> days prior to time required for preparation and review of related submittals.
- I. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within [60] <Insert number> days after **commencement of the Work**. Requests received after that time may be considered or rejected at discretion of Architect.
- I. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

I.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions" (ASI).

I.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect or Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests (WCPR) issued by Architect or Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times,

and activity relationship. Use available total float before requesting an extension of the Contract Time.

- e. Quotation Form: Use forms acceptable to Architect or Construction Manager.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the Architect or Construction Manager.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use form acceptable to Architect or Construction Manager.

I.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

I.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive (CCD) on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01-2600

SECTION 01 29 00 - PAYMENT PROCEDURES

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 01 22 00 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 2. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 3. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

I.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

I.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. **Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.**
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than **seven** days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

- I. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
2. Arrange schedule of values consistent with format of **AIA Document G703**
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of **five** percent of the Contract Sum.
 - a. Include separate line items under principal subcontracts for Project closeout requirements in an amount totaling **five** percent of the Contract Sum and subcontract amount.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

I.5 APPLICATIONS FOR PAYMENT

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

- G. Transmittal: Submit **three** signed and notarized original copies of each Application for Payment to **Architect** by a method ensuring receipt **within 24 hours**. One copy shall include waivers of lien and similar attachments if required.
- I. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
- I. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
 5. lawfully entitled to a lien.
 6. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
 5. Products list (preliminary if not final).
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire Owner's insurance.
- J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 01-3200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01-7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01-7700 "Closeout Procedures" for coordinating closeout of the Contract.

I.3 DEFINITIONS

- A. RFI: Request from Owner, Owner's Representative, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

I.4 INFORMATIONAL SUBMITTALS

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

cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

I.5 GENERAL COORDINATION PROCEDURES

- A. 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 performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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. Project closeout activities.
 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

I.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

- I. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 1. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 2. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 3. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit **1-1/4 inches** in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 4. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 5. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. File Preparation Format: DWG, Version, operating in Microsoft Windows operating system.
 3. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
 4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files. See Section 01 34 00 for more information.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in AutoCAD.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

I.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect and Owner's Representative.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716.

- I. Attachments shall be electronic files in Adobe Acrobat PDF format.
 - D. Architect's and Owner's Representative's Action: Architect and Owner's Representative will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect or Owner's Representative after 1:00 p.m. will be considered as received the following working day.
 - I. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Owner's Representative in writing within 10 days of receipt of the RFI response.
 - E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect and Owner's Representative.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's and Owner's Representative's response was received.
 - F. On receipt of Architect's and Owner's Representative's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Owner's Representative within seven days if Contractor disagrees with response.
 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- I.8 PROJECT MEETINGS
- A. General: GC to Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Owner's Representative, and Architect, within three days of the meeting.
- B. "Preconstruction Conference: GC to schedule, prepare agenda, create and distribute meeting minutes and conduct a Preconstruction Conference before starting construction, at a time convenient to the Owner, Owner's Rep and Architect.
1. Conduct the conference to review responsibilities and personnel assignments
 2. Attendees: Authorized representatives of Owner, Owner's Rep, Architect and their Consultants; Prime Contractors and their Project Managers and Superintendents; major subcontractors; suppliers; and other key parties as appropriate. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative Construction schedule
 - b. Phasing
 - c. Critical Work sequencing
 - d. Designation of key personnel and their duties
 - e. Lines of communication
 - f. Procedures for processing field decisions and Change Orders
 - g. Procedures for RFI's
 - h. Procedures for testing and inspections
 - i. Procedures for processing Applications for Payment
 - j. Distribution of the Contract Documents
 - k. Submittal procedures
 - l. Preparation of Record Documents
 - m. Use of the Premises
 - n. Work restrictions
 - o. Working hours
 - p. Owner's occupancy requirements
 - q. Responsibility for temporary facilities and controls
 - r. Procedures for moisture and mold control
 - s. Procedures for disruptions and shutdowns
 - t. Construction waste management and recycling
 - u. Parking and laydown areas
 - v. Office, work and storage areas
 - w. Equipment deliveries and priorities
 - x. First Aid
 - y. Security
 - z. Progress cleaning and site maintenance
- C. Preinstallation Conferences: 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 Architect, Owner's 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. Deliveries.
 - b. Submittals.
 - c. Review of mockups.
 - d. Possible conflicts.
 - e. Compatibility requirements.
 - f. Time schedules.
 - g. Weather limitations.
 - h. Manufacturer's written instructions.
 - i. Compatibility of materials.
 - j. Acceptability of substrates.
 - k. Space and access limitations.
 - l. Testing and inspecting requirements.
 - m. Installation procedures.
 - n. Coordination with other work.
 - o. Required performance results.
 - p. Protection of adjacent work.
 - q. Protection of construction and personnel.
 3. 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 other parties requiring information.
 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.
- D. Progress Meetings: GC conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner, Owner's Representative, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.

- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation for processing pay requests
 - 19) Manpower summaries and work progress
 - 20) Status of inspections
 - 21) Status of testing
- 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- E. Coordination Meetings: Owner's Representative will conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 - 1. Attendees: In addition to representatives of Owner, Owner's Representative, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each contractor present, including the following:

- 1) Interface requirements.
- 2) Sequence of operations.
- 3) Status of submittals.
- 4) Deliveries.
- 5) Off-site fabrication.
- 6) Access.
- 7) Site utilization.
- 8) Temporary facilities and controls.
- 9) Work hours.
- 10) Hazards and risks.
- 11) Progress cleaning.
- 12) Quality and work standards.
- 13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01-3100

aa.

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Periodic construction photographs.
- B. Related Requirements:
 - 1. Section 01-3300 "Submittal Procedures" for submitting photographic documentation.
 - 2. Section 01-7700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

I.3 INFORMATIONAL SUBMITTALS

- A. Digital Photographs: Submit image files within one week of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 - 3. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name of Contractor.
 - c. Date photograph was taken.
 - d. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - e. Unique sequential identifier keyed to accompanying key plan.

I.4 QUALITY ASSURANCE

- A. Photographer Qualifications: Site superintendent or other qualified individual.

I.5 USAGE RIGHTS

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

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

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

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect and Construction Manager.
- D. Periodic Construction Photographs: Take 30 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

END OF SECTION 01-3233

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART I - GENERAL

I.1 RELATED DOCUMENTS

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

I.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Division I Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Division I Section "Substitutions".
 - 3. Division I Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Division I Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 5. Division I Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 6. Division I Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

I.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- ~~C.~~ Basis-of-Design: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

~~D.C.~~

- ~~E.D.~~ File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP

site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

F.E. **Portable Document Format (PDF):** An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

I.4 ACTION SUBMITTALS

- A. **Submittal Schedule:** Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. **Initial Submittal:** Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. **Final Submittal:** Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 4. **Format:** Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

I.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. **Architect's Digital Data Files:** Electronic digital data files of the Contract Drawings may be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish each Contractor requesting one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

- b. Contractor shall execute a data licensing agreement in the form of Agreement provided by the Architect.
 - c. Digital data will not be processed into a different format/version/etc than that in which it was originally documented.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule. Incomplete submittals will be returned not reviewed.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 12 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 10 days for review of each resubmittal.
 - 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 - 5. Concurrent Consultant Review: With Architect's approval submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 12 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Provide a space approximately **6 by 8 inches** on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 - 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.

- g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - l) As directed by Architect.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
- a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
- a. Transmittal Form for Paper Submittals: Use AIA Document G810.
 - b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Architect.
 - 6) Name of Construction Manager.
 - 7) Name of Contractor.
 - 8) Name of firm or entity that prepared submittal.
 - 9) Names of subcontractor, manufacturer, and supplier.
 - 10) Category and type of submittal.
 - 11) Submittal purpose and description.
 - 12) Specification Section number and title.
 - 13) Specification paragraph number or drawing designation and generic name for each of multiple items.
 - 14) Drawing number and detail references, as appropriate.
 - 15) Indication of full or partial submittal.
 - 16) Transmittal number, numbered consecutively.
 - 17) Submittal and transmittal distribution record.
 - 18) Remarks.
 - 19) Signature of transmitter.
6. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
7. Name file with submittal number or other unique identifier, including revision identifier.
- a. File name shall use project identifier and Specification Section number followed by a dash and then a sequential number (e.g., G-00-0000-01-A). Resubmittals shall include an

alphabetic suffix after another decimal point (e.g. G-00-0000-01-B). The beginning letter will designate the Prime Contract (G=General, M=Mechanical, E=Electrical, P=Plumbing, F=Fire Protection)

8. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.
- J. Rejected Submittals: The Architect shall not be required to make exhaustive reviews of incorrect or incomplete shop drawings and submittals. If shop drawings or submittals are returned "Rejected" or "Revise and Resubmit" 3 times then the time to review each subsequent submission will be charged to the Contractor at the Architect's hourly rates. These charges will be executed as deduct change order(s) to the Contractor's contract with the Owner, with payment remitted by the Owner to the Architect.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Action Submittals: Submit PDF of each submittal unless otherwise indicated. If the submittal is larger than 11"x17" then also provide 1 full size paper copy. Architect will return a PDF with action indicated.
 2. Informational Submittals: Submit PDF of each submittal unless otherwise indicated. Architect will not return a PDF unless requested.
 3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

- a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:

- a. PDF file. If submittal is larger than 11"x17" then also provide 2 full size paper set (one to architect).
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit 2 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit 2 sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

- 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.
- F. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three paper copies of certificate, signed and sealed by the responsible design

professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

- I. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division I Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 33 00

SECTION 01 34 00 - COORDINATION DRAWINGS

PART I – GENERAL

I.1 RELATED DOCUMENTS

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

I.2 SUMMARY

- A. Coordination of the Work, and production of Coordination Drawings, are contractual obligations of the Construction Manager, and as delegated to the subcontractors. The Owner will not compensate any for conflicts arising during installation, should they be the result of improper coordination between Prime Contractors. Nor will the Owner extend the Contract duration, due to delays caused by improper coordination. Each Contractor shall be solely responsible to recover any and all construction time lost as a result of such delays.
- B. Coordination drawings are in addition to a separate shop drawings to be submitted at the conclusion of the coordination process by each Prime Contractor (as required by other specification sections).

I.3 SUBMITTALS

- A. Time of submission of Coordination Drawings shall be determined at the initial job conference, and shall be included as a milestone on the Construction Schedule. The General Construction Contractor (Project Coordinator) shall initiate this action and acquire the necessary dates from the other Prime Contractors as part of their overall scheduling responsibilities.
- B. All Prime Contractor{s} shall jointly develop and submit dimensioned Coordination Drawings indicating the arrangement of General Construction, Mechanical (HVAC), Plumbing, Electrical and Fire Protection work, including but not limited to: all ducts, air-handling equipment, control equipment, piping, conduits, raceways, junction boxes, fixtures, panels, and all associated equipment, which must be coordinated with the General Construction and other equipment or distribution lines. The Coordination Drawings must be signed and dated by all Prime Contractors, indicating concurrence, and transmitted to the Project Coordinator (in accordance with the construction schedule), for submission.
- C. The Owner's receipt of Coordination Drawings does not in any way constitute approval, or relieve the Prime Contractors of the responsibility to accurately coordinate and install their work.
- D. The Project Coordinator shall submit completed, signed, and dated Coordination Drawings as follows:
 - I. The Architect and CM – one (1) copy of each Coordination Drawing and one (1) PDF file containing each drawing.
- E. Note: If determined necessary, Coordination Drawings may be formulated and submitted in partial submittals to facilitate the construction schedule and sequence of work within the Project. This must be

jointly discussed and agreed to by all Prime Contractors at the initial job conference, and a priority of sequence must be established that has the concurrence of all parties (including the Owner).

- F. The Project Coordinator shall keep all coordination drawings on-site at all times and updated regularly through the entire construction duration. These drawings will become part of the as-built drawing package.

I.4 COORDINATION OF WORK

- A. Construction Manager shall coordinate its construction operations with those of all Contractors and entities to ensure efficient and orderly installation for each part of the Work. The Construction Manager shall:
 - 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 all components to ensure adequate accessibility/clearance for required maintenance and service.
 - 3. Make provisions to accommodate items scheduled for later installation.
- B. Each Prime Contractor shall clearly show, and coordinate with the other Prime Contractors, the following:
 - 1. Arrange for pipe spaces, chases, slots, sleeves, and openings with general construction work, and arrange in building structure during progress of the Work, to allow for and facilitate distribution line and equipment installation.
 - 2. Coordinate installation of required supporting devices for ductwork, piping, and conduit, as well as sleeves, and other structural components, as they are constructed.
 - 3. Coordinate requirements for access panels and doors for HVAC, Plumbing, Fire Protection and Electrical items requiring access where concealed behind finished surfaces.
 - 4. Coordinate electrical connections to equipment provided by all Contractors.
 - 5. Sequence, coordinate, and integrate installing materials and equipment for efficient flow of the Work. Coordinate installing large items of equipment requiring positioning before closing in the building.

I.5 COORDINATION DRAWINGS

- A. Format: All Coordination Drawings shall include “X, Y & Z” coordinates for all distribution and equipment, which will allow a three-dimensional coordination plan to be created.
 - 1. Indicate ducts, pipes and conduits of dimensions greater than 6” by double lines.
 - 2. Circle and clearly note all deviations from the Contract Documents, with reason for deviation stated.
 - 3. Use scale not less than ¼” = 1’-0”. Detail complex areas at larger scale.

4. Each different system shall be drawn in a different color.
5. The Mechanical Contractor shall prepare a title box on each drawing which allows space for the signature of the authorized individual from the Prime Contractor's firms, with the statement below:

“The undersigned individuals certify by their signatures that they have coordinated their work with all other work noted on this drawing and the contract documents and shall be held responsible for any costs arising out of their respective inability to fully coordinate their work.”

B. Coordination Procedure:

1. The Project Coordinator is responsible for acquiring from all the other Prime Contractors and assembling scaled coordination drawings indicating all new and existing architectural finishes, as well as the locations of all ductwork, piping, conduit, system devices, associated equipment, etc. for this Project.
2. The Project Coordinator shall prepare the basic background drawings, showing the existing conditions as well as the new construction items to be installed by this Contractor. The Project Coordinator may either:
 - a. Produce the required base drawings itself,
 - b. Obtain them from the Architect, at a cost not to exceed 1.2 times the cost of reproduction, or
 - c. Via e-mail, obtain electronic files from the Architect of the floor plans and reflected ceiling plans for a fee of \$250.00, payable to the Architect. A Letter of Indemnification will need to be signed by any contractor using the electronic files.
3. After producing its own background drawings or obtaining background drawings from the Architect, the Project Coordinator shall put the following information on the Coordination Drawings: Architectural backgrounds, structural work, ceiling systems, and any special work, such as theatre/stage/rigging work. The Lead Contractor shall call attention on the Coordination Drawings to particular areas of conflict, which may affect the architecture or the structure.
4. After adding its specific requirements to these reproducible background drawings, the Project Coordinator shall place his signature on each sheet and give the Coordination Drawings to the HVAC Contractor.
5. The HVAC Contractor shall put the following information on the Coordination Drawings: HVAC Contract Work, including Control Systems.
6. After adding its specific requirements to these reproducible background drawings, the HVAC Contractor shall place his signature on each sheet and give the Coordination Drawings to the Plumbing Contractor.
7. The Plumbing Contractor shall put the following information on the Coordination Drawings: Plumbing Contract Work, including Sprinkler/ Fire Protection Systems.
8. After adding its specific requirements to these reproducible background drawings, the Plumbing Contractor shall place his signature on each sheet and give the Coordination Drawings to the Fire Protection Contractor.
9. The Fire Protection Contractor shall put the following information on the Coordination Drawings: Fire Protection Contract Work, including Sprinkler/ Fire Protection Systems.

10. After adding its specific requirements to these reproducible background drawings, the Fire Protection Contractor shall place his signature on each sheet and give the Coordination Drawings to the Electrical Contractor.
11. The Electrical Contractor shall put the following information on the Coordination Drawings: Electrical Contract Work, including fire alarm, telecommunications and security systems, major conduit runs, lighting and panel locations, and conduit embeds in floor slabs and underground.
12. The Electrical Contractor shall place his signature on each sheet and give the Coordination Drawings to the next Prime Contractor (if there are other Prime Contractors not mentioned here), or otherwise return the Coordination Drawings to the Project Coordinator, for Submission to the Owner and Architect.
13. Discrepancies between the Prime Contractors shall be settled by the Project Coordinator, if no design modifications are required. Where design modifications are required, affected Contractor(s) shall submit them to the Architect for review and resolution, or initiate a Request For Information (RFI).
14. The Prime Contractors, together, are solely responsible for the accuracy and completeness of all Coordination Drawings.
15. The Mechanical/Electrical Coordinator shall lead in the resolution of the final coordination drawing to be initialed (certifying that they have met, reviewed and agreed) by all contractors and submitted to the Architect within 65 days after the start of construction for review. Other contractors shall finalize their shop drawings and submittals in accordance with the coordination drawings.

C. Distribution:

- I. Upon receipt of all fully-coordinated and signed Coordination Drawings from the other Prime Contractors, the Project Coordinator shall make proper distribution, as defined above

D. Review:

- I. Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

I.06 SPECIFIC REQUIREMENTS

A. General Construction/Structural Work Information Required:

1. Openings and sleeve locations required in slabs, walls, beams, and other structural elements, including required openings not indicated on the Contract Documents.
2. Slab edge locations.
3. Embed locations, as described above. Note embedded steel angles at edges of sump and sewage ejector pits, to accept basin covers.
4. Wall and chase spaces for housing HVAC, Plumbing, Fire Protection, or Electrical items.

5. All site work and utilities
6. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

B. HVAC Work Information Required:

1. Sizes and bottom elevations of rectangular ductwork, including angle bracing, flanges, and support systems.
2. Sizes and centerline elevations of round ductwork, piping and conduit runs
3. Acoustical lining in ductwork.
4. Identification of ductwork pressure class.
5. Dimensions of major components, such as dampers, valves, diffusers, registers, cleanouts, coils, VAV boxes, HVAC equipment, and electrical distribution equipment.
6. Fire-rated enclosures around ductwork.
7. Access panels required.
8. Geothermal well field
9. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

C. Plumbing and Fire Protection Information Required:

1. Sizes and centerline elevations of piping runs.
2. Locations of plumbing valves, equipment, and fixtures.
3. Locations of standpipes, floor control assemblies, fire hose valves, mains, piping, branch lines, pipe drops, sprinkler heads, fire pumps/controllers, and jockey pumps.
4. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

D. Electrical Work Information Required:

1. Runs of vertical and horizontal conduit, 1 ¼" diameter and larger.
2. Light fixture locations.
3. Exit light locations.
4. Smoke detector and other fire alarm locations.
5. Panelboards, switchboards, switchgear, transformers, busways, generators and motor control center, exit signs, and emergency battery pack locations.

6. Locations of pull boxes and junction boxes, dimensioned from column centerlines.
7. Access panels required.
8. Site electric
9. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

E. Ceiling Systems and Plenum Space Information Required:

1. For HVAC, plumbing, fire protection, fire alarm, electrical, controls, and telecommunications Work penetrating acoustical ceilings, show locations of each item (including sprinkler heads, diffusers, grilles, access doors, light fixtures, smoke detectors, exit signs, speakers, and other visible ceiling-mounted devices) relative to the acoustical ceiling grid.
2. Locate components within ceiling plenums to accommodate layout of light fixtures indicated on Drawings. Clearly indicate areas of conflict between light fixtures and other components on Coordination Drawings.
3. Other specific/critical conditions unique to this Project, not noted above but necessary to assure proper coordination.

I.07 ORGANIZATION OF DRAWINGS

- A. Organize Coordination Drawings into a set, as follows: Floor Plans, Wall and Building Sections, Mechanical/Plumbing/Electrical Rooms, Structural Penetrations, Imbeds, Curbs, Pads, and Floor Depressions.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01 34 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART I - GENERAL

I.1 RELATED DOCUMENTS

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

I.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Division I Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.

I.3 DIVISION OF RESPONSIBILITIES

- A. General: These Specifications assign each prime contractor specific responsibilities for certain temporary facilities used by other prime contractors and other entities at the site. The Contractor for General Construction (G.C.) is responsible for providing temporary facilities and controls that are not normal construction activities of other prime contractors and are not specifically assigned otherwise by the Architect.
- B. The Contractor for GC is responsible for the following:
 - 1. Permits, installation, operation, maintenance, and removal of each temporary facility usually considered as its own normal construction activity, as well as the costs and use charges associated with each facility.
 - 2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
 - 3. Its own storage and fabrication sheds.
 - 4. Temporary enclosures for its own construction activities.
 - 5. Staging and scaffolding for its own construction activities
 - 4. Hoisting all of their own equipment (whether inside or outside of the building).
 - 5. Collection and disposal of its own hazardous, dangerous, unsanitary, or other harmful waste material.
 - 6. Progress cleaning of work areas affected by its operations on a daily basis.
 - 7. Secure lockup of its own tools, materials, and equipment.
 - 8. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
 - 9. Dewatering facilities and drains.
 - 10. Temporary telephone and internet service.
 - 11. Temporary field offices for Contractor's personnel and Project Progress Meetings.
 - 12. Temporary toilets, including disposable supplies.
 - 13. Temporary wash facilities, including disposable supplies.
 - 14. Temporary enclosure of the building.
 - 15. General collection and disposal of wastes.
 - 16. Project identification sign, project acknowledgment sign, and temporary signs.
 - 17. Rodent and pest control.
 - 18. Barricades, warning signs, and lights.
 - 19. Temporary fence around construction site (project limits).

- 20. Environmental protection.
- 21. Temporary heat and humidity control prior to “enclosure” of the building.
- 22. Snow removal within the project boundaries
- 23. Drinking water.
- 24. Temporary heat & humidity control, upon “enclosure” of the building.
- 28. Temporary lighting.
- 29. Temporary site security lighting.

I.4 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Telephone, Internet and Cellular Service: General Construction Contractor will provide telecommunication systems and pay for use charges for common use field office.

I.5 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent. Conform to approved land development plans.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

- E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste handling procedures.
 - 5. Other dust-control measures.

I.6 QUALITY CONTROL

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

I.7 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pavement: Comply with Division 32 Section "Hot-Mix Asphalt Paving."
- B. Chain-Link Fencing: Minimum 2-inch , 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts. Provide screening if required by the Owner.

Camera security system.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches .
- E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- F. Signs:
 - 1. Project Identification Sign:

- a. The Owner will decide if any signage beyond those potentially required below are acceptable to be displayed, and where they can be located.
 - b. The General Contractor will provide any other signs that may be required by US, State or Local government.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touchup signs so they are legible at all times.
4. Unauthorized signs are not permitted.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Each prime contractor is to provide its own office and storage trailers as required.
- B. Common-Use Field Office: GC to provide a trailer of sufficient size to accommodate needs of Owner, Architect, and General Contractor's construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 2. Conference room of sufficient size to accommodate meetings of 12 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
 3. Drinking water.
 4. Coffee machine and supplies.
 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F
 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
 7. A copy of the latest edition of the IBC.
- C. Construction Manager or Owner's Representative Field Office: GC to provide a trailer meeting the same requirements as the Common Use Field Office.
- D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

- I. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: **If** Owner and Architect authorize the use of permanent HVAC system for temporary use during construction (for either heating or humidity control), provide filter with MERV of 8 at each return-air grille in system and remove at end of construction. Clean HVAC system and replace all filters as required in Division 01 Section "Closeout Procedures." HVAC system warranties, regardless of whether they are used or not during construction, will start when the Certificate of Substantial completion is issued by the Architect.
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- I. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
- I. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
- I. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

- I. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- H. Concrete Moisture Content: The General Contractor is responsible to provide concrete slabs with moisture content that is acceptable and compatible with selected floor finishes. This can be accomplished by the use of fans, dehumidification systems or sealers (if compatible with final floor finishes). The cost of this work is included with the construction contract. The use of permanent HVAC systems is not considered an acceptable way to dry out concrete slabs.
- I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- I. Install electric power service overhead unless otherwise indicated.
- J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 2. Install lighting for Project identification sign.
- K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
- I. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine in each field office.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.

- h. Principal subcontractors' field and home offices.
- 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 TEMPORARY HEAT

- A. General: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- B. The temporary heat requirements on this project are divided into two (2) categories, i.e., (1) temporary heat required prior to the enclosure of the building, buildings, or portions thereof; (2) temporary heat required subsequent to the enclosure of the building, buildings or portions thereof.
- C. A building or portion thereof shall be considered to be “enclosed” when (a) the roof is on and tight; (b) the exterior walls have been constructed with studs, sheathing, building paper (or wrap), and insulation; and (c) when openings, doors and windows are closed with permanent closures or with substantial temporary closures of tarpaulins attached with battens which will affect the retention of heat within the building or portion thereof.
- D. Prior to enclosure of building, buildings or portions thereof, and when official local weather predictions indicate below freezing temperatures or temperatures that may damage the work, the General Construction Contractor shall provide, maintain, operate and pay all costs, including fuel, for a sufficient number of approved portable heaters so that the progress of its work is not impeded, and proper protection of its work from freezing is maintained. Self-contained oil-fired portable heaters, if used, must be vented to the outside of the enclosed structure. Oil-fired heaters shall be used only in areas where finish work has not started.
- E. After the building, buildings or portions thereof are enclosed, and temporary heat is required for proper construction, the HVAC Contractor shall provide, maintain, operate and pay all costs, including fuel, for a sufficient number of approved portable heaters so that the progress of its work is not impeded, and proper protection of its work from freezing is maintained. The HVAC Contractor may, with the Architect and Owner’s approval, utilize the permanent system or portions thereof or may install temporary steam or hot water radiation or convectors or a combination of both.
- F. Temporary heating system as hereinafter noted, shall be of sufficient capacity to heat the interior of the building to 60°F, when outside temperature is 0°F. Temperature at all times must be 60°F, or above. This service shall be continued until the entire project is completed, except as hereinafter noted.
- G. Where electricians or plumbers are required to install, operate supervise or maintain equipment used in the provisions of temporary heat, the payment of the services of such personnel shall be the responsibility of the Electrical and the Plumbing Contractors respectively. It will be the responsibility of the Electrical and Plumbing Contractors to coordinate with the HVAC Contractor for temporary heat.
- H. The G.C. shall remove all soot, smudges, and other deposits from walls, ceilings and exposed surfaces which are the result of the use of any temporary heating equipment after enclosure, including the use of the permanent heating system for temporary heating purposes. No finish work shall start until all such surfaces are properly cleaned.
- I. All permanent heating equipment used to supply temporary heat shall be completely cleaned and reconditioned by the HVAC Contractor, prior to final acceptance, in the presence of the Owner personnel. HVAC contractor shall also replace all filters. All permanent heating equipment such as radiator trap seats and diaphragms, valve sets and discs, strainer internals or any other equipment found to be damaged due to

being used for temporary heat shall be replaced. The HVAC Contractor shall pay for all replacement parts and labor.

- J. The use of temporary electric-resistance heating will not be permitted for temporary heat. Where electric-resistance heating is specified as part of the permanent heating system it may not be used for temporary heat.
- K. The total cost of temporary heat shall be made a part of the lump sum bid submitted by each Contractor. The cost of temporary heat after enclosure shall be shown as the last item on the HVAC Contractor's Application for Payment, Schedule of Values and shall include the number of calendar days, cost per twenty-four (24) hour day and extended price. Any adjustment to the number of days of temporary heat, used or not used, will be based on this unit price. The HVAC Contractor shall include 90 days of temporary heat in its bid.

3.4 HUMIDITY CONTROL

- A. The contractor requiring humidity control for the installation of their work shall provide humidity control.

3.5 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas for access for equipment adequate for construction operations. Locate temporary roads and paved areas as required for construction equipment. Provide binder course paved access from the main entry to the building for emergency vehicle access by no later than the start of structure erection.
- C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earth Moving."
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving."
 - 5. G.C. shall be responsible to maintain clean egress to/from site and shall expeditiously clean up any debris.
 - 6. G.C. is responsible for all snow removal within the project boundaries.
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Coordinate with the Owner for parking areas for construction personnel.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Signs:

1. Signs will be fabricated and installed by the GC at a location designated by the Owner and Architect.

H. Waste Disposal Facilities: Comply with requirements specified in Division I Section "Construction Waste Management and Disposal."

I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Division I Section "Execution."

J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

M. Staging: Furnish, erect, and maintain in safe condition all exterior and interior staging and scaffolding required to properly carry out and complete the work.

1. Staging and Scaffolding shall comply in all respects to the governing laws and codes.

3.6 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary."

- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: Entire building area to be enclosed. Any additional fence required for an enlarged construction area will be provided and paid for by the GC.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner and Owner's Representative.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas.

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.7 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control building humidity. Use of permanent HVAC systems is not considered an adequate way of reducing the moisture content in concrete slabs.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

- c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.8 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - I. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - I. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01-50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012300 "Alternates" for products selected under an alternate.
 - 3. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 4. Section 014200 "References" for applicable industry standards for products specified.

I.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide

products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

I.4 ACTION SUBMITTALS

- A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within **[seven]** **<Insert number>** days of receipt of a comparable product request. Architect will notify Contractor **[through Construction Manager]** of approval or rejection of proposed comparable product request within **[15]** **<Insert number>** days of receipt of request, or **[seven]** **<Insert number>** days of receipt of additional information or documentation, whichever is later.
 - a. Form of Architect's Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

I.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.

- c. Capacity.
 - d. Speed.
 - e. Ratings.
- 3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

I.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.
 - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

I.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect[**through Construction Manager**] in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: ..."
 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: ..."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **[will]** be considered **[unless otherwise indicated]**.
 - a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: ..."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
 - a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: ..."
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **[will]** be considered **[unless otherwise indicated]**.
 - a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: ..."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: ..."
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect

will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 2. Evidence that proposed product provides specified warranty.
 3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 4. Samples, if requested.
- B. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017700 - CLOSEOUT PROCEDURES

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

I.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at final completion.

I.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

I.5 MAINTENANCE MATERIAL SUBMITTALS

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

I.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of [10] **<Insert number>** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by [Architect]. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of [10] **<Insert number>** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 - 6. Advise Owner of changeover in utility services.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 9. Complete final cleaning requirements.

10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of [10] <Insert number> days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

I.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit final completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

I.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, [**starting with exterior areas first**] [**and**] [**proceeding from lowest floor to highest floor**].
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.

- b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
4. Submit list of incomplete items in the following format:
- a. MS Excel electronic file. Architect will return annotated file.
 - b. PDF electronic file. Architect will return annotated file.

I.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within **[15]** **<Insert number>** days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit **[on digital media acceptable to Architect]**.
- E. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive **8-1/2-by-11-inch (215-by-280-mm)** paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

- I. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - I. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment[, **elevator equipment,**] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - I) Clean HVAC system in compliance with **[Section 230130.52 "Existing HVAC Air-Distribution System Cleaning."]** Provide written report on completion of cleaning.

- p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

I.3 DEFINITIONS

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

I.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.

2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
1. Submit [**on digital media acceptable to Architect**]. Enable reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least [**10**] days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least [**10**] days before commencing demonstration and training. Architect will return copy with comments.
1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within [**10**] days of receipt of Architect's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

I.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

I.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.
 3. Manual contents.

- B. Title Page: Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

I.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

I.8 EMERGENCY MANUALS

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

I.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

I.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.

I.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
1. Product name and model number.

2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

I.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit 2 set(s) of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints.
- B. Record Specifications: Submit [**annotated PDF electronic files**] of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit [**annotated PDF electronic files and directories**] of each submittal.

- I. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit **[annotated PDF electronic files and directories]** of each submittal.

I.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - I. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: **[DWG] [Microsoft Windows]** operating system.
 3. Format: Annotated PDF electronic file[**with comment function enabled**].
 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 5. Refer instances of uncertainty to Architect for resolution.
 6. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file[**with comment function enabled**].
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect
 - e. Name of Contractor.

I.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders[, **record Product Data,**] and record Drawings where applicable.

B. Format: Submit record Specifications as [**annotated PDF electronic file**]

I.6 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders[, **record Specifications,**] and record Drawings where applicable.
- C. Format: Submit record Product Data a [**scanned PDF electronic file(s) of marked-up paper copy of Product Data**].
 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

I.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as [**scanned PDF electronic file(s) of marked-up miscellaneous record submittals**].
 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

I.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for

construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017839

SECTION 02-4119 - SELECTIVE DEMOLITION

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1. Section 01-1000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 31-1000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

I.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

I.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of each Prime Contractor.
- B. All stained glass and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

I.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Owner, Architect, MEP Engineer and Structural Engineer must attend, at minimum virtually.

I.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Predemolition Photographs or Video: Submit before Work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

I.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

I.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

I.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - I. Before selective demolition, Owner will remove the following items:
 - a. All hazardous materials.
 - b. All fixtures and furnishings that the Owner desires to retain. Anything that remains in the building within the scope of work, other than identified herein, will be demolished.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition. No additional fee will be allowed for replacement of items not required to be demolished or for items not demolished that are required to be demolished later.
- D. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous materials will be removed by the Owner's vendor prior to the start of demolition.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents. Owner's vendor will remove any additional hazardous materials encountered.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - I. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record or architectural documents.

- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required. Any accidental demolition of items intended to remain will be replaced by the GC at no additional cost to the project.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - I. Comply with requirements for existing services/systems interruptions specified in Section 01-1000 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Each Prime Contractor is responsible for the existing systems of their trade. Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - I. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- C. Refrigerant: Mechanical Contractor is responsible to remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - I. Comply with requirements for access and protection specified in Section 01-5000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - I. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01-5000 "Temporary Facilities and Controls."

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Each Prime Contractor is responsible to demolish and remove existing construction of their trade only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly. Comply with requirements in Section 01-7419 "Construction Waste Management and Disposal."
 10. Holes or openings created by the removal of ductwork, louvers, piping, conduit, etc in existing walls and floors to remain will be closed and patched as required by the General Contractor.
- B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
1. Building Structure and Shell: 95 percent.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Transport items to Owner's storage area on-site.
 3. Protect items from damage during transport and storage.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least **3/4 inch (19 mm)** at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers. As much as possible do not disturb terrazzo floors.
- F. Salvage existing brick for reuse in areas indicated on drawings and for brick repairs that may be required. Provide Owner with 1 pallets of existing brick for future use.
- G. Stained Glass Windows to be salvaged for return to Owners, as indicated on drawings. Stained glass windows to remain in building are also identified in drawings.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, each Prime Contractor is responsible to remove the demolished materials of their trade from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02-4119

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections:
 - 1. Division 03 Section "Architectural Concrete" for general building applications of specialty finished and formed concrete.
 - 2. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
 - 3. Division 32 Section "Concrete Paving" for concrete pavement and walks.
- C. Applicable Codes and Standards:
 - 1. "2020 Building Code of New York State."
 - 2. ACI 301-16, "Specification for Structural Concrete."
 - 3. ACI 306R-16, "Guide to Cold Weather Concreting."
 - 4. ACI 117-10, "Specifications for Tolerances for Concrete Construction and Materials."
 - 5. ACI 318-14, "Building Code Requirements for Structural Concrete."
 - 6. ASCE 7-16, "Minimum Design Loads and Associated Criteria for Buildings and Other Structures."

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Isolated/individual footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Piers
 - 5. Suspended Slabs-on-Deck

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement..
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- F. Samples: For water-stops, vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and testing agency.
- B. Welding Certificates
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.

3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semi-rigid joint filler.
13. Joint-filler strips.
14. Repair materials.

- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Field quality-control reports.
- F. Minutes of pre-installation conference

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.
- C. 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."
- D. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II
 3. Certification of recycled content shall be in accordance with the Sustainable Building Submittal Requirements of this section.
 4. Adhesives or sealants used for work in this section shall meet the VOC requirements of this section, where applicable.
 5. Recycled Steel: Reinforcing bar, steel wire, welded wire fabric, and miscellaneous steel accessories shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials).
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- G. 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 and Section 7, "Lightweight Concrete."
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

- I. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - J. Pre-installation Conference: Conduct conference at Project site or another pre-approved location.
 - 1. Review the proposed concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor / finishing foreman.
 - e. Special concrete finish subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- 1.8 MEASUREMENTS
- A. Field Measurements: Obtain all field measurements required for proper fabrication and installation of work. Submit prior to installation, all measurements indicating discrepancies from the drawings. Describe in writing, and where applicable, by sketches proposed methods of correcting the discrepancies. Measurements are the responsibility of the contractor.
 - B. Lay out each part of the work in strict accordance with the architectural, structural, mechanical, electrical, plumbing and all other drawings and be responsible for correct location of the same. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.
 - C. Templates: Furnish templates and layout drawings for exact locations of items to be embedded in concrete, with setting instructions required for installation of embedded items.

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.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 35 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed, or Grade 75 (Grade 520), deformed, where specified.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- D. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420) or Grade 75 (Grade 520) where specified, deformed bars, assembled with clips.
- E. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- F. Deformed-Steel Wire: ASTM A 496/A 496M.
- G. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
- H. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 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. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C 330, 3/4 inch (19mm) nominal maximum aggregate size.
- E. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260. Subject to compliance with requirements, provide one of the following:
 - 1. Air Mix 200 or AEA 92S; Euclid Chemical Company
 - 2. Darex AEA; W.R. Grace

3. MasterAir VR 10; BASF
- B. 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. Provide one of the following:
 - a. Eucon WR-91; Euclid Chemical Company
 - b. MasterPolyheed 997; BASF
 - c. WRDA 64; W.R. Grace
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D. Provide one of the following:
 - a. Eucon Retarder 75; Euclid Chemical Company
 - b. MasterSet R 100; BASF
 - c. Daratard; W.R. Grace
 - d. Plastiment; Sika Corp.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F. Provide one of the following:
 - a. Eucon 37, Plastol Series or SPC; Euclid Chemical Company
 - b. MasterRheobuild 1000 or MasterGlenium 7500; BASF
 - c. Daracem-100; W.R. Grace
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G. Provide one of the following:
 - a. MasterGlenium Series; BASF
 - b. Eucon 537; Euclid Chemical Company
 - c. ViscoCrete Series; Sika Corp.

2.6 FIBER REINFORCEMENT

- A. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
 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. Monofilament Micro-Fibers:
 - 1) Axim Italcementi Group, Inc.; Fibrasol II P.
 - 2) Euclid Chemical Company (The); Fiberstrand 100.
 - 3) Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
 - 4) Sika Corporation; Sika Fiber PPM.
 - b. Fibrillated Micro-Fibers:
 - 1) Axim Italcementi Group, Inc.; Fibrasol F.
 - 2) Euclid Chemical Company (The); Fiberstrand F.
 - 3) Grace Construction Products, W. R. Grace & Co.; Grace Fibers.
 - 4) Sika Corporation; Sika Fiber PPF.
- B. Synthetic Macro-Fiber: Synthetic (Polyolefin) Macro fibers shall be a coarse monofilament, self-fibrillating, polypropylene/polyethylene to blend in accordance with ASTM C1116, Paragraph 4.1.3, Type III and ASTM D7508. Synthetic macro-fiber shall be a minimum 1-1/2 inch (38mm) length, a minimum aspect ratio of 50-90, and shall provide a minimum tensile strength of 70 KSI (483 MPa). Synthetic macro-fiber shall be UL-certified for 2-hour minimum fire-resistance-rated construction when used in lieu of welded wire fabric in UL Design Series D700, D800, and D900 Floor-Ceiling Assemblies.
 1. Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 4.0 lb/cu. yd. (2.4 kg/cu. m) for suspended slabs over metal decks in accordance with Steel Deck Institute Manual 31.

2. Submit fiber manufacturer's documentation indicating that proposed fiber dosage will provide a minimum Re3 ($R^{D_{T1.50}}$) value of <insert value> percent in accordance with ASTM C 1609.
3. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 3.0 lb/cu. yd. (1.78 kg/cu. m) for concrete slabs on ground.
 - a. Tuf-Strand SF; Euclid Chemical Company
 - b. Strux 90/40; GCP Applied Technologies

2.7 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 1. 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. BoMetals, Inc.
 - b. Greenstreak.
 - c. Paul Murphy Plastics Company.
 - d. Vinylex Corp.
 2. Profile: Ribbed with center bulb
 3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick) nontapered.
- B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
 - b. CETCO; Volclay Waterstop-RX.
 - c. Concrete Sealants Inc.; Conseal CS-231.
 - d. Greenstreak; Swellstop.

2.8 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 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. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
 - b. Meadows, W. R., Inc.; Perminator 15 mil.
 - c. Raven Industries Inc.; Vapor Block 15.
 - d. Reef Industries, Inc.; Griffolyn Type-65G.

2.9 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid/Sealer Densifier (VOC Compliant): Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. The compound must contain a minimum solids content of 20%, of which 50% is silicate.
 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. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
 - b. L&M Construction Chemicals, Inc.; Seal Hard.
 - c. Meadows, W. R., Inc.; LIQUI-HARD.
 2. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for sealants applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- a. Primers, Sealers, and Undercoaters: 200 g/L.
- b. Waterproofing Concrete/Masonry Sealers: 400 g/L.
- c. Concrete-Curing Compounds: 100 g/L.
- d. Floor Coatings: 100 g/L.

2.10 CURING MATERIALS

- A. 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.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound (VOC Compliant): ASTM C 309, Type 1, Class B, dissipating.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. BASF Construction Chemicals - Building Systems; Kure 200.
 - c. Euclid Chemical Company (The); Kurez DR VOX OR Everclear VOX.
 - d. L&M Construction Chemicals, Inc.; L&M Cure R.
 - e. Meadows, W. R., Inc.; 1100-CLEAR.
 - 2. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for sealants applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - a. Primers, Sealers, and Undercoaters: 200 g/L.
 - b. Waterproofing Concrete/Masonry Sealers: 400 g/L.
 - c. Concrete-Curing Compounds: 100 g/L.
 - d. Floor Coatings: 100 g/L.
 - 3. Provide one of the following:
 - a. Dural 452 Series; The Euclid Chemical Company
 - b. Sikadur 32 Hi-Mod Series; Sika Corp.

2.11 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Epoxy Bonding Adhesive (VOC Compliant): ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 - 2. VOC Content: Epoxy Bonding Adhesive shall have a VOC content of 70 g/L or less.
- C. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- D. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
5. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. Flo-Top, Super Flo-Top or EucoFloor SL160; Euclid Chemical Company
 - b. MasterTop 111 SL; BASF
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 4000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.
 5. Products: Subject to compliance with requirements, provide one of the following (or equal) approved by the Engineer of Record:
 - a. Thin Top Supreme, Tammspatch II or Concrete Top Supreme; Euclid Chemical Company
 - b. Sikatop 121 or Sikatop 122; Sika Corp.

2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- 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 40 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use high water-reducing admixture in pumped concrete, architectural concrete for heavy-use industrial slabs and parking structure slabs, self-consolidating concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Use a non-corrosive accelerator in all concrete less than 8 inches in thickness, placed at temperatures below 50 degrees Fahrenheit. Do not use calcium chloride, salts or other admixtures containing more than 0.5% chloride ions by weight.
 5. Use corrosion inhibiting admixture in concrete mixtures where indicated. The dosage shall be 3-5 gallons/cy unless otherwise noted on the plans.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Isolated Footings, Foundation Walls, and Piers: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4,000 psi (27.6 MPa) at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 3. Slump Limit: 9 inches (225 mm) for concrete with verified waterslump of 2 to 3 inches (50 to 75 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4,000 psi (27.6 MPa) at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 - 3. Minimum Cementitious Materials Content: 540 lb/cu. yd. (320 kg/cu. m).
 - 4. Slump Limit: 6 inches (150 mm).
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- C. Suspended Slabs: Proportion normal weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4,000 psi (27.6 MPa) at 28 days.
 - 2. Calculated Equilibrium Unit Weight: 145 lb/cu. ft. plus or minus 3 lb/cu. ft. as determined by ASTM C 567.
 - 3. Slump Limit: 6 inches (150 mm), plus or minus 1 inch (25mm).
 - 4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.15 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 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. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Do not chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED 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.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 80 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES

- A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR 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.

3.6 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.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
 - D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
 - E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- 3.7 JOINTS
- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
 - B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Space vertical joints in walls as indicated.
 6. Locate vertical joints in walls beside piers integral with walls, near corners, and in concealed locations where possible.
 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 1. 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.
 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- 3.8 WATERSTOPS
- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
 - B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.
- 3.9 CONCRETE PLACEMENT
- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
 - B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
 2. The Concrete Producer shall provide a re-dosage chart for the high range water reducing admixture. Re-dosage onsite may be required to keep the concrete in the approved slump or spread envelope.

- C. 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. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 - D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
 - E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
 - 4. Freeze resistant concrete may be used with prior approval of the Engineer of Record.
 - F. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- 3.10 FINISHING FORMED SURFACES
- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to view.
 - B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete or as indicated.
 - C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
 - E. Architectural Concrete Finish: Provide smooth, uniform finish upon form removal with no patching, stoning or other form of repair, except washing, permitted unless otherwise noted for walls, columns and other surfaces visible to view when the work is complete. Use self-consolidating concrete. The surface shall match the approved jobsite mockup panel.
- 3.11 FINISHING FLOORS AND SLABS
- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
 - B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.
 - C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to surfaces indicated or to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
 - D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
 - b. Specified overall values of flatness, F(F) 30; and levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and levelness, F(L) 15; for suspended slabs.
 3. 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 3/16 inch (4.8 mm).
 - E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
 - F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a strippable or dissipating curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing and Sealing 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. Interior slabs to receive resilient flooring: Cure only with moisture retaining cover. Strippable or dissipating curing compounds may be used on trowel finished surfaces.

3.14 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 14 days old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least 6 month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to

- produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
 - F. Repair materials and installation not specified above may be used, subject to Architect's approval.
- 3.17 FIELD QUALITY CONTROL
- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - B. Inspections:
 1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
 - C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173 M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Water Content and W/cm: In accordance with AASHTO T318 (Microwave Test).
 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

- b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 - 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 - 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 - 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 - 11. Monthly charts of compressive strength, w/cm and air content will be sent to all parties on the pre-concrete conference distribution list.
 - 12. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 - 13. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 - 14. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 - 15. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 - 16. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.
- 3.18 PROTECTION OF LIQUID FLOOR TREATMENTS
- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 04 22 00 - COLD-FORMED METAL FRAMING

PART I - GENERAL

I.01 SUMMARY

- A. Section includes combination flashing, mortar deflection, and weep as complete one step system. Using this system deletes requirement for mortar deflection devices.
- B. Related sections:
 - 1. 04 05 23 Masonry Accessories.
 - 2. 04 21 13 Brick Masonry
 - 3. 04 22 00 Concrete Unit Masonry
 - 4. 04 72 00 Cast Stone Masonry.
 - 5. 05 40 00 Cold Formed Metal Framing.
 - 6. 06 10 00 Rough Carpentry.
 - 7. 07 11 10 Damp Proofing or Air Barrier
 - 8. 07 60 00 Flashing and Sheet Metal.
 - 9. 07 65 00 Flexible Flashing.
- C. Alternates: This Section replaces the multiple component technology and multiple trade involvement of older technologies; providing a single source/single trade engineered & warranted system.

I.02 REFERENCES

- A. Standards of the following as referenced:
 - 1. ASTM.
 - 2. Brick Industry Association (BIA).
- B. Industry standards:
 - 1. BIA *Technical Notes on Brick Construction No. 7, Water Penetration Resistance- Design and Detailing*, August 2005.
 - 2. BIA *Technical Notes on Brick Construction No. 28B, Brick Veneer/Steel Stud Walls*, August 2005.

I.03 DEFINITIONS

- A. Terms:
 - 1. Cavity wall flashing: Same as flexible flashing.
 - 2. Foundation sill flashing: Same as flexible flashing.
 - 3. Flexible flashing: Water-proof material typically used in cavity wall construction to contain and assist in the proper water drainage that may penetrate wall system veneer. Other materials may be required to constitute the system.
 - 4. Head and sill flashing: Same as flexible flashing.
 - 5. Through-wall flashing:
 - a. Generally considered the same as flexible flashing.
 - b. Rare definition referred to full width cap flashing under copings or wall caps.

I.04 SUBMITTALS

- A. Product data: Indicate material type, composition, thickness, and installation procedures.
- B. Samples: 3" by 5" flashing material.

C. Product Quality & Environmental submittals:

1. Certificates:

- a. Indicate materials supplied or installed are asbestos free.
- b. Indicate recycled content: a minimum of 60% total recycled material; based on 60% Post Industrial Recycled Content.

2. Critical Performance Attributes:

- a. Tensile Strength, stainless steel 100,000 psi average
- b. Puncture Resistant, stainless steel 2,500 psi average
- c. When tested as manufactured, product resists growth of mold pursuant to test method ASTM D 3273.
- d. Fire Rating: flame spread and smoke generation
 1. Rated Class A, ASTM E84
- e. Certify the use of domestic manufactured stainless steel for flashing.
- f. Certify products contain no silica or asbestos.

I.05 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Provide flashing materials by single manufacturer with not less than twenty five years of experience in manufacturing flexible flashing products.
2. If product is used with spray polyurethane foam, then flashing materials must be able to withstand 300 ° F temperatures without changing the long term performance of the flashing.

I.06 WARRANTY

A. Special warranty:

1. Manufacturer: **Warrant flexible flashing/drainage system material for life of the wall.**
2. Begin warranty at Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Stainless steel core flexible flashing with drainage fabric:

1. Product standard of quality: York Manufacturing, Inc.; York Flash-Vent SS,
2. Accepted products:
 - a. York Manufacturing, Inc.; York Flash-Vent SS, (www.yorkmfg.com)
 - b. STS Coatings, Inc.; Wall Guardian Venting Stainless Steel TWFF (www.stscoatings.com)
 - c. Building Materials West Company, Inc.; Evacu-Flash SS (www.evacu-flash.com)
 - d. Other flashings that meet the requirements in section I.04.C
3. Characteristics:
 - a. Type: Engineered system, with high resistant to damage, composite with a stainless steel with non-asphalt adhesive polymer fabric laminated to one stainless steel and non-woven drainage fabric laminated to opposing face with non-asphalt adhesive.
 - b. Stainless steel: type 304, ASTM A240. Domestically sourced per DFARS 252.225-7008 and/or DFARS 252.225-7009.
 - c. Fabrics:
 - 1) Polymer fabric; laminated back face to stainless steel core
 - 2) Non-woven drainage fabric: Fabric laminated to front face stainless

- steel core.
- d. Recycled content: stainless steel is 60% recycled
- e. Size: Manufacturer's standard width rolls.

2.2 ACCESSORIES

- A. Mastic/sealant: Product standard of quality is York Manufacturing, Inc.; UniverSeal US100.
 - 1. Characteristics:
 - a. Type: One part 100% solids, solvent-free formulated silyl-terminated polyether (STPE), ASTM C920-II, Type S, Grade NS, Class 50.
- B. Outside corner and inside corner material; manufacturer's standard available units using:
 - 1. Stainless steel: 26 gauge stainless steel.
- C. End dam: Product may be folded in line with the flashing material or utilize preformed end dams by manufacturer using:
 - 1. Stainless steel: 26 gauge stainless steel
- D. Splice material: Product standard of quality is York 304 by York Manufacturing, standard self-adhered metal material; material matching system material or use York Manufacturing's Multi-Flash Stainless Steel lap piece and polyether sealant as a splice.
- E. Termination bar: Product standard of quality is York T-96 termination bar. Manufacturer's standard 1" composite material bar or a 1" 26 gauge stainless steel termination bar with sealant lip.
- F. Weep vent protection: Product standard of quality is York's Weep Armor. Geotextile drainage fabric at least 12" in height.
- G. Repair and other materials/accessories: Manufacturer's standard.
- H. Fasteners: Domestic manufactured fastener types and sizes recommended by flashing manufacturer for intended use.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Install where indicated, specified, or required in accord with flashing manufacturer's written instructions and as follows.
 - a. Prohibited practice: Tucking the flashing into the backer wall.
 - b. Prohibited practice: Bonding or splicing to non-woven drainage fabric.
 - 2. Extend flashing 6" minimum, beyond opening, each side without stretching flashing material. Fold flashing ends at end of openings or horizontal flashing terminations to form end dam or use preformed end dams from manufacturer.
 - 3. Flashing width: Width required starting 1.5" to the exterior of the outside face of exterior wythe, extending through cavity, rising height required to extend above lintel steel at least 2". After inspection by the agreed upon parties the flashing should be cut flush with the leading edge of the brick.
 - 4. Splice end joints by butting ends together over 4" wide piece of self-adhering stainless steel flashing. The self-adhering stainless steel flashing should be sealed metal face down on to the substrate with the mastic. Remove the release liner and butt the two piece of flashing together and embed them into the splice sealant. Then seal the butt seam with sealant.
 - 5. Masonry back up:
 - a. Surface mount flashing after damp proofing installation specified in Damp

- Proofing Section in accord with manufacturer's installation instructions.
- b. Apply flashing with drainage surface to outside.
 - c. Fasten to masonry back-up surface at top by embedding in layer of sealant and use a termination bar to fasten to the backer wall and seal the top of the termination bar with sealant.
6. Concrete back up:
- a. Surface mount flashing after damp proofing installation specified in Damp Proofing Section in accord with manufacturer's installation instructions.
 - b. Apply flashing with drainage surface to outside.
 - c. Fasten to concrete back-up surface at top by embedding in layer of sealant and use a termination bar to fasten to the backer wall and seal the top of the termination bar with sealant.
7. Stud back up with sheathing:
- a. Surface mount flashing after certified compatible damp proofing installation specified in Damp Proofing Section in accord with manufacturer's installation instructions
 - b. Apply flashing with drainage surface to the outside.
 - c. Fasten to stud back-up surface at top by embedding in layer of sealant and use a termination bar to fasten to the backer wall and seal the top of the termination bar with sealant.
8. Confirm compatibility with manufacturer's mutual letters for all lapping components, Air barrier installation lapping over flashing top in the Air Barrier Section.
9. Lay flashing in continuous bead of sealant on masonry supporting steel.
10. Fold ends of flashing at end of opening to form dam; seal with sealant or utilize preformed end dams from manufacturer.
11. Inside corners: Make in manufacturers accepted manner using corner and splice material or utilize preformed corners from manufacturer.
12. Outside corners: Make in manufacturers accepted manner using corner and splice material or utilize preformed corners from manufacturer.
13. Do not coat the entire drainage fabric with air barrier. Leave the drainage fabric exposed at least an inch over the top of the mortar droppings.
14. Weep vent protection use the geotextile drainage and install it on the third row height of standard bricks to have the fabric reach the base of the flashing and covering the weep vents.
15. Cover flashing within a few days of installation to protect it from damage from the different trades, the environment and falling debris. If flashing is left unprotected and it is punctured, torn, or has loose scrim you should contact the manufacturer for repair instructions.

3.02 SCHEDULES

- A. Locations:
- 1. Exterior door heads.
 - 2. Window heads and sills.
 - 3. Storefront heads.
 - 4. Horizontal control joints.
 - 5. Changes in veneer materials, vertically.
 - 6. Other wall openings.
 - 7. Other locations indicated.

END OF SECTION 04 22 00

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Structural steel.
- B. This Section includes structural steel and architecturally exposed structural steel.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Quality Control" for independent testing agency procedures and administrative requirements.
 - 2. Division 5 Section "Steel Deck" for field installation of shear connectors.
 - 3. Division 5 Section "Metal Fabrications" for loose steel bearing plates and miscellaneous steel framing.
 - 4. Division 9 Section "Special Coatings" for surface preparation and priming requirements.
 - 5. Division 9 Section "Painting" for surface preparation and priming requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using general notes provided on the plans and AISC 360.
 - 2. Engineering Responsibility: Fabricator's responsibilities include using a qualified licensed professional engineer to prepare structural analysis data for structural steel connections.

1.4 ACTION SUBMITTALS

- A. Product Data for each type of product specified.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 6. Prepare shop drawings in conformance with the best standards if the construction industry and not less complete than indicated by the applicable procedures shown in "Structural Steel Detailing" latest edition published by the AISC. Prepare shop drawings under the supervision of competent engineering personnel, licensed by the state in which the construction is taking place. During preparation of shop drawing, and prior to submittal, coordinate and cross check all shop drawings, including those prepared by subcontractors, for compliance with the Contract Documents. Each shop drawing shall bear the signature of the engineer in charge of structural steelwork for the steelwork subcontractor, and the initials of the individual actually preparing the drawing.
 - 7. Show clearly all work, including relationship of structural steel to the adjacent work of other trades and to significant lines of finishes of other trades.
 - 8. Do not fabricate or deliver work to the site before drawings reviewed by the Architect have been returned.
 - 9. Show explicitly the type of connection used in each location, the grade, size and number of bolts; the type, number, position, designation and orientation of each hole, and the size of each hole,

whether slotted or round. Ensure that an adequate wrench clearance for correct bolt tightening is provided and note special bolt tightening sequences were necessary.

10. Prepare original shop drawings. The use of the engineer's or architect's drawings as a base for photographic or other reproduction for shop drawings or details will not be permitted. Show clearly the size and location of each member and the erection mark assigned to each member. Show each field connection with all data and details necessary for assembling the structure. Direct special attention to the possible need for special guying, bracing, or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings, and by forces of natural phenomena.
 11. Prepare, keep up-to-date, and submit a complete drawing index cross-referencing each assigned piece mark with the drawing number in which the piece is detailed. Detail drawings submitted without an up-to-date index and the applicable erection drawing(s) showing the location of each piece will be deemed an incomplete submission and will not be accepted as subject to and agreed shop drawing review schedule.
 12. Prepare anchor bolt and baseplate erection drawings containing complete location and placing details, including details of all templates. Provide anchor bolt erection drawings to the concrete trade in advance of applicable concrete work and in coordination with the concrete construction sequence.
 13. Direct the architect's attention in writing to any proposed deviations from the Contract Documents, prior to the submission of shop drawings showing the proposed deviation. Submit requests for deviations on the steelwork subcontractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in shop drawings or both, without the required written request, may not be accepted, and shall be sufficient cause for the architect to return each shop drawing containing such deviations without further action. Acceptance of shop drawings containing deviations not detected by the architect during shop drawing review shall not relieve the steelwork subcontractor from responsibility to conform strictly to the Contract Documents.
 14. Prior to resubmission of shop drawings with additions or corrections, circle and identify all changes. Drawings submitted without each change being clearly identified are subject to return for resubmission.
- C. Qualification Data: For qualified Installer, fabricator, professional engineer.
 - D. Welding certificates.
 - E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
 - F. Mill test reports for structural steel, including chemical and physical properties.
 - G. Product Test Reports: For the following:
 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 2. Direct-tension indicators.
 3. Tension-control, high-strength bolt-nut-washer assemblies.
 4. Shear stud connectors.
 5. Shop primers.
 6. Nonshrink grout.
 - H. Source quality-control reports.
 - I. Field quality-control and special inspection reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer, who to the satisfaction of the Architect and Owner, has successfully completed similar projects in size and complexity to the proposed project, and who can provide suitable documentation to confirm this experience and capabilities. Said documentation shall be data for recent project experience including, but not limited to; owner name and contact information, location, name and contact information for general contractor, gross area of building, use of building, contract amount, and any other information that is deemed appropriate to communicate the installer is appropriately qualified. Installer shall also provide a copy of their detailed written quality assurance plan/program. Qualified installer shall participate in the AISC Quality Certification Program and be designated an AISC-Certified Erector, Category CSE or provide a similar quality program acceptable to the Architect.
- B. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 2. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
 3. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
 4. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
 5. AISC's "Seismic Provisions for Structural Steel Buildings."
 6. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
 7. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 8. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- F. 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."
- G. Preinstallation Conference: Conduct conference at Project site.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.
- C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.
- 1.7 COORDINATION
- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
- 1.8 COORDINATION
- A. Field Measurements: Obtain all field measurements required for proper fabrication and installation of work. Submit prior to installation, all measurements indicating discrepancies from the drawings. Describe in writing, and where applicable, by sketches proposed methods of correcting the discrepancies. Measurements are the responsibility of the contractor.
- B. Lay out each part of the work in strict accordance with the architectural, structural, mechanical, electrical, plumbing and all other drawings and be responsible for correct location of the same. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.

- C. Templates: Furnish templates and layout drawings for exact locations of items to be embedded in concrete, with setting instructions required for installation of embedded items.
- D. Contractor shall provide a certified survey showing the exact location of the centers of the columns at their top most level, exactly as installed. This information shall be incorporated into the "as built" drawings.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 - 1. W-Shapes: 35 percent.
 - 2. Channels, Angles, M, S-Shapes: 35 percent.
 - 3. Plate and Bar: 25 percent.
 - 4. Cold-Formed Hollow Structural Sections: 35 percent.
 - 5. Steel Pipe: 25 percent.
 - 6. All Other Steel Materials: 25 percent.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.
- D. Plate and Bar: ASTM A 36/A 36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - 1. Weight Class: As indicated.
 - 2. Finish: Black except where indicated to be galvanized.
- G. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
- H. Steel Forgings: ASTM A 668/A 668M.
- I. Welding Electrodes: Comply with AWS requirements

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 or ASTM A490; Cold forged with rolled threads. Do not use A325 and A490 bolts of the same diameter. Different grade bolts must vary in diameter by a minimum of 1/4 inch.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type with plain finish.
- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip zinc coating.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight or Hooked.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 5. Finish: Plain except where indicated to be hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- F. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
3. Finish: Plain except where indicated to be hot-dip zinc coating, ASTM A 153/A 153M, Class C

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
 1. Compatible with Section 099600 "High-Performance Coatings."
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 and/or ASTM A 780.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction [and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.

2.4 GROUT

- A. Non-metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, non-metallic aggregate grout, non-corrosive and non-staining, 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.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- F. 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.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. Shop install and tighten non high-strength bolts, except where high-strength bolts are indicated.
- B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- C. Shop install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
 - 2. Bolts: ASTM A 490 (ASTM A 490M) high-strength bolts, unless otherwise indicated.
 - 3. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
 - 4. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.
- D. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
 - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

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.
 - 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. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels, shelf angles and members which are permanently exposed to weather.

2.9 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
 - 2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Shop-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.
- F. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, 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. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
 - 4. Ultrasonic Inspection: ASTM E 164.
- G. In addition to visual inspection, shop-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:
 - 1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates and other embedments showing dimensions, locations, angles and elevations.
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 - 4. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 - a. Comply with manufacturer's instructions for proprietary grout materials.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection.
- H. Finish sections thermally cut during erection equal to a sheared appearance.
- I. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
- B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
 2. Bolts: ASTM A 490 (ASTM A 490M) high-strength bolts, unless otherwise indicated.
 3. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
 4. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.
- D. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.
 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Field-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

- F. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, 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. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
 - 4. Ultrasonic Inspection: ASTM E 164.
 - G. In addition to visual inspection, field-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:
 - 1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.
- 3.6 REPAIRS AND PROTECTION
- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).
 - B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Division 9 Section "Painting."
 - C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION 051200

SECTION 05 31 00 – METAL CANOPY**Part 1: General****I.1 Description of Work**

1. Work in this section includes furnishing and installation of extruded aluminum overhead cantilever supported canopies as manufactured by Mapes Industries Inc.
2. Related Items and Considerations
 1. Flashing of various designs may be required. Generic flashing supplied by Mapes. 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.

I.2 Quality Assurance

1. Products meeting these specifications established standard of quality required as manufactured by Mapes Industries, Inc. Lincoln, Nebraska 1-888-273-1132.

I.3 Field Measurement

1. Confirm dimensions prior to preparation of shop drawings when possible.
2. If requested, supply manufacturer's standard literature and specifications for canopies.
3. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

I.4 Performance Requirements

1. Canopy must conform to local building codes.
2. PE Stamped calculations are required and must be signed and sealed by an engineer licensed within the state canopy is installed.

I.5 Deliver, Storage, Handling

1. Deliver and store all canopy components in protected areas.

Part 2: Products**2.1 Manufacturer**

1. Mapes Canopies
Lincoln, Nebraska
Phone: 1-888-273-1132.
Fax: 1-877-455-6572.

2.2 Materials

1. Decking shall consist of 3" extruded flat soffit .078 decking.
2. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures.
3. Cantilever supported brackets shall be standard finish.
4. Fascia shall be standard extruded 8" J style.

2.3 Finishes

1. Finish type shall be -- Bronze Baked Enamel.

CANOPY

2.4 Fabrication

1. All Mapes Super Lumideck extruded aluminum canopies are shipped with the materials precut to size for field assembly.
2. 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.
3. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to None.

Part 3: Execution

3.1 Inspection

1. Confirm that surrounding area is ready for the canopy installation.
2. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.
3. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed

3.2 Installation

1. 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, entire system shall be left in a clean condition.

SECTION 05 31 00 – STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Composite floor deck.
 - 2. Roof deck.
- B. Related Sections include the following:
 - 1. Division 5 Section "Structural Steel" for shop-welded shear connectors.
 - 2. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 3. Division 9 Section "Painting" for repair painting of painted deck.
 - 4. Division 9 Section "Special Coatings" for repair of deck special coatings.
 - 5. Division 16 Section "Underfloor Raceway" for preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts used with cellular deck floor systems.

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
 - 1. Mechanical fasteners.
- F. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- C. Source Limitations for Cellular Deck Floor Systems with Electrical Distribution: Obtain cellular floor deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from the same manufacturer. Electrical components are specified in Division 16 Section "Underfloor Raceway."
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- E. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- F. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

- G. Electrical-Raceway Units: Provide UL-labeled cellular floor deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.
 - H. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
 - B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
- 1.6 MEASUREMENTS
- A. Field Measurements: Obtain all field measurements required for proper fabrication and installation of work. Submit prior to installation, all measurements indicating discrepancies from the drawings. Describe in writing, and where applicable, by sketches proposed methods of correcting the discrepancies. Measurements are the responsibility of the contractor.
 - B. Lay out each part of the work in strict accordance with the architectural, structural, mechanical, electrical, plumbing and all other drawings and be responsible for correct location of the same. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.
 - C. Templates: Furnish templates and layout drawings for exact locations of items to be embedded in concrete, with setting instructions required for installation of embedded items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Deck:
 - a. BHP Steel Building Products USA Inc.
 - b. Consolidated Systems, Inc.
 - c. Epic Metals Corp.
 - d. Marlyn Steel Products, Inc.
 - e. Nucor Corp.; Vulcraft Div.
 - f. Roof Deck, Inc.
 - g. United Steel Deck, Inc.
 - h. Verco Manufacturing Co.
 - i. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

2.2 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.3 COMPOSITE FLOOR DECK

- A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
 - 2. Profile Depth: As indicated on the drawings.

3. Design Uncoated-Steel Thickness: As indicated on the drawings; 0.0474 inch (1.20 mm).
4. Span Condition: Triple span or more.

2.4 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
 2. Deck Profile: As indicated on the drawings.
 3. Profile Depth: As indicated on the drawings; 1-1/2 inches (38 mm) minimum.
 4. Design Uncoated-Steel Thickness: As indicated on the drawings; 0.0358 inch (0.91 mm) minimum.
 5. Span Condition: Triple span or more.
 6. Side Laps: Overlapped or interlocking seam at Contractor's option and in coordination with deck manufacturer.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8 mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile [indicated] [recommended by SDI Publication No. 29 for overhang and slab depth].
- H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- I. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- J. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [0.0598 inch (1.52 mm)] [0.0747 inch (1.90 mm)] thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
- K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and [level] [sloped] recessed pans of 1-1/2- inch (38-mm) minimum depth. For drains, cut holes in the field.
- L. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- M. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.
- N. Galvanizing Repair Paint: [ASTM A 780] [SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight].
- O. Repair Paint: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate decking bundles to prevent overloading of supporting members.

- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels for entire length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 COMPOSITE FLOOR DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch (16 mm), nominal.
 - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
 - 3. Weld Spacing: Space and locate welds as indicated.
 - 4. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (914 mm), and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
 - 2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped or butted at Contractor's option.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches (38 mm) long, and as follows:
 - 1. Weld Diameter: 5/8 inch (16 mm), nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
 - 3. Weld Washers: Install weld washers at each weld location as/if required based on deck gauge.
- A. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches (914 mm), and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
 - 2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped 2 inches (51 mm) minimum or butted at Contractor's option.

- C. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least 1 weld at each corner.
- D. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.5 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.
- B. Field welds will be subject to inspection.
- C. Shear connector stud welds will be inspected and tested according to AWS D1.1 for stud welding and as follows:
 - 1. Shear connector stud welds will be visually inspected.
 - 2. Bend tests will be performed if visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud.
 - 3. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to AWS D1.1.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 9 Section.
- C. Repair Painting: Wire brushing, cleaning and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 9 Section.
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Ceiling joist framing.
 - 3. Soffit framing.
- B. Related Sections include the following:
 - 1. Section 018113 "Sustainable Design Requirements" for LEED credit requirements.
 - 2. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory.
 - B. LEED Submittals:
 - 1. Completed "LEED Criteria Worksheet," for each material of the product, assembly, or used in the installation of Work of this section. Refer to Division 01 Section 018113, "Sustainable Design Requirements."
 - 2. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 3. Product Data for Credit EQ 4.2: For paints and coatings used inside the weatherproofing system, including printed statement of VOC content.
 - C. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 3. 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.
 - D. Delegated-Design Submittal: For cold-formed steel framing.
 - E. Welding certificates.
 - F. Qualification Data: For professional engineer.
 - G. Product Test Reports: For each listed product, for tests performed by a qualified testing agency:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
 - H. Research/Evaluation Reports: For cold-formed metal framing.
- 1.5 QUALITY ASSURANCE
- A. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal

thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Steel Sheet."
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- 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 - Header Design."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. List below includes members of Steel Stud Manufacturers Association.
 - 2. AllSteel & Gypsum Products, Inc.
 - 3. California Expanded Metal Products Company.
 - 4. ClarkWestern Building Systems, Inc.
 - 5. Consolidated Fabricators Corp.; Building Products Division.
 - 6. Craco Mfg., Inc.
 - 7. Custom Stud, Inc.
 - 8. Design Shapes in Steel.
 - 9. Dietrich Metal Framing; a Worthington Industries Company.
 - 10. Formetal Co. Inc. (The).
 - 11. MarinoWARE
 - 12. Nuconsteel; a Nucor Company.
 - 13. Quail Run Building Materials, Inc.
 - 14. SCAFCO Corporation.
 - 15. Southeastern Stud & Components, Inc.
 - 16. Steel Construction Systems.
 - 17. Steeler, Inc.
 - 18. Super Stud Building Products, Inc.
 - 19. United Metal Products, Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on the contract documents and/or required by code.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Component deflection limits in first eight subparagraphs below are examples only. Select deflection limits from applicable subparagraphs or insert other limits as appropriate for wall, floor, and ceiling finish materials.
 - b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.

- c. Ceiling Joist Framing: Vertical deflection of $1/360$ of the span.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of $3/4$ inch.
 - 5. Design exterior non-load bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
 - C. Cold-Formed Steel Framing Design Standards:
 - 1. Floor and Roof Systems: AISI S210.
 - 2. Wall Studs: AISI S211.
 - 3. Headers: AISI S212.
 - 4. Lateral Design: AISI S213.
 - D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
 - E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- 2.3 COLD-FORMED STEEL FRAMING, GENERAL
- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 35 percent.
 - B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90 or equivalent.
 - C. Steel Sheet for Vertical Deflection or Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90.
- 2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING
- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by design, 0.0538 inch minimum.
 - 2. Flange Width: $1-5/8$ inches minimum.
 - B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs, 0.0538 inch minimum.
 - 2. Flange Width: $1-1/2$ inches.
 - C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWARE.
 - c. SCAFCO Corporation

- d. The Steel Network, Inc.
 - D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch.
 - 2. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.
 - E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch.
 - b. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch
 - b. Flange Width: Dimension equal to sum of outer deflection track flange width plus 1 inch.
 - F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.
- 2.5 CEILING JOIST FRAMING
- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with enlarged service holes if required, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by design; 0.0538 inch minimum.
 - 2. Flange Width: 1-5/8 inches, minimum.
- 2.6 SOFFIT FRAMING
- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by design; 0.0538 inch minimum.
 - 2. Flange Width: 1-5/8 inches, minimum.
- 2.7 FRAMING ACCESSORIES
- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
 - B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers, knee braces, and girts.
 - 9. Joist hangers and end closures.
 - 10. Hole reinforcing plates.
 - 11. Backer plates.
- 2.8 ANCHORS, CLIPS, AND FASTENERS
- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel 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.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: 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.
- E. 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.
- F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035 and ASTM A 780.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction [and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Primers, Sealers, and Undercoaters: 200 g/L.
 - 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - 5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
- C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, non-leaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.10 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
 - B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
 - C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
 - D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
 - E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
 - F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
 - G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
 - H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
 - I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
 - J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- 3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION
- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches, unless otherwise required by design.
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
 - 4. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - a. Install solid blocking at centers indicated on Shop Drawings.
 - 2. 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 wall-framing system.

3.5 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
 - 1. Joist Spacing: 16 inches, unless otherwise required by design.
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
- F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 05 50 00 - RAILINGS

Part I - General:

- I.1 Section Includes
 - a. Pre-engineered Optik glass and stainless steel Railing System. All drawings, general and supplementary conditions including division one specifications apply to this section.
- I.2 Related Sections
 - a. Division 5: Ornamental Handrails and Railings.
- I.3 References and Design Requirements
 - I.3.1 Principle items specified in this section are:
 - a. Stainless steel or Stainless/wood combination handrails.
 - b. Stainless steel mounting hardware.
 - c. Tempered glass structural infill panels.
 - I.3.2 Design requirements are based on IBC and ADA standards:
 - I.3.2.1 Guardrails and handrails shall meet or exceed all applicable building codes.
 - I.3.2.2 Railings shall have high strength stainless steel to comply with structural requirements with an appropriate safety margin.
 - I.3.2.3 ½" thick structural glass panels shall be fully tempered with a required attached handrail or cap rail, unless local code otherwise allows.
 - I.3.2.4 ¾" structural glass panels shall be fully tempered with an attached handrail or cap rail.
 - I.3.2.5 All internal members shall be stainless steel or aluminum to eliminate the possibility of rust.
 - I.3.2.6 Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - I.3.3 Work Included
 - Provide all materials, labor and equipment necessary to fabricate and completely install handrails, guardrails, infill panels, and other railing options as shown on drawings or specified herein.
- I.4 System Performance Requirements
 - I.4.1 Railings shall meet or exceed the requirements of all applicable building codes.
 - I.4.2 Railings shall have high strength stainless steel in order to comply with I.4.1 with adequate safety margin.
 - I.4.3 All internal members shall be stainless steel, nylon or wood to eliminate the possibility of rust.
 - I.4.4 Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- I.5 Submittals
 - I.5.1 Shop Drawings for architectural approval, showing fabrication and installation of handrails and railings including plans, elevations, sections, details of components and attachments to other units of work.
 - I.5.2 Product data for stainless steel/wood products to be supplied by the manufacturer.
 - I.5.3 Structural computations or test data/evaluations, material properties, PE (professional engineering) calculations signed/sealed in the State of the project, and other information needed to ensure satisfactory structural compliance to applicable building codes to be supplied by the manufacturer, based on final fabrication drawings and documents.

I.5.4 Maintenance instructions: Provide manufacturer's maintenance and cleaning instructions.

I.5.5 Warranty: Provide manufacturer's warranty effective from completion of work.

I.5.6 Initial selection

Provide 6" long handrail samples complete with supports and rosette covers to demonstrate stainless steel grade and finish. Nylon components to be included if specified, color as indicated.

I.5.7 Final verification

Qualification data for authorized installers specified in Quality Assurance is to demonstrate their capabilities and experience. Include list of completed projects with project and architect names.

I.6 Quality Assurance

I.6.1 Single Source Responsibility.

I.6.2 Execution tolerance plus/minus 5/64" (2 mm).

I.7 Storage

I.7.1 Store handrails and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind.

I.6.2 Materials must be kept in original packing until installation.

I.6.3 Materials to be stored at not lower than -40°C (-104°F) or higher than 100°C (212°F).

I.8 Project Conditions

I.8.1 All measurements for handrails and railings should be taken from construction site elements to which railings are to fasten. This information to be recorded on final shop drawings.

I.8.2 Coordinate fabrication schedule with construction progress to avoid delay of work

Part 2 - Product:

2.1 Manufacturer

2.1.1 Manufacturer shall be HDI Railing Systems, a U.S. manufacturer of a custom pre-engineered, mechanically fastened guardrail and handrail system, in strict compliance with all technical requirements of the drawings and specifications. Miscellaneous metal fabricators/suppliers will not be acceptable. This standard is based on HDI Railing Systems, 3905 Continental Drive, Columbia PA 17512 (Tel. 717.285.4088 Fax. 717.285.5083).

2.1.2 Alternate qualified manufacturers may be presented.

2.2 Materials: Guardrails and Handrail System

2.2.1 All rails and other tubular components shall be constructed using the following:

- a. Handrails to be Stainless steel grade UNS I.4305, type 304; surface to be 240 grain/grit finish; tubes 1-1/2" (38mm) outside diameter by 5/64" (2 mm) wall thickness.
- b. Handrail supports to be Stainless steel grade UNS I.4305, type 304; finish to match handrail.
- c. Metal Cap to be stainless steel satin finish (architect to select type and size)
Square section, 1" by 1-5/16", 1-1/2" or 2" square

Round section, diameters 1-1/2", 1.66", 2", 2-1/2" or 3"

- b. Optik Disc lock™ system includes plastic inserts to isolate glass from metals and a stainless Disc lock™ mechanism to secure glass in the aluminum shoe base.
 - c. Shoe Base:
 - i. Profile: Rectangular cross-section. 2-3/4 inches (63.5 mm) wide by 4-1/8 inches (104.7 mm) high
 - ii. Material: Aluminum 6063 – T52
 - iii. Finish: Mill finish
 - iv. Base Cladding: Brushed finish sheet metal cladding added to exposed shoe base sections. Adhere with double-sided tape and/or silicone adhesive. Provide end caps where ends of shoe base sections are exposed.
 - d. Optional natural wood handrails and top rails to be connected to stainless steel true bar secured to posts using stainless steel T-connectors on top of posts: Mitered joints required by changes in direction require stainless steel true bar to be inserted into the underside of the wood. Standard wood types are available in natural beech, birch or maple, other wood types available upon request. All custom stains are subject to customer approval and require customer samples. Wood to be continuous throughout. Returns to wall or floor that require stainless steel bends should have transitions that are smooth and without burrs.
- 2.2.3 Fastening for shoe mounting method structural glass to be as specified in Glass products section (2.4) base to be Aluminum alloy 6063 - T52.
- 2.2.3 Fastening bolts to be stainless steel or other high strength material as determined by engineering requirements.
- 2.2.4 Neoprene gasket material to be used at all through bolt connections to ensure separation between metal and glass.
- 2.3 Glass products, glazing and infill materials.**
- 2.3.3 Tempered glass: Provide fully tempered safety glass with polished edges and dubbed (blunt) corners complying with ASTM C1048. Kind FT (fully tempered), condition A (un-coated). Types I (transparent glass, flat), quality Q3 (glazing select), class, thickness and manufacturing process as indicated below. Tempered, laminated glass infill panels are required in railings where there is access to areas below the railing (check local codes).
- 2.3.2 Clear glass: Class I clear
- 2.3.3 Tinted glass: Class 2 (tinted heat absorbing and light reducing). Manufacturer's standard tint color indicated below:
- a. Bronze, Gray, or other as indicated
 - b. Low iron
 - c. Custom pattern, art glass, etch, edges or surface, laminate or embeds, as specified herein.
- 2.3.4 Allowable thickness either:
- 2.3.4.1 1/2" thick structural glass panels shall be fully tempered with a required attached handrail or cap rail to be noted on final shop drawings, unless local code otherwise allows.
 - 2.3.4.2 3/4" structural glass panels shall be fully tempered with an attached handrail or cap rail to be noted on final shop drawings.

- 2.3.5 Manufacturing process: Manufacture fully tempered glass by horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed.
- 2.3.6 Structural glass railing to be designed for compliance with appropriate building codes. Structural computations showing material properties and other information needed to ensure satisfactory structural compliance to applicable building codes to be supplied by the manufacturer – based on final fabrication drawings and documents, anchoring type, spacing and glass thickness.

2.5 Fasteners

Types and sizes indicated in shop drawings.

- A. For concrete attachment, hole size in base shoe is to be 9/16" (14.3 mm), counter bore 7/8" (22.2 mm) x depth 1/2" (12.7 mm), center-to-center spacing of holes is 12" (304.8mm). Use Power Fasteners 3/8" x 4" Wedge-Bolts Part # WBA38X4 with Wedge-Bolt Washer Part # WBAW38.
- B. For steel attachment, hole size in base shoe is to be 9/16" (14.3 mm), counter bore 7/8" (22.2 mm) x depth 1/2" (12.7 mm), center-to-center spacing of holes is 12" (304.8mm). Use 1/2" – 13 x 1 stainless steel socket head cap screw Part # SHCS12X1.
- C. Sill Angles for Tempered Glass Railing Assemblies: Steel angle profiles conforming to ASTM A 36, with anchoring devices, sizes indicated in shop drawing of section 05522, drilled and tapped for fastener types, sizes, and spacing indicated.

2.5.1 Anchors shall be fabricated from stainless steel or other materials as determined by engineering requirements with capability to sustain, without failure, load imposed within a safety factor of 4, as determined by testing per ASTM E488.

2.6 Fabrication

2.6.1 Fabricate railing system for compliance with structural requirements of applicable codes.

2.6.2 Pre-assemble railings prior to shipping to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and for coordination with shop drawings.

2.6.3 Stainless steel tubing cuts shall be square, without burrs and where exposed, rounded to produce smooth rigid and hairline joints.

Part 3 – Execution:

3.1 Examination

3.1.1 Do not begin installation until substrates have been properly prepared.

3.1.2 Verify that reinforcement and anchoring devices are the correct type, have been located correctly, and have been installed properly.

3.1.3 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 Preparation

Provide information on fastening point locations for anchors or posts where necessary to relevant parties.

3.3 Installation

Installation shall be by a qualified, authorized representative of the manufacturer.

3.3.1 Installation must be in accordance with standard or non-standard, yet applicable details (instructions) included on installation/shop drawings provided by manufacturer.

3.3.2 Install components plumb and in-line, accurately fitted, free from distortion or defects and securely anchored to structure.

3.3.3 Provide anchors, plates, angles, etc., necessary for connecting railings to structure.

3.3.4 Any and all field welding shall be by a certified welder.

3.3.5 Access for anchors that require through bolting either vertically or horizontally to be made available through General Contractor.

3.3.6 Maximum variation from plumb shall be 1/4".

3.3.7 Maximum offset from true alignment for every 50-foot of railing shall be 1/4", non-accumulative.

3.4 Cleaning and Protection

3.4.1 Remove manufacturer's protective coverings from exposed surfaces after installation.

3.4.2 Railings shall be cleaned, including infill panels, by contractor to the satisfaction of the owner.

3.4.3 Wipe with moistened cloth only. Do not use cleaning agents with abrasive or acid/alkaline content.

3.4.4 General contractor to provide protective covering on handrails and guardrails if construction is not yet finished in the area where the railings are installed.

3.4.5 Railings shall be cleaned, including infill panels, by contractor to the satisfaction of the owner.

3.4.6 Wipe with moistened cloth only. Do not use cleaning agents with abrasive or acid/alkaline content.

3.5 Correction of deficiencies

All deficiencies in work and/or items not meeting specified requirements shall be corrected in order to meet specification requirements at no additional cost to owner.

End of Section

SECTION 05 71 00 - DECORATIVE METAL STAIRS

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes decorative metal stairs.
- B. Related Requirements:
 - 1. Section 093013 "Ceramic Tiling" for ceramic-tile treads and landings.

I.3 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 anchorages for metal stairs.
 - 1. 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.
 - 2. Deliver such items to Project site in time for installation.

I.4 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Shop primer products.
 - 2. Grout.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
 - 3. Include plan at each level.
- C. Samples for Verification: For each type and finish of tread.
- D. Delegated-Design Submittal: For stairs, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

I.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that the engineer is licensed in the **[State]** in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

I.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - 4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

I.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 - 1. Keep members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 - 2. Protect members and packaged materials from corrosion and deterioration.
 - 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m)
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to **[L/360]**

- C. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]**, refer to structural drawings.

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: **[ASTM A 500/A 500M (cold formed)] [or] [ASTM A 513/A 513M]**.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, **[either commercial steel, Type B, or] structural steel, Grade 25 (Grade 170)**, unless another grade is required by design loads; exposed.
- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, **[either commercial steel, Type B, or] structural steel, Grade 30 (Grade 205)**, unless another grade is required by design loads.
- F. Galvanized-Steel Sheet: ASTM A 653/A 653M, **G90 (Z275)** coating, **[either commercial steel, Type B, or] structural steel, Grade 33 (Grade 230)**, unless another grade is required by design loads.
- G. Stainless Steel Sheet: ASTM A 240/A 240M or ASTM A 666, **[Type 304] [Type 316]**, stretcher-leveled standard of flatness.

2.3 NOSINGS

- I. Metal finishing nosing, refer to details

2.4 FASTENERS

- A. General: Provide **[zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5] [Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5]** where built into exterior walls.
 - I. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
 - I. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for **[exterior stairs] [stairs indicated to be galvanized] [stairs indicated to be shop primed with zinc-rich primer]**.
- D. Post-Installed Anchors: **[Torque-controlled expansion anchors] [or] [chemical anchors]** capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry

and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [Group I (A1)] [Group 2 (A4)] stainless steel bolts, ASTM F 593, and nuts, ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with painting specifications, see also A11.X series for finish schedule.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Zinc-Rich Primer: Complying with SSPC-Paint 20, [Type I-A] [Type I-B] [Type I-C] [Type II], Level [1] [2] [3], and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with [SSPC-Paint 20] [ASTM A 780/A 780M] and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- H. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.
- I. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
- J. Plain Steel Welded-Wire Reinforcement: ASTM A 1064/A 10645M, [steel,] [galvanized steel,] 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated on Drawings.
- K. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 1. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
 2. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

- L. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for [interior] [exterior] use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.6 CAST-IN-PLACE CONCRETE TREADS

- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 5000 psi (35 MPa) and a total air content of not less than 4 percent or more than 6 percent.
- B. Reinforcement: Galvanized, welded-wire reinforcement, 2 by 2 inches (50 by 50 mm) by 0.062-inch- (1.6-mm-) diameter steel wire; comply with ASTM A 1064/A 1064M, except for minimum wire size.

2.7 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs in shop to greatest extent possible.
 - 1. Disassemble units only as necessary for shipping and handling limitations.
 - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of a welded joint.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.

2.8 FABRICATION OF STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Architectural Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 1. Fabricate stringers **as indicated on Drawings**.
 - a. Stringer Size: **[As indicated on Drawings]**.
 - b. Provide closures for exposed ends of **[channel/tube]** stringers.
 - c. Finish: **Painted** per finish schedule
 2. Construct platforms of steel **[plate or channel] [rectangular tube]** headers and miscellaneous framing members as **[indicated on Drawings]**.
 - a. Provide closures for exposed ends of **[channel] [tube]** framing.
 - b. Finish: **[Shop primed] [Painted] [Galvanized]**.
 3. Weld **[or bolt]** stringers to headers; weld **[or bolt]** framing members to stringers and headers. **[If using bolts, fabricate and join so bolts are not exposed on finished surfaces.]**
- C. Subtreads, Risers, and Subplatforms:
 1. Fabricate subtreads and subplatforms of steel **[plates] [shapes indicated on Drawings]**.
 2. Form subtreads, risers, and subplatforms to configurations indicated from **[uncoated, cold-rolled steel sheet] [uncoated, hot-rolled steel sheet] [galvanized steel sheet] [of thickness needed to comply with performance requirements, but not less than 0.075 inch (1.9 mm) thick] [of thickness indicated on Drawings]**.
 3. Weld subtreads to stringers.
 - a. Locate welds on top of subtreads where they will be concealed by finished treads.
 4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads.
 - a. Weld subplatforms to platform framing.
 - b. Locate welds on top of subplatforms where they will be concealed by finished flooring.
 - c. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.9 STAIR RAILINGS

- A. Comply with applicable requirements in Section 05 50 00 "Railings."

2.10 FINISHES

- A. Finish metal stairs after assembly.
- B. Steel Galvanized Finish: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent and drain holes that are exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Steel Shop Prime Finish:
 - 1. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with [**SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."**] [**SSPC-SP 3, "Power Tool Cleaning."**]
 - 2. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 - 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
 - a. Clean bottom surface of plates.

- b. Set plates for structural members on wedges, shims, or setting nuts.
 - c. Tighten anchor bolts after supported members have been positioned and plumbed.
 - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- E. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 2. 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.
 - 3. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete.
 - 2. Center nosings on tread width.
- G. Install precast concrete treads with adhesive supplied by manufacturer.
- H. Install precast terrazzo treads according to manufacturer's written instructions.

3.3 REPAIRS

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."] [Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 057100

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Wood blocking, cants, and nailers.
 - 3. Wood furring and grounds.
 - 4. Utility shelving.
 - 5. Plywood backing panels.
- B. Related Requirements:
 - 1. Section 06 16 00 "Sheathing" for sheathing, subflooring, and underlayment.

I.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

I.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

I.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

I.6 QUALITY ASSURANCE

- ### A. Testing Agency Qualifications:
- For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

I.7 DELIVERY, STORAGE, AND HANDLING

- ### A.
- Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- ### A.
- Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Dress lumber, S4S, unless otherwise indicated.
- ### B.
- Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- ### A.
- Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all miscellaneous carpentry unless otherwise indicated.:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
1. Treatment shall not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
1. Concealed blocking.
 2. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.

3. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Blocking.
 2. Nailers.
 3. Cants.
 4. Furring.
 5. Grounds.
 6. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
 1. Hem-fir (north); NLGA.
 2. Mixed southern pine or southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Utility Shelving: Lumber with 15 percent maximum moisture content of the following species and grades:
 1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
 2. Mixed southern pine or southern pine No. 1 grade; SPIB.
 3. Hem-fir or hem-fir (north), Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.
 4. Spruce-pine-fir (south) or spruce-pine-fir, Select Merchantable or No. 1 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. Concealed Boards 19 percent maximum moisture content of any of the following species and grades:
 1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
 2. Hem-fir or hem-fir (north), Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
 3. Spruce-pine-fir (south) or spruce-pine-fir, Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
 4. Eastern softwoods, No. 3 Common grade; NELMA.
 5. Northern species, No. 3 Common grade; NLGA.
 6. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.
- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS I, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than **3/4-inch (19-mm)** nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - I. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
 - I. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with **ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).**

2.7 METAL FRAMING ANCHORS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. [Cleveland Steel Specialty Co.](#)
 - 2. [KC Metals Products, Inc.](#)
 - 3. [Phoenix Metal Products, Inc.](#)
 - 4. [Simpson Strong-Tie Co., Inc.](#)
 - 5. [USP Structural Connectors.](#)
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, **G60 (Z180)** coating designation.
 - I. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G185 (Z550)** coating designation; and not less than **0.036 inch (0.9 mm)** thick.
 - I. Use for wood-preservative-treated lumber and where indicated.

- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - I. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - I. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch (0.6 mm)**.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD I, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - I. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than **16 inches (406 mm)** o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - I. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than **96 inches (2438 mm)** o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than **96 inches (2438 mm)** o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and **2-inch nominal (38-mm actual)** thickness.
 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than **100 sq. ft. (9.3 sq. m)** and to solidly fill space below partitions.
 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than **20 feet (6 m)** o.c.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 3. ICC-ES evaluation report for fastener.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than **1-1/2 inches (38 mm)** wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

Specification for USG Structural Panel Concrete Subfloor Floor Systems

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of Work: Work of this Section includes, but is not limited to, the following:
 - 1. Framing.
 - 2. Fasteners.
 - 3. Underlayment and floor coverings.
 - 4. Sound attenuation materials.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. See Section 05 20 00, Metal Joists
- B. See Section 05 40 00, Cold-Formed Metal Framing
- C. See Section 06 10 00, Rough Carpentry
- D. See Section 09 30 00, Tiling
- E. See Section 09 60 00, Flooring
- F. See Section 13 40 00, Integrated Construction

1.03 SYSTEM DESCRIPTION

USG Structural Panel floor system consists of steel joists, trusses or framing members and USG Structural Panel Concrete Subfloor installed with mechanical fasteners. USG Structural Panel Concrete Subfloor is a high-strength reinforced concrete panel typically for use in noncombustible construction, as required by the applicable building codes. Adhesives are not recommended, nor required.

1.04 REFERENCES

- A. ICC-ES AC318 – Acceptance Criteria for Structural Cementitious Floor and Roof Sheathing Panels
- B. ICC-ES AC319 – Acceptance Criteria for Horizontal Diaphragms Consisting of Structural Cementitious Floor Sheathing Panels Attached to Cold-Formed Steel Framing
- C. ASTM A588/A588M – Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
- D. ANSI/AISI S100 – North American Specification for the Design of Cold-Formed Steel Structural Members
- E. ANSI/AISI S210 – North American Specification for Cold-Formed Steel Framing – Floor and Roof System Design
- F. ANSI/AISI S214 – North American Specification for Cold-Formed Steel Framing – Truss Design
- G. ANSI/AISI S230 – Standard for Cold-Formed Steel Framing – Prescriptive Method for One and Two Family Dwellings
- H. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
- I. ASTM E119 – Standard Test Method for Fire Tests of Building Construction and Materials
- J. ASTM E136 – Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C

1.05 SYSTEM REQUIREMENTS

- A. Performance Requirements: Fabricate and install systems as indicated:
1. Floor Framing:
 - a. Standard systems:
 - i. Floor framing shall be designed with a minimum deflection of $L/360$, where the Uniform Floor Load is 120 PSF (5.7 kPa) (Allowable) for framing spaced at 24" (610 mm) on center.
 - ii. Floor framing shall be designed with a minimum deflection of $L/360$, where the Uniform Floor Load is 283 PSF (13.5 kPa) (Allowable) for framing spaced at 16" (406 mm) on center.
 2. Fasteners:
 - a. Follow the selected fastener layout for Screw Patterns, for the design Diaphragm Loads as described in the current Progressive Engineering, Inc.'s Evaluation Report PER-13067. Available at www.per13067.com.
 3. Panel Layout:
 - a. Follow the USG Structural Panel Concrete Subfloor application described in the current Progressive Engineering, Inc.'s Evaluation Report PER-13067.
 - B. Fire Resistance Ratings: Where fire resistance classifications are indicated, provide materials and application procedures identical to those listed by UL or tested according to ASTM E119 for type of construction shown.

Note: *Fire-resistance ratings may require lighter gauge framing than that required for Shear- or Uniform-Loading. In this case, the gauge and joist depth must be selected by the strongest governing factor.*
 - C. Noncombustible Ratings: Where noncombustible assemblies are required, provide materials and application procedures identical to those tested according to ASTM E136, "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 °C."

Note: *Materials with modified ASTM E136-16 evaluations are not acceptable.*
 - D. **Acoustical Ratings:** Where sound ratings are indicated, provide materials and application procedures identical to those tested by manufacturer to achieve Sound Transmission Class (STC) in accordance with ASTM E90 and/or Impact Insulation Class (IIC) in accordance with ASTM E492 specified. Refer to USG Structural Panel Fire & Acoustic Manual - SCP100 for specific acoustical assemblies and performance ratings.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Delivery:
1. Deliver material to site promptly without undue exposure to weather.
 2. Deliver in manufacturer's unopened containers, pallets, or panels fully identified with name, brand, type and grade.
- B. Storage:
1. Store above ground in dry, ventilated space.
 2. Protect materials from soiling, exposure, and damage.
 3. If stored outside, material shall be covered with waterproof tarps.

Note: *If USG Structural Panels are frozen while stored outdoors, allow to thaw-out naturally. Do not use salts or fertilizers to defrost the panels or attempt to pry them apart.*

4. Panels must be stored over stable soil or other surface. Soil or surface must be able to carry the load of the stored pallet(s). Each 20-piece pallet weights 3500 lbs (1542 kg). It is recommended that the load carrying capacity of the floor or surface be verified before storing panels.
5. Pallets must not be stacked out of alignment by more than +/- 1/2" (13 mm) , measured on any side of the pallet.

1.09 PROJECT CONDITIONS

A. Environmental Requirements:

1. When mechanically fastened, do not install USG Structural Panel Concrete Subfloor when ambient or conditioned temperature is below 0 °F (-18 °C).
2. Prior to the application of finished flooring, USG Structural Panel Concrete Subfloor must be conditioned at the same temperature as required for the finished flooring for at least 48 hours.
3. Do not apply finished flooring over USG Structural Panel Concrete Subfloor when wet, frozen or with surface frost.
Note: If installed panels have snow or ice, do not use salts or defrosting agents, sand is recommended over slippery surfaces.

PART 2 – PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

- A. Structural Concrete Panel: Listed products establish standard of quality and are manufactured by United States Gypsum Company (USG), Chicago, IL.

2.02 MATERIALS

A. Structural Concrete Panel:

1. USG Structural Panel Concrete Subfloor, A noncombustible structural subfloor panel manufactured in accordance with Acceptance Criteria AC318.
 - a. Panel Dimensions:
 - i. Thickness: **3/4" (19 mm)**
 - ii. Width: **4' (1220 mm)**
 - iii. Lengths: **[8' (2440 mm)]** or **[6' (1829 mm)]** or **[6'-8" (2032 mm)]**
 - iv. Long Edges: **Tongue and Groove**
 - b. Panel Properties:
 - i. Density: **75 lb/ft³ (1200 kg/m³)** tested in accordance with ASTM C1185
 - ii. Weight: **5.0 lbs/ft² (24.4 kg/m²)** tested in accordance with ASTM D1037 at a thickness of 3/4 inch (19 mm)
 - iii. Noncombustibility: **Pass** tested in accordance to ASTM E136
 - iv. Surface Burning Characteristics: **0 – Flame Spread / 0 Smoke Developed** tested in accordance with ASTM E84

- v. Mold Resistance: **10** tested in accordance with ASTM D3273
0 tested in accordance with G21.
- B. USG Structural Panel Concrete Subfloor Recommended Fasteners:
 - a. In accordance with PER-13067 (Subfloor) and PER-14076 (Roof Deck), PER-15092 (Foundation Wall), and ESR-1792 (Subfloor).
 - b. Use only fasteners recommended by USG. Go to www.USGSCP95.com for the current list of recommended fasteners.
 - c. Install using the recommended spacing and distance from the Ends (square cut) and Edges (tongue & groove) of the panel.
 - d. Any length of USG recommended fasteners may be used but do not use a larger size fastener unless specified by the structural engineer.
- C. Floor Coverings and Underlayment:
 - 1. Follow floor covering manufacturers' installation procedures.
- D. Sound Attenuation:
 - 1. Consult with USG for sound system design and products.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, adjoining construction and conditions under which Work is to be installed. Do not proceed with Work until unsatisfactory conditions are corrected.
- B. Steel framing to receive the USG Structural Panel Concrete Subfloor shall be structurally sound, free from bows, twists or other malformations and in general compliance with local building code requirements. Damaged framing shall be replaced before installation of USG Structural Panel Concrete Subfloor.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Cold-Formed Steel Framing:
 - 1. The floor joists and other floor framing components must be designed to meet the strength and deflection criteria specified in the contract documents.
 - 2. The attachment flange or bearing edge for cold-formed steel must be a minimum 1-5/8" (41 mm) wide, 2" preferred, with at least 3/4" (19 mm) of the panel bearing on the supporting flange.
 - 3. The size of the cold-formed steel framing flange required will vary based on the specified mil thickness/gauge and fastener selected.
 - 4. Cold-formed steel framing thickness and size is always based on diaphragm capacity but must be a minimum 43 mil (18 gauge) and spaced no greater than 24" (610 mm) o.c. for up to 450 plf. When significant diaphragm capacity is required, 54 mil (16 gauge) may be required.
 - 5. Joist bearing shall be provided at the foundation that is uniform and level.
 - 6. Cold-formed steel joists shall be located directly over bearing studs or a header installed at the top of the bearing wall to distribute the load.
 - 7. Joist framing must be perpendicular to rim joists.

8. On steel framing, a web stiffener shall be provided at reaction points and/or concentrated loads as specified in the contract documents. End blocking shall be provided where joist ends are not otherwise restrained from rotation.
9. Additional joists shall be provided under parallel partitions and around all floor openings that interrupt one or more spanning members. Framing must be properly fastened to the supporting walls or structure.
10. All blocking or bridging must be installed prior to the installation of USG Structural Panel Concrete Subfloor.
11. Framing must be of good quality, free of bows, twists or other malformations.

B. Hot-Rolled Steel Framing:

1. The floor joists and other floor framing components must be designed to meet the strength and deflection criteria specified in the contract documents.
2. Framing shape and size is always based on diaphragm capacity.
3. Hot-rolled steel framing shall have a 3" (76 mm) or larger bearing surface suitable for fastener insertion and panels must bear a minimum of 1 1/4" (32 mm) on the framing member.
4. Framing bearing shall be provided at the foundation that is uniform and level.
5. Joist framing must be perpendicular to support beams.
6. Additional framing members shall be provided under parallel partitions and around all floor openings that interrupt one or more spanning members. Framing must be properly fastened to the supporting walls or structure.
7. All blocking or bridging must be installed prior to the installation of USG Structural Panel Concrete Subfloor.
8. Framing must be of good quality, free of bows, twists or other malformations.

C. USG Structural Panel Concrete Subfloor:

1. This product may contain respirable crystalline silica. Refer to OSHA Rule 29 CFR 1926.1153 for specific details about limiting worker exposure to respirable silica.
2. The panels shall be cut to size with a circular saw equipped with carbide-tipped cutting blade and a dry dust industrial HEPA vacuum collection device for control of dust and silica. Wear safety glasses and a NIOSH-approved dust mask when cutting the panel. Collected dust shall be disposed in a safe manner and in compliance with local, state and federal ordinances.
3. USG Structural Panel Concrete Subfloor shall be installed with the long edges (tongue & groove) perpendicular to the framing.
4. The fire, sound and structural ratings listed in the USG Structural Panel Fire and Acoustic Manual - SCP100 for the USG Structural Panel Concrete Subfloor system are based on fastener attachment only, no adhesives. www.USGSCP100.com.
5. Begin panel installation by snapping a line across the joists parallel to the rim joist at a distance equal to the width of the first panel being placed. Given that panel width is 48" (1220 mm), plan the layout so the first and last panel row width is a minimum of 24" (610 mm) wide. In the case where the row width is less than 24" (610 mm) wide, panels shall be blocked on all edges by framing (strapping is not sufficient).

6. Ensure that all supporting members are free of debris before placing panels. Place the cut edge or tongue along the rim joist. Place each panel across three or more supports [minimum two-span condition]. Less than full length panels at the end of a row may span a single framing opening. Cut panels to length as needed to ensure that the butt end of the panel is centered on the framing member. Install panels in a direction that ensures that the butt end falls over the open side of the joist. This will help keep adjacent ends in the same place.
7. USG Structural Panel Concrete Subfloor shall be fastened following the fastening schedule listed in the contract documents. Begin fastening at one end and fan out across the panel. Do not fasten all the corners first. After the installation of one complete row, begin the next row. Slide panels together so that the tongue of the panel being installed fits into the groove of the installed panel. If there is construction debris lodged inside the groove, do not force the tongue into the clogged groove. Clean the plugged groove with a stiff bristle brush to dislodge the trapped debris. Do not gap the panels. Install the second panel and all subsequent panels in a similar manner to complete the row. Install all rows in a running bond pattern so that end joints fall over the center of the framing members and are staggered by at least two supports from where the end joints fall in the adjacent rows. Less than full length panels at the end of a row may be staggered by a single support.
8. Penetrations in the panels should be made before installing the panel whenever possible. If a penetration is required after the panel is installed, set the depth of the saw blade to ensure that the framing is not scored. Support the ends and edges of any penetrations with framing if they are greater than 6" (153 mm) in any direction (refer to SCP14 Installation Guidelines).
9. Ensure panel is flush with supporting member, drive fasteners so the heads are flush with the surface of the board. Go to www.USGSCP95.com for the current list of recommended fasteners.
10. Construction Traffic Protection – prior to floor finishing, place minimum 3/8" (9.525 mm) thick plywood sheathing materials on the floor in high traffic areas over newly installed USG Structural Panel Concrete Subfloor (i.e. additional USG Structural Panels or plywood). 1/4" plywood may be used in lieu of 3/8" material provided it is fastened at all four corners to prevent shifting and curling. Thicker protecting material may be required if heavier loads are expected or work is to be performed that may damage USG Structural Subfloor.

D. Sound Mat and Underlayments

1. Sound Mat:

- a. Refer to USG Structural Panel Fire & Acoustic Manual - SCP100 for specific acoustical assemblies and performance ratings. www.USGSCP100.com.
- b. Refer to USG Performance Flooring Portfolio – IG2013, along with USG's submittal and SDS pages at USG.com/floor for the most recent product data and installation procedures for USG Levelrock® Brand, Durock™ Brand, and USG Fiberock® Brand Underlayment products.
- c. Install sound mat over USG Structural Panel Concrete Subfloor according to sound mat manufacturer's recommendations.
- d. USG Fiberock® Underlayment over Sound Mat:
 - 1) Lay cut edges of USG Fiberock® Underlayment base layer against the wall; only factory edges should be joined. Begin laying panels at one corner. Maintain 1/4" (6.35 mm) space between panels and perimeter walls. Stagger joints of surface layer a minimum of 16" (406 mm) so that four panel corners never meet, and offset end and edge joints of panels a minimum of 12" - 16" (305 mm - 406 mm)

from subfloor panel joints. Adjoin panel edges and ends lightly together. A maximum 1/32" (0.76 mm) gap is allowed.

- 2) The base and surface layers of USG Fiberock® Underlayment panels must be bonded together with modified thin set mortar and will 'float' on sound mat.
- 3) Use staples to hold panel layers together during mortar drying period. Staples (1/4" (6.35 mm) crown, 43 mil (18 ga.), and 1/2" (12.7 mm) legs) to be installed at 8" (203.2 mm) on center in the field and 1" (25.4 mm) on center along the perimeter of the USG Fiberock® panel. Set pneumatic tool pressure to drive fasteners flush or slightly below underlayment surface. To prevent fastener heads from telegraphing through resilient floor covering, do not countersink more than 1/16" (1.58 mm) below surface.
- 4) On surface layer of USG Fiberock® Underlayment, use patching compound sparingly to fill wide joints, repair any surface voids and correct joint lippage (panel edge sitting above or below the floor plane). Carefully fill joints wider than 1/32" (0.76 mm) and any surface imperfections with only enough material to infill void - do not feather. Correct joint lip-page by applying patching compound to low side only and feathering to level. Allow compound to dry completely (90 min. minimum), then lightly sand or scrape, taking care not to scuff panel surface; use a flat blade to scrape away any excess material. Remove dust, dirt and debris from underlayment surface before application of floor covering.

2. Poured Floor Underlayment:

- 1) USG Levelrock® Brand or DUROCK™ Brand floor underlayment can be poured directly onto USG Structural Panel Concrete Subfloor in lieu of a dry underlayment panel.

Note: USG Structural Panel Concrete Subfloor joints must be taped, and a primer may be required, prior to underlayment pour.

- 2) USG Fiberock® Brand Underlayment panels should be secured to USG Structural Panel Concrete Subfloor using staples and a modified thin set mortar.
- 3) Refer to USG Performance Flooring Portfolio – IG2013, along with USG's submittal and SDS pages at USG.com/floor for the most recent product data and installation procedures for USG Levelrock® Brand, Durock™ Brand, USG Fiberock® Brand Underlayment products.

3. USG Fiberock® Underlayment (over USG Structural Panel Concrete Subfloor without sound mat):

- 1) Lay cut edges of USG Fiberock® Underlayment against the wall; only factory edges should be joined. Begin laying panels at one corner. Maintain 1/4" (6.35 mm) space between panels and perimeter walls. Stagger joints a minimum of 16" (406 mm) so that four panel corners never meet, and offset end and edge joints of panels a minimum of 12" - 16" (305 mm - 406 mm) from subfloor panel joints. Adjoin panel edges and ends lightly together. A maximum 1/32" (0.76 mm) gap is allowed.
- 2) The USG Fiberock® Underlayment must be bonded with modified thin set mortar
- 3) Staples (1/4" (6.35 mm) crown, 43 mil (18 ga.), and 1" (25.4 mm) legs) to be installed at 4" (102 mm) on center in the field and 1" (25.4 mm) on center along the perimeter of the USG Fiberock® panel. Set pneumatic tool pressure to drive fasteners flush or slightly below underlayment surface. To prevent fastener

heads from telegraphing through resilient floor covering, do not countersink more than 1/16" (1.58 mm) below surface.

- 4) Use patching compound sparingly to fill wide joints, repair any surface voids and correct joint lippage (panel edge sitting above or below the floor plane). Carefully fill joints wider than 1/32" (0.76 mm) and any surface imperfections with only enough material to infill void - do not feather. Correct joint lip-page by applying patching compound to low side only and feathering to level. Allow compound to dry completely (90 min. minimum), then lightly sand or scrape, taking care not to scuff panel surface; use a flat blade to scrape away any excess material. Remove dust, dirt and debris from underlayment surface before application of floor covering.

E. Floor Finish:

1. Leftover material shall be removed from the job site.
2. Remove all foreign material from the floor surface and vacuum all dust from the surface.
4. Before the application of floor finish materials, ensure that all panels are properly fastened, with the fastener head driven flush or slightly below the surface of the panels. If required butt joints and T&G joints shall be filled with an elastomeric patching compound [*cement-based compounds, can crack*].
5. Direct application of bonded floor finishes to USG Structural Subfloor is not recommended.
6. Engineered Wood – Apply a building paper, No. 15 felt or equivalent, over USG Structural Panel Concrete Subfloor prior to applying wood flooring. For engineered wood flooring, use the moisture barrier recommended for the engineered wood flooring system specified in lieu of the building paper. Follow the wood flooring manufacturer's installation instructions for applying wood flooring to plywood or OSB floor sheathing. USG Structural Panels must be kept dry and maintained in a conditioned space for a minimum of 30 days prior to installation of wood flooring.
7. Ceramic Tile – Ceramic tile should be installed over an underlayment panel or poured underlayment as described in §3.02.D of this specification. Apply Ceramic tile in accordance with ceramic tile manufacturer's instructions.
8. Carpet – For residential carpet & pad, apply tackless strips (designed for concrete application) for the installation of stretched carpet. Residential carpet and pad can be installed directly to USG Structural Panel Concrete Subfloor or to an underlayment. For all Carpet Tile, it is recommended to use an underlayment as described in §3.02.D of this specification.
9. Vinyl Flooring - An appropriate underlayment should be used as described in §3.02.D of this specification.
10. If USG Structural Panel Concrete Subfloor is left bare in extremely-light traffic areas, it is recommended that you seal the panels with a concrete sealer to seal the porous surface.

END OF SECTION

SECTION 06 16 00 - SHEATHING

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Parapet sheathing.
 - 3. Subflooring.
 - 4. Sheathing joint and penetration treatment.
 - 5. Roof Sheathing
- B. Related Requirements:
 - 1. Section 06 10 53 "Miscellaneous Rough Carpentry" for plywood backing panels.

I.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - 4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

I.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated plywood.
 - 2. Fire-retardant-treated plywood.

I.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

I.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - I. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

- A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- B. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - I. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet (3.2 m)** beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to **170 deg F (76 deg C)** shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings, and the following:
 - 1. Roof and wall sheathing within **48 inches (1220 mm)** of fire walls.
 - 2. Roof sheathing.
 - 3. Subflooring and underlayment for raised platforms.

2.5 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 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. [CertainTeed Corporation.](#)
 - b. [Georgia-Pacific Building Products.](#)
 - c. [National Gypsum Company.](#)
 - d. [United States Gypsum Company.](#)
 - 2. Type and Thickness: Type X, **5/8 inch (15.9 mm)** thick.
 - 3. Size: **48 by 96 inches (1219 by 2438 mm)** for vertical installation.

2.6 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure I sheathing.
 - 1. Span Rating: Not less than 24/0.
 - 2. Nominal Thickness: Not less than 5/8 inch.

2.7 PARAPET SHEATHING

- A. Plywood Sheathing: DOC PS I, Exterior, Structural I sheathing.
 - 1. Span Rating: Not less than 32/16
 - 2. Nominal Thickness: Not less than 1/2 inch (13 mm).
- B. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 - d. United States Gypsum Company.
 - 2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
 - 3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.

2.8 SUBFLOORING AND UNDERLAYMENT

- A. Plywood Combination Subfloor-Underlayment: DOC PS I, Exposure I, Structural I, Underlayment single-floor panels.
 - 1. Span Rating: Not less than 24.
 - 2. Nominal Thickness: Not less than 7/8 inch (22.2 mm)
 - 3. Edge Detail: Tongue and groove.
 - 4. Surface Finish: Fully sanded face.

2.9 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

- D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.
- G. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.10 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- B. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.11 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Coordinate wall, parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Combination Subfloor-Underlayment:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels **1/8 inch (3 mm)** apart at edges and ends.
 - 2. Subflooring:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels **1/8 inch (3 mm)** apart at edges and ends.
 - 3. Wall Sheathing:
 - a. Screw to cold-formed metal framing.
 - b. Space panels **1/8 inch (3 mm)** apart at edges and ends.
 - 4. Roof Sheathing:
 - a. Nail to wood framing in accordance with nailing requirements indicated.
 - b. Space panels 1/8 inch apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with screws.
 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 3. Install panels with a **3/8-inch (9.5-mm)** gap where non-load-bearing construction abuts structural elements.
 4. Install panels with a **1/4-inch (6.4-mm)** gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately **8 inches (200 mm)** o.c. and set back a minimum of **3/8 inch (9.5 mm)** from edges and ends of panels.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately **8 inches (200 mm)** o.c. and set back a minimum of **3/8 inch (9.5 mm)** from edges and ends of panels.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 16 00

SECTION 06 16 43 – GYPSUM SHEATHING

PART I - GENERAL

I.01 SUMMARY

A. Section Includes: Fiberglass-mat faced, moisture and mold resistant gypsum sheathing.

B. Related Sections:

1. Section 05 41 00 Structural Metal Stud Framing.
2. Section 06 10 00 Rough Carpentry.
3. Section 09 21 16 Gypsum Board Assemblies.

I.02 REFERENCES

A. ASTM International (ASTM):

1. ASTM C473 Standard Test Methods for Physical Testing of Gypsum Panel
2. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
3. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
4. ASTM C1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
5. ASTM C1280 Standard Specification for Application of Gypsum Sheathing.
6. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
7. ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
8. ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
9. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
10. ASTM C1396 Standard Specification for Gypsum Board
11. ASTM E 136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
12. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

I.03 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each product specified.

I.04 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of installation of the product in such structure.

B. Manufacturer's Warranty: Five years against manufacturing defects from the date of purchase of the product for installation

PRODUCTS

MANUFACTURERS

A. Georgia-Pacific Gypsum LLC:

1. Fiberglass-Mat Faced Gypsum Sheathing: DensGlass Sheathing.
2. Fiberglass-Mat Faced Gypsum Sheathing, Type X for Fire Rated Designs: DensGlass Fireguard Sheathing.
3. Alternates are considered when proven to be of equal performance.

I.1 MATERIALS

A. Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177:

1. Thickness: 1/2 inch. Project Name/Number/Date 06 16 43-4 Gypsum Sheathing
2. Width: 4 feet.
3. Length: [8 feet] [9 feet] [10 feet].
4. Weight: 1.9 lb/sq. ft.
5. Edges: Square.
6. Surfacing: Fiberglass mat on face, back, and long edges.
7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 pounds per square foot, dry.
8. Flexural Strength, Parallel (ASTM C473): 80 lbf, parallel.
9. Humidified Deflection (ASTM C1177): Not more than 2/8 inch.
10. Permeance (ASTM E96): Not less than 23 perms.
11. R-Value (ASTM C518): 0.56.
12. Mold Resistance (ASTM D3273): I0, in a test as manufactured.

13. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.

14. Acceptable Products: a. 1/2 inch DensGlass Sheathing, Georgia-Pacific Gypsum LLC.

B. Fire-Rated Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177, Type X:

1. Thickness: 5/8 inch.

2. Width: 4 feet.

3. Length: [8 feet] [9 feet] [10 feet].

4. Weight: 2.5 lb/sq. ft.

5. Edges: Square.

6. Surfacing: Fiberglass mat on face, back, and long edges.

7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 654 pounds per square foot, dry.

8. Flexural Strength, Parallel (ASTM C1177): 100 lbf, parallel.

9. Humidified Deflection (ASTM C1177): Not more than 1/8 inch.

10. Permeance (ASTM E96): Not less than 17 perms.

11. R-Value (ASTM C518): 0.67.

12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.

13. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.

14. Acceptable Products: a. 5/8 inch DensGlass Fireguard Sheathing, Georgia-Pacific Gypsum LLC.

1.3 ACCESSORIES

A. Screws: ASTM C1002, corrosion resistant treated.

2.1 EXECUTION

2.01 EXAMINATION A. Verification of Conditions:

1. Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

2.02 INSTALLATION A. General: In accordance with GA-253, ASTM C1280 and the manufacturer's recommendations.

1. Manufacturer's Recommendations: a. Current "Product Catalog", Georgia-Pacific Gypsum.

2. Protect gypsum board installations from damage and deterioration until date of substantial completion.

END OF SECTION 057100

SECTION 06 41 16 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-faced architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
- B. Related Requirements:
 - 1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

I.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

I.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products, high-pressure decorative laminate and cabinet hardware and accessories.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for [electrical switches and outlets] [and other items] installed in architectural plastic-laminate cabinets.
 - 4. Apply WI Certified Compliance Program label to Shop Drawings.
 - 5. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.
3. Thermoset decorative panels.

D. Samples for Verification:

1. Plastic laminates, **8 by 10 inches (200 by 250 mm)** for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Wood-grain plastic laminates, **12 by 24 inches (300 by 600 mm)**, for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.
3. Thermoset decorative panels, **8 by 10 inches (200 by 250 mm)**, for each color, pattern, and surface finish, with edge banding on one edge.
4. Corner pieces as follows:
 - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, **18 inches (450 mm)** high by **18 inches (450 mm)** wide by **6 inches (150 mm)** deep.
 - b. Miter joints for standing trim.
5. Exposed cabinet hardware and accessories, one unit for each type and finish.

I.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For the following:
 1. Composite wood and agrifiber products.
 2. Thermoset decorative panels.
 3. High-pressure decorative laminate.
 4. Glass.
 5. Adhesives.
- C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

I.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of typical plastic-laminate cabinets as shown on Drawings
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

I.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

I.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
- B. Grade: Premium

- C. Type of Construction: As indicated in drawings
- D. Cabinet, Door, and Drawer Front Interface Style: As indicated in drawings
- E. Reveal Dimension: As indicated in drawings
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard. Selections refer to finish schedule.
 - I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Formica Corporation.
 - b. Lamin-Art, Inc.
 - c. Pionite; a Panolam Industries International, Inc. brand.
 - d. Wilsonart International Holdings, Inc.
- G. Drawer Construction: Refer to drawings.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - I. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade I 30.
 - 2. Particleboard: ANSI A208.1, Grade M-2
 - 3. Softwood Plywood: DOC PS I, medium-density overlay.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-I
 - 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets as indicated on drawings.

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: Contact cement
 - I. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces].

2.5 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- 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 average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)**.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - I. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - I. Install cabinets with no more than **1/8 inch in 96-inch (3 mm in 2400-mm)** sag, bow, or other variation from a straight line.

2. Fasten wall cabinets through back, near top and bottom, and at ends not more than **16 inches (400 mm)** o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi exposed surfaces.

END OF SECTION 06 41 16

SECTION 06 83 16 - FIBERGLASS REINFORCED PANELING**I.1 SECTION INCLUDES**

- A. Fiberglass reinforced plastic (FRP) wall panels.

I.2 RELATED REQUIREMENTS

- A. Section 07 92 00 – Joint Sealants.

I.3 REFERENCE STANDARDS

- A. ASTM International (ASTM) (www.astm.org):
 - 1. ASTM D 2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
 - 2. ASTM D 5319 – Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
 - 3. ASTM D 5420 – Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
 - 4. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

I.4 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each type of product required.
- B. Samples: Submit manufacturer's selection and verification samples for finish, colors, patterns, and textures.
 - 1. Submit 2 samples of each type of panel, trim, and fastener.
- C. Certificates: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- D. Test and Evaluation Reports: Submit reports showing compliance with specified performance characteristics and physical properties.
- E. Manufacturer's Instructions: Submit manufacturer's installation and storage instructions.
- F. Manufacturer's Project References: Submit manufacturer's list of successfully completed FRP panel projects, including project name and location, name of architect, and type and quantity of FRP panels furnished.
- G. Installer's Project References: Submit installer's list of successfully completed FRP panel projects, including project name and location, name of architect, and type and quantity of FRP panels installed.

I.5 CLOSEOUT SUBMITTALS

- A. Comply with Division 01.
- B. Care and Maintenance Instructions: Submit manufacturer's care and maintenance instructions, including cleaning and repairing instructions.
- C. Warranty Documentation: Submit manufacturer's standard warranty.

I.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Comply with Division 01.
- B. Extra Stock Materials:
 - 1. Deliver to Owner extra stock materials from same production run as products installed.
 - 2. Quantity: Furnish quantity of FRP panels equal to 2% percent of amount installed.
 - 3. Delivery, Storage, and Protection:
 - a. Comply with Owner's requirements for delivery, storage, and protection of extra stock materials.
 - b. Package extra stock materials with protective covering and include labels clearly identifying product name and manufacturer.

I.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged, for a minimum of 10 years, in the manufacturing of FRP panels of similar type to that specified.
- B. Installer's Qualifications:
 - 1. Installer regularly engaged, for a minimum of 5 years, in installation of FRP panels of similar type to that specified.
 - 2. Employ persons trained for installation of FRP panels.
- C. Mock-ups:
 - 1. Install at Project site a mock-up using acceptable products and manufacturer-approved installation methods.
 - 2. Construct mock-up in place.
 - 3. Obtain Architect approval and acceptance of finish, color, texture, pattern, trim, fasteners, and quality of installation.
 - 4. Mock-Up Size min.: 4' x 8'.
 - 5. Mock-up may be incorporated into final construction upon Architect approval.

I.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials in accordance with manufacturer's instructions.
 - 2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
 - 3. Store materials in clean, dry area indoors at temperature and humidity conditions in accordance with manufacturer's instructions.
 - 4. Store materials on flat, level surface, raised above floor, with adequate support to prevent sagging.
 - 5. Store materials out of direct sunlight.
 - 6. Protect materials and finish during storage, handling, and installation to prevent damage.

I.9 AMBIENT CONDITIONS

- A. Do Not Begin Installation Until:
 - 1. Building is enclosed.
 - 2. Permanent heating and cooling equipment is in operation.
 - 3. Residual moisture from plaster, concrete, or terrazzo has dissipated.
- B. During installation and within 48 hours before installation, maintain ambient temperature and relative humidity within limits required by type of FRP panel adhesive used and adhesive manufacturer's instructions.

I.10 WARRANTY

- A. Warranty Period: 1 year from date of purchase.
- B. Limited Warranty Period: Prorated years 2 to 10 from date of purchase.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Crane Composites, Inc. (formerly Kemlite) 23525 West Eames Street, Channahon, Illinois 60410. Toll Free 800-435-0080. Phone 815-467-8600. Fax 815-467-8666. Website www.cranecomposites.com. Email salesbp@cranecomposites.com.
- B. Substitutions: Comply with Division 01.

2.2 FRP PANELS

- I. As per Architectural Finish Schedule (A11.1).
- B. Panel Compliance: ASTM D 5319.
- C. Panel Surface Protection: "Surfaseal" molecularly-bonded surface protection film for impact, abrasion, and scratch resistance.
- D. Panel Color: As selected by Architect from manufacturer's full range.
 - I. Wall Panel Size: As indicated on the Drawings.

2.3 ACCESSORIES

- A. Moldings, Trim, and Caps: 1-piece extruded polypropylene, configured to cover panel edges and corners.
 - I. Color: As selected by Architect from manufacturer's full product range.
- B. Panel Adhesive: As recommended by FRP panel manufacturer for required substrates.
- C. Panel Seam Sealant: Bright white, 2-part urethane sealant, as recommended by FRP panel manufacturer.
 - I. VOC Content: 0.0 g/L.
- D. Rivets:
 - I. Color: Match FRP panels.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive FRP panels.
- B. Examine Substrate Surfaces to Determine:
 - 1. Corners: Plumb and straight.
 - 2. Surfaces: Smooth, sound, and uniform.
 - 3. Nails or Screw Fasteners: Countersunk.

4. Joints and Cracks: Filled flush and smooth with adjoining surfaces.

- C. Notify Architect of conditions that would adversely affect installation or subsequent use.
- D. Do not begin preparation or installation until unacceptable conditions are corrected.

3.2 PREPARATION

- A. Clean substrates to remove substances that could impair bond of adhesive, including oil, grease, dirt, dust, or other contaminants.
- B. Acclimate FRP panels by unpacking and placing in installation space a minimum of 24 hours before installation.
- C. Lay out FRP panels before beginning installation.
 1. Locate panel joints to provide equal panel widths at ends of walls.
 2. Locate panel joints to provide trimmed panels at corners a minimum of 12 inches (300 mm) wide.

3.3 INSTALLATION

- A. Install FRP panels in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install FRP panels plumb, level, square, flat, and in proper alignment.
- C. Install FRP panels to be water resistant and washable.
- D. Install FRP panels with manufacturer's recommended gap for panel field and corner joints.
- E. Fasteners:
 1. Use fasteners in accordance with manufacturer's instructions to install FRP panels securely to supports.
 2. Pre-drill fastener holes in FRP panels, 1/8 inch (3.2 mm) greater in diameter than fasteners.
- F. Adhesive:
 1. Install FRP panels in full spread of adhesive.
 2. Follow adhesive manufacturer's instructions for application of adhesive.
- G. Install trim accessories with adhesive and nails or staples.
 1. Do not fasten through FRP panels.
- H. Sealant:
 1. Fill grooves in trim accessories with sealant before installing FRP panels.
 2. Bed inside corner trim in bead of sealant.
 3. Remove excess sealant and smears as FRP panels are installed.
 4. Clean in accordance with sealant manufacturer's instructions.
- I. Tolerances: Install FRP panels within manufacturer's installation tolerances.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: If requested by Owner, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - I. Site Visits: I.

3.5 ADJUSTING

- A. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Remove and replace with new material, damaged components that cannot be successfully repaired, as determined by Architect.

3.6 CLEANING

- A. Clean FRP panels promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.7 PROTECTION

- A. Protect installed FRP panels and finish surfaces from damage during construction.

END OF SECTION 06 83 16

SECTION 07 01 50.19 - PREPARATION FOR REROOFING

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Full tear-off down to roof deck [**of roof system at areas indicated on Drawings**].
 - 2. Re-cover preparation [**of entire roof area**] [**of roof areas indicated on Drawings**].
 - 3. Removal of flashings and counterflashings.
 - 4. Temporary roofing.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for use of premises and for phasing requirements.
 - 2. Section 012300 "Alternates" for extent of alternates.
 - 3. Section 015000 "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for reroofing preparation.

I.3 ALLOWANCES

- A. Allowance for removal of existing wet insulation and replacement with new insulation, removal of drywall and replacement with new gwb, is specified under Section 012100 "Allowances."

I.4 UNIT PRICES

- A. Work of this Section is affected by [**insulation removal and replacement unit price**] [**metal deck removal and replacement unit price**] [**roof sheathing removal and replacement unit price**] [**and**] [**parapet wall sheathing removal and replacement unit price**] <Insert name of unit price>.

I.5 DEFINITIONS

- A. EPS: Molded (expanded) polystyrene.
- B. Full Roof Tear-off: Removal of existing roofing system down to existing [**roof deck**]
- C. OSB: Oriented strand board.

- D. Partial Roof Tear-off: Removal of selected components and accessories from existing roofing system.
- E. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.
- F. Roof Re-Cover Preparation: Existing roofing system is to remain and be prepared for new roof installed over it.

I.6 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at **[Project site]** **<Insert location>**.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing tear-off, including, but not limited to, the following:
 - a. Reroofing preparation, including roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system components that are to remain.
 - c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
 - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
 - e. Existing roof deck conditions requiring Architect notification.
 - f. Existing roof deck removal procedures and Owner notifications.
 - g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
 - h. Structural loading limitations of roof deck during reroofing.
 - i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
 - j. HVAC shutdown and sealing of air intakes.
 - k. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
 - l. Asbestos removal and discovery of asbestos-containing materials.
 - m. Governing regulations and requirements for insurance and certificates if applicable.
 - n. Existing conditions that may require Architect notification before proceeding.

I.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Temporary Roofing Submittal: Product data and description of temporary roofing system.
 - 1. If temporary roof remains in place, include surface preparation requirements needed to receive permanent roof, and submit a letter from roofing manufacturer stating acceptance of the temporary roof and that its inclusion does not adversely affect the new roofing system's resistance to fire and wind **[or specified special warranty]**

I.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
 - 1. Include certificate that Installer is approved by warrantor of existing roofing system.
 - 2. Include certificate that Installer is licensed to perform asbestos abatement.
- B. Field Test Reports:
 - 1. Fastener pull-out test report.
- C. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations.
 - 1. Submit before Work begins.
- D. Landfill Records: Indicate receipt and acceptance of **[demolished roofing materials and]** hazardous wastes, such as asbestos-containing materials, by a landfill facility licensed to accept them.

I.9 QUALITY ASSURANCE

- A. Installer Qualifications: **[Approved by warrantor of existing roofing system to work on existing roofing] [and] [licensed to perform asbestos abatement in the state or jurisdiction where Project is located]**.
- B. Regulatory Requirements:
 - 1. Comply with governing EPA notification regulations before beginning roofing removal.
 - 2. Comply with hauling and disposal regulations of authorities having jurisdiction.

I.10 FIELD CONDITIONS

- A. Existing Roofing System: **[Built-up roofing with marble chips** roofing.
- B. Owner **[will not]** occupy portions of building immediately below reroofing area, but will occupy space below that.
 - 1. Conduct reroofing so Owner's operations are not disrupted.
 - 2. Provide Owner with not less than **[72] <Insert number>** hours' written notice of activities that may affect Owner's operations.
 - 3. Coordinate work activities daily with Owner so Owner has adequate advance notice to place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
 - 4. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area.
 - a. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.

- C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- E. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
 - 1. A roof moisture survey of existing roofing system is available for Contractor's reference.
 - 2. The results of an analysis of test cores from existing roofing system are available for Contractor's reference.
 - 3. Construction Drawings[**and Project Manual**] for existing roofing system are provided for Contractor's convenience and information, but they are not a warranty of existing conditions. They are intended to supplement rather than serve in lieu of Contractor's own investigations. Contractor is responsible for conclusions derived from existing documents.
- F. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed to **<Insert load>** for rooftop equipment wheel loads and **<Insert load>** for uniformly distributed loads.
- G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
 - 1. Remove only as much roofing in one day as can be made watertight in the same day.
- H. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. Existing roof will be left no less watertight than before removal.
 - 3. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
 - a. Hazardous materials will be removed by Owner under a separate contract.
- I. Hazardous Materials: A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except according to procedures specified elsewhere in the Contract Documents.
 - 3. Coordinate reroofing preparation with hazardous material remediation to prevent water from entering existing roofing system or building.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

- A. EPS Insulation: ASTM C 578.
- B. Plywood: DOC PS I, Grade CD, Exposure I.

- C. OSB: DOC PS 2, Exposure I.

2.2 TEMPORARY ROOFING MATERIALS

- A. Design and selection of materials for temporary roofing are Contractor's responsibilities.
- B. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
- C. Base Sheet: ASTM D 4601/D 4601M, Type II, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet.
- D. Glass-Fiber Felts: ASTM D 2178/D 2178M, Type IV, asphalt-impregnated, glass-fiber felt.
- E. Asphalt Primer: ASTM D 41/D 41M.
- F. Roofing Asphalt: ASTM D 312/D 312M, Type III or IV.
- G. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FM Approvals' RoofNav.

2.3 INFILL AND REPLACEMENT MATERIALS

- A. Use infill materials matching existing roofing system materials unless otherwise indicated.
 - I. Infill materials are specified in [**Section 075423 "Thermoplastic-Polyolefin (TPO) Roofing"**] unless otherwise indicated.
- B. Wood blocking, curbs, and nailers are specified in [**Section 061000 "Rough Carpentry."**] or [**Section 061053 Miscellaneous Rough Carpentry."**]
- C. Fasteners: Factory-coated steel fasteners with metal or plastic plates listed in FM Approvals' RoofNav, and acceptable to new roofing system manufacturer.

2.4 AUXILIARY REROOFING MATERIALS

- A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of [**existing and**] new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - I. Protect existing roofing system that is not to be reroofed.
 - 2. Loosely lay 1-inch- (25-mm-) minimum thick, EPS insulation over existing roofing in areas not to be reroofed.

- a. Loosely lay 15/32-inch (12-mm) plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of 1 inch (25 mm).
3. Limit traffic and material storage to areas of existing roofing that have been protected.
4. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
5. Comply with requirements of existing roof system manufacturer's warranty requirements.
- B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.
- C. Shut off rooftop utilities and service piping before beginning the Work.
 - I. Immediately notify Architect of any blockages or restrictions.
- D. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.
 - I. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- E. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- F. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.
 - I. Prevent debris from entering or blocking roof drains and conductors.
 - a. Use roof-drain plugs specifically designed for this purpose.
 - b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.
 - a. Do not permit water to enter into or under existing roofing system components that are to remain.

3.2 ROOF TEAR-OFF

- A. Notify Owner each day of extent of roof tear-off proposed for that day
- B. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.
- C. Remove aggregate ballast from roofing
 - I.
- D. Full Roof Tear-off: **[Where indicated on Drawings, remove] [Remove]** existing roofing and other roofing system components down to the existing **[roof deck] [concrete fill]**.
 - I. Remove **[substrate board] [vapor retarder] [roof insulation] [and] [cover board]**.

2. Remove base flashings and counter flashings.
3. Remove perimeter edge flashing and gravel stops.
4. Remove copings.
5. Remove expansion-joint covers.
6. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
7. Remove roof drains indicated on Drawings to be removed.
8. Remove wood blocking, curbs, and nailers.
9. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry.
 - a. Remove unadhered bitumen, unadhered felts, and wet felts.
10. Remove fasteners from deck[**or cut fasteners off slightly above deck surface**].

3.3 DECK PREPARATION

- A. Inspect deck after tear-off of roofing system.
- B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect.
 - I. Do not proceed with installation until directed by Architect.
- C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect.
 - I. Do not proceed with installation until directed by Architect.

3.4 TEMPORARY ROOFING

- A. Install approved temporary roofing over area to be reroofed.
- B. Remove temporary roofing before installing new roofing.
- C. Prepare temporary roof to receive new roofing [**according to approved temporary roofing proposal**] [**by patching and repairing temporary roofing**] <Insert preparation method>.
 1. Restore temporary roofing to watertight condition.
 2. Obtain approval for temporary roof substrate from roofing manufacturer and Architect before installing new roof.

3.5 ROOF RE-COVER PREPARATION

- A. Remove blisters, ridges, buckles,[**mechanically attached roofing fastener buttons projecting above roofing,**] and other substrate irregularities from existing roofing that inhibit new recover boards from conforming to substrate.
 - I. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.

2. Scarify surface of sprayed polyurethane foam as necessary to achieve a sufficiently uniform plane to receive new recover boards.
 3. Broom clean existing substrate.
 4. Coordinate with Owner's inspector to schedule times for tests and inspections.
 5. Verify that existing substrate is dry.
 - a. Spot check substrates with an electrical capacitance moisture-detection meter.
 6. Remove materials that are wet or damp.
 - a. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
 - B. Remove blisters and areas of roofing not fully adhered.
 - C. Remove[**mechanically attached roofing fastener buttons projecting above roofing and other**] substrate irregularities that inhibit new recover boards from conforming to substrate.
 1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
 2. Clean substrate of contaminants, such as dirt, debris, oil, and grease, that can affect adhesion of coated foamed roofing.
 3. Power vacuum the existing roof surface.
 - a. If recommended by foam manufacturer, prime dried surface at recommended rate with recommended primer.
 4. Scarify surface of coated polyurethane roofing as necessary to achieve a suitable substrate for new roofing.
 5. Provide additional uplift securement for existing roofing system with new screws and plates applied to each roof zone at the following densities:
 - a. Field of roof, one fastener for each **<Insert area>**.
 - b. Corners of roof, one fastener for each **<Insert area>**.
 - c. Perimeters of roof, one fastener for each **<Insert area>**. Width of perimeter zone of roof is **<Insert dimension>**.
 6. Verify that surface is dry by pressing litmus paper to surface areas most likely to retain moisture, such as shaded areas and low spots.
 - a. If paper changes color, surface is too wet to apply foam.
 7. Build up isolated low spots on existing roofing with sprayed foam specified in Section 075700 "Coated Foamed Roofing" to prevent ponding.
- 3.6 BASE FLASHING REMOVAL
- A. Remove existing base flashings.
 1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
 - B. Do not damage metal counterflashings that are to remain.

- I. Replace metal counterflashings damaged during removal with counterflashings [**of same metal, weight or thickness, and finish as existing.**] [**specified in Section 076200 "Sheet Metal Flashing and Trim."**] [**specified in Section 077100 "Roof Specialties."**]
- C. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage.
 - I. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
- D. Remove existing parapet sheathing and replace with new parapet sheathing to comply with Section 061600 "Sheathing."
 - I. If parapet framing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
- E. When directed by Architect, replace parapet framing, wood blocking, curbs, and nailers to comply with [**Section 054000 "Cold-Formed Metal Framing."**] [**Section 061000 "Rough Carpentry."**] [**Section 061053 Miscellaneous Rough Carpentry."**]

3.7 FASTENER PULL-OUT TESTING

- A. [**Perform**] [**Retain independent testing and inspecting agency to conduct**] fastener pull-out tests according to SPRI FX-I, and submit test report to [**Architect**] [**and**] [**roofing manufacturer**] before installing new roofing system.
 - I. Obtain [**Architect's**] [**roofing manufacturer's**] approval to proceed with specified fastening pattern.
 - a. [**Architect**] [**Roofing manufacturer**] may furnish revised fastening pattern commensurate with pull-out test results.

3.8 DISPOSAL

- A. Collect demolished materials and place in containers.
 1. Promptly dispose of demolished materials.
 2. Do not allow demolished materials to accumulate on-site.
 3. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150.19

SECTION 07 11 20 - UNDER-SLAB VAPOR BARRIER

PART 1 – GENERAL

1.1 SUMMARY

- A. Products supplied under this section:
 - 1. Vapor barrier, seam tape, and mastic for installation under concrete slabs.
- B. Related sections:
 - 1. Section 03 30 00 Cast-in-Place Concrete

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 1745-09 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - 2. ASTM E 154-99 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - 3. ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials.
 - 4. ASTM F 1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
 - 5. ASTM E 1643-09 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. American Concrete Institute (ACI):
 - 1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

- A. Quality control/assurance:
 - 1. Summary of test results as per paragraph 8.3 of ASTM E 1745.
 - 2. Manufacturer's samples, literature.
 - 3. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Vapor barrier must have all of the following qualities:
 - 1. Permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with ASTM E 1745 Section 7.
 - 2. Other performance criteria:
 - a. Strength: ASTM E 1745 Class A.
 - b. Thickness: 15 mils minimum
- B. Vapor barrier products:
 - 1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 - 2. Fortifiber Moistop Ultra 15 mil
 - 3. Reef Industries Griffolyn G15
 - 4. Substitutions as per Section 01 25 00.

2.2 ACCESSORIES

- A. Seam tape:
 - I. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- B. Vapor-proofing mastic:
 - I. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Ensure that base material is approved by Architect or Geotechnical Engineer.
 - I. Level and compact base material.

3.2 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643.
 - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.
 - 2. Lap vapor barrier over footings and/or seal to foundation walls.
 - 3. Overlap joints 6 inches min. and seal with manufacturer's tape.
 - 4. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
 - 6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

END OF SECTION 07 11 20

SECTION 07 21 00 - CONTINUOUS INSULATION SPECIFICATION

PART I – GENERAL

I.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

I.02 SUMMARY

- A. Definitions:

- 1. Continuous Insulation (CI) is defined by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) as insulation that is uncompressed and continuous across all structural members without thermal bridges other than fasteners and service openings and is installed on the interior or exterior or is integral to any opaque surface of the building envelope.

- B. Section Includes:

- 1. Exterior installation and performance of CI rigid insulation panels.

- C. Related Sections:

- 1. Division 03 – Concrete: Cast-In-Place Concrete
 - 2. Division 05 – Metals: Cold-Formed Metal Framing
 - 3. Division 06 – Wood, Plastics, and Composites: Sheathing
 - 4. Division 07 – Thermal and Moisture Protection: Fluid-Applied Membrane Air Barriers
 - 5. Division 07 – Aluminum Composite Material Panel System
 - 6. Division 07 – Thermal and Moisture Protection: Sheet Metal Flashing and Trim
 - 7. Division 08 – Openings: Aluminum Windows
 - 8. Division 08 – Openings: Glazing
 - 9. Division 08 – Openings: Glazed Aluminum Curtain Walls

I.03 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed have either been identified by the

International Building Code (IBC) or local building code or are specific requirements for this building construction type.

B. International Energy Conservation Code (IECC)

C. National Fire Protection Association (NFPA):

1. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

I.04 DESCRIPTION

A. Performance Requirements:

1. Provide installed CI rigid insulation panels designed to withstand project-specific design loads while maintaining Deflection and Thermal Movement and Fire Performance without defects, damage, or failure as defined by the Manufacturer and required by this section. Fasteners must satisfy the thermal bridge requirements of ASHRAE 90.1.

B. Deflection and Thermal Movement: Provide installed CI rigid insulation panels that have been designed to resist project-specific wind loads, acting both inward and outward:

1. Panel Deflection: Deflection of the panel face shall not exceed $L/120$ normal to plane of the wall, where L is the unsupported span of the panel between load transfer locations.
2. Thermal Movements: Allow for free and noiseless horizontal and vertical thermal movement due to expansion and contraction of plywood sheathing over a temperature range of -20°F to +180°F at the panel surface.
 - a. Buckling, undue stress on fasteners, or any other detrimental effects of thermal movement are not permitted.
 - b. Installation procedures shall take into account the ambient temperature range at the time of the respective operation.

C. Fire Performance: Wall assemblies containing CI rigid insulation panels shall meet the requirements of NFPA 285 using the Intermediate-Scale Multi-Story Test Apparatus (ISMA), where required by code based on the design of this project.

I.05 SUBMITTALS

A. General: Provide submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section as follows:

B. Product Data: Submit material descriptions, dimensions of individual components, and profiles for each type of CI Panel.

C. Samples:

- I. Submit 6 inches x 6 inches, or size as required, demonstrating CI Panel construction. Samples to be provided in thickness specified.

D. Quality Assurance Submittals:

- I. CI Panel Material Certification: Submit an official written statement from the Manufacturer documenting that product raw materials meet specified standards. Certification shall be backed by test reports and/or material certificates.
2. CI Panel Certification: Submit an official written statement from the Manufacturer documenting that the CI rigid insulation panels comply with specified Performance Requirements and Testing Performance sections indicated in this specification. Certification shall be backed by test reports.

E. Closeout Submittals:

- I. Warranty: Submit Manufacturer and Installer warranty documents as specified within the Warranty section of this specification.

I.06 QUALITY ASSURANCE

A. Qualifications:

- I. Manufacturer Qualifications: Company with a minimum of 15 years of continuous experience manufacturing CI rigid insulation panels in the United States of America of the type specified:
 - a. Able to provide a list of other projects of similar size including approximate date of installation for each.
2. Installer Qualifications:
 - a. The Installer shall have:
 - i. Been in business of a similar trade and under the present company name for at least five (5) years prior to the start of this project, and
 - ii. Experience with similar sized sheathing installations, and
 - iii. Completed at least ten (10) successful sheathing installations within the last three (3) years
 - I) Acceptable, varying combinations of successful sheathing installations and/or years of experience shall be determined at the discretion of the Manufacturer.
 - b. The Installer must be capable of providing field service representation during installation.

- B. Regulatory Code Agencies Requirements: Provide CI rigid insulation panels that have been evaluated and/or are in compliance with the following, where required:
 - 1. International Code Council (ICC)
 - 2. International Energy Conservation Code (IECC)
 - 3. ASHRAE
- C. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, and Manufacturer's installation details.

I.07 DELIVERY AND STORAGE

- A. Upon receipt, perform visual inspection of CI rigid insulation panels and inventory to identify any damages that may have occurred during shipping or any missing panels.
- B. Storage:
 - 1. Store CI rigid insulation panels horizontally on pallets in a dry, well-ventilated environment under the protection of a temporary or permanent structure. If required to be stored in an exterior area, CI rigid insulation panels must be placed under a well-ventilated, waterproof covering.
 - 2. Store CI rigid insulation panels a minimum of 4" above ground level to avoid contact with standing moisture (e.g. water, snow, etc.).
 - 3. Store CI rigid insulation panels in an area protected from other construction activities and associated debris.
 - 4. Storage temperatures are not to exceed 120°F. Protect CI rigid insulation panels from moisture and direct sunlight while on the job-site.
 - 5. Do not stack more than 1500 pounds of CI rigid insulation panels on one pallet. Other materials shall not be stacked on, or placed in contact with, CI rigid insulation panels to prevent staining, denting, or other damages.

I.08 PROJECT CONDITIONS

- A. Substrate Requirements: Exterior wall assembly, including exterior sheathing, with appropriate fire rating in place prior to CI rigid insulation panels.
- B. Field Measurements: Verify locations of wall framing members and wall opening dimensions by field measurements prior to the installation of the CI rigid insulation panels. Field measurements to be taken once all substrate materials and adjacent materials are installed.
 - 1. Verify spacing of wall framing members meets Manufacturer's requirements.

2. Notify General Contractor and Architect of spacing discrepancies.
- C. Substrate Tolerances: The General Contractor is responsible for providing an acceptable substrate per Manufacturer's requirements including:
 1. Adjacent substrate faces out-of-plane offset: +/- 1/8 inch, and
 2. Level, plumb, and location control lines as indicated: 1/4 inch in any 20 feet, and
 3. Any building elevation direction deviation: +/- 1/2 inch

I.09 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Material Warranty: Submit, to the Owner, the Manufacturer's standard warranty.
 - I. Warranty Period:
 - a. Material and Product Integrity: Thirty (30) days against plywood delamination due to manufacturing defects. Checking, leafing, splitting, and broken grain shall be excluded.
 - b. Thermal Performance: Fifteen (15) years against loss of thermal resistance greater than twenty (20) percent from published R-Value at 75 °F in accordance with ASTM C518.
- C. Installation Warranty: Installer shall submit to the Owner a standard warranty document executed by an authorized company official. The warranty shall be in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.
 - I. Warranty Period:
 - a. Workmanship: One (1) year warranty period commencing on Date of Substantial Completion.

PART 2 – PRODUCTS

2.01 CI PANEL MANUFACTURERS

- A. CI Panel Manufacturers:
 1. Omega CI by Laminators Inc. – www.laminatorsinc.com
 2. **Other CI Panel manufacturer who meets the requirements of this specification**

2.02 BOARD INSULATION

A. CI Panel Description

1. Construction:

- a. A closed cell foam plastic core bonded on both sides to a coated glass facer with an additional fire-treated plywood layer on one side.

2. Thickness: 2.1 inches (nom), typ.

3. Foam Core: Polyisocyanurate (ISO), Type II, Class 2, Grade 3

4. Fire-Treated Plywood Thickness: 5/8 inch

5. Product:

- a. On Types I, II, III, and IV Construction to any height above grade in accordance with the provisions of IBC Sections 2603.5.1 through 2603.5.7.

6. Testing Performance:

- a. ASTM C209: Water absorption of the foam core less than 0.1% by volume.
- b. ASTM C518: Thickness / R-Value of the panel of 2.1 inches / R-9.6 hr °F ft² / BTU
- c. ASTM D1621: Compressive strength of the foam core rating of Grade 3 (25 psi minimum).
- d. ASTM D2126: Dimensional stability of the foam core measured at 2% (lineal change) when tested at 7 days.
- e. ASTM D3273: Resistance to mold of the foam core passes (10).
- f. ASTM E84: Flame Spread Index (FSI) of the foam core of 20 and Smoke Developed Index (SDI) of the foam core of 250.
- g. ASTM E96: Moisture vapor permeance of the foam core less than 1.2 perms (Class III).

B. Panel Fasteners

1. Type: As required by Manufacturer.

2.03 RELATED MATERIALS

- A. General: Refer to Related Sections specified herein for other materials, including concrete, masonry, framing, sheathing, barriers, flashing and trim, windows, glazing, and/or curtain walls.

PART 3 – EXECUTION

3.01 INSTALLER INSTRUCTIONS

- A. Compliance: Comply with Manufacturer's product data, including, but not limited to, installation guides, design details, product technical bulletins, supplemental technical instructions, and any other product packaging instructions.

3.02 PREPARATION

- A. Site Verification of Conditions: Verify that conditions of substrate previously installed under other sections are acceptable for the CI rigid insulation panels installation. Documentation should be provided indicating any conditions detrimental to the performance of the CI rigid insulation panels.

3.03 INSTALLATION

A. Panel Installation:

I. Handling:

- a. Handle CI rigid insulation panels with work gloves to avoid hand injury from any plywood edges and to prevent potential irritation from the polyisocyanurate core.
- b. When removing individual CI rigid insulation panels from stacks, always lift one panel completely off the next to prevent localized surface gouges or crushing of the polyisocyanurate core.
- 2. Install the CI rigid insulation panels plumb, level, and true in accordance with Manufacturer's requirements.
- 3. Do not over-tighten fasteners along panel perimeter.
- 4. Cleanly trim CI rigid insulation panels to fit. Insulate any miscellaneous gaps and voids.
 - a. Fit insulation tight to fenestrations and service openings, and match depth of CI rigid insulation panels.
- 5. Protect CI Panel edges from direct exposure to water and maintain dry conditions at all times. Any wet conditions shall be allowed to completely dry prior to the application of the air and water barrier (AWB).
- 6. Install AWB over CI rigid insulation panels as specified in Section 072726.
- 7. Installation Tolerances:
 - a. Adjacent vertical or horizontal panel out-of-plane offset: +/- 1/8 inch
 - b. Vertical or horizontal joint width: +/- 1/16 inch
 - c. Maximum vertical or horizontal joint intersection deviation: 1/4 inch in any 20 feet

8. Do not cut or trim CI rigid insulation panels during installation in a manner which would damage the surface, decrease strength, or result in a failure in performance.
- B. Related Products Installation Requirements: Refer to other sections in Related Sections for installation of related products.

3.04 REMEDIATION

A. Remediation:

1. Remove and replace CI rigid insulation panels damaged as a direct result of activities in the Panel Installation section.
2. Panel Installation completion shall be agreed-upon between the Installer and the General Contractor.
3. Following Panel Installation completion, any determination of replacement of CI rigid insulation panels is at the discretion of the Architect. Such replacement shall become the responsibility of the General Contractor.
4. Removal and replacement of CI rigid insulation panels damaged by other trades shall be the responsibility of the General Contractor.
5. If required after Panel Installation, any additional protection of the CI rigid insulation panels shall be the responsibility of the General Contractor.
6. Remove from project site damaged CI rigid insulation panels and other debris attributable to work of this section.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board.
 - 2. Glass-fiber blanket.
 - 3. Spray-Applied Cellulosic Insulation
- B. Related Requirements:
 - 1. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.
 - 2. Section 075423 "TPO" includes requirements for insulation below TPO at roof.

I.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

I.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

I.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.
- B. Extruded Polystyrene Board, Type X – For Above Grade Cavity Walls: ASTM C 578, Type X, **15-psi (104-kPa)** minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [DiversiFoam Products.](#)
 - b. [Dow Chemical Company \(The\).](#)
 - c. [Owens Corning.](#)
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- C. Extruded Polystyrene Board, Type IV- for below grade foundation walls and under concrete slabs. ASTM C 578, Type IV, **25-psi (173-kPa)** minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [DiversiFoam Products.](#)
 - b. [Dow Chemical Company \(The\).](#)
 - c. [Owens Corning.](#)
 - d. [Pactiv Corporation.](#)
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS-FIBER BLANKET

- A. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
 - 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - 2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.
- B. Glass-Fiber Blanket, Unfaced – where designated.: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

- a. [CertainTeed Corporation.](#)
 - b. [Guardian Building Products, Inc.](#)
 - c. [Johns Manville; a Berkshire Hathaway company.](#)
 - d. [Knauf Insulation.](#)
 - e. [Owens Corning.](#)
- C. Glass-Fiber Blanket, Foil Faced – where designated: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category I (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
- I. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [CertainTeed Corporation.](#)
 - b. [Guardian Building Products, Inc.](#)
 - c. [Johns Manville; a Berkshire Hathaway company.](#)
 - d. [Knauf Insulation.](#)
 - e. [Owens Corning.](#)

2.3 SPRAY-APPLIED CELLULOSIC INSULATION

- A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), chemically treated for flame-resistance, processing, and handling characteristics.
- I. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [Central Fiber LLC.](#)
 - b. [GreenFiber.](#)
 - c. [Hamilton Manufacturing Inc.](#)
 - d. [International Cellulose Corp.](#)
 - e. [Nu-Wool Co., Inc.](#)

2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
- I. **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. [AGM Industries, Inc.](#)
 - b. [Gemco.](#)
 2. Plate: Perforated, galvanized carbon-steel sheet, **0.030 inch (0.762 mm)** thick by **2 inches (50 mm)** square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; **0.105 inch (2.67 mm)** in diameter; length to suit depth of insulation.

- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place for spandrel glass insulation conditions.
- I. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Gemco.
 2. Angle: Formed from **0.030-inch- (0.762-mm-)** thick, perforated, galvanized carbon-steel sheet with each leg **2 inches (50 mm)** square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; **0.105 inch (2.67 mm)** in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from **0.016-inch- (0.41-mm-)** thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than **1-1/2 inches (38 mm)** square or in diameter.
- I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
- I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.

2.5 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
 2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- C. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - I. If not otherwise indicated, extend insulation a minimum of **24 inches (610 mm)** below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - I. If not otherwise indicated, extend insulation a minimum of **24 inches (610 mm)** in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - I. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 2. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.

3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately **24 inches (610 mm)** o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain **3-inch (76-mm)** clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. For metal-framed wall cavities where cavity heights exceed **96 inches (2438 mm)**, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward interior of construction.
 - b. Interior Walls: Set units with facing placed toward areas of high humidity
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately **2.5 lb/cu. ft. (40 kg/cu. m)**.
 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
- C. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
 - 1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
 - 2. Install insulation to fit snugly without bowing.

3.8 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes fluid-applied, vapor-permeable membrane air barriers.
- B. Related Requirements:
 - 1. Section 06 16 00 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

I.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

I.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

I.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 2. Include details of interfaces with other materials that form part of air barrier.

I.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

I.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 according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

I.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

I.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

I.10 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum **0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa)**, when tested according to ASTM E 283.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.
 - I. Elastomeric, Modified Bituminous Membrane:
 - a. **Products:** Subject to compliance with requirements, provide one of the following:
 - 1) **Henry Company; Air-Bloc 17MR.**
 - 2) **Hohmann & Barnard, Inc;** Textroflash Liquid VP.
 - 3) **Tremco Incorporated;** ExoAir 220R.
 - 4) W.R. Meadows, Inc.; Air-Shield, LMP
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum **0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa)** pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum **10 perms (580 ng/Pa x s x sq. m)**; ASTM E 96/E 96M.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
 - d. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Primer: Liquid solvent-borne primer recommended for substrate by air-barrier material manufacturer.
- C. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
- D. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- E. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- F. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, **0.0250 inch (0.64 mm)** thick, and Series 300 stainless-steel fasteners.

- G. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft (24- to 32-kg/cu. m) density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- H. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil-(0.43-mm-)thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance value of 37 perms (2145 ng/Pa x s x sq. m).
- I. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
- J. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."
- K. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - I. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of **3 inches (75 mm)** along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

3.4 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - I. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply adhesive-coated transition strip so that a minimum of **3 inches (75 mm)** of coverage is achieved over each substrate. Maintain **3 inches (75 mm)** of full contact over firm bearing to perimeter frames with not less than **1 inch (25 mm)** of full contact.
 - 1. Adhesive-Coated Transition Strip: Roll firmly to enhance adhesion.
 - 2. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil (1.0-mm) dry film thickness, applied in one or more equal coats.
- C. Apply strip and transition strip a minimum of 1 inch (25 mm) onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches (75 mm) onto each surface according to air-barrier manufacturer's written instructions.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Continuous structural support of air-barrier 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. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Strips and transition strips have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests: As determined by Owner's testing agency from among the following tests:

1. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of **30 lbf/sq. in. (207 kPa)** according to ASTM D 4541 for each **600 sq. ft. (56 sq. m)** of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 07 27 26

SECTION 07 42 13.23 - ALUMINUM COMPOSITE MATERIAL (ACM) SYSTEM SPECIFICATION

PART I – GENERAL

I.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

I.02 SUMMARY

A. Definitions:

- 1. An Aluminum Composite Material (ACM) Panel System includes ACM panels, joints, attachment system components and miscellaneous materials as appropriate for the design of the project to provide a weather-resistant exterior veneer system.
- 2. A “Shop-Fabricated” ACM Panel System is designed with components that permit the complete fabrication in the shop and the subsequent installation of the system in the field.

B. Section Includes:

- 1. Exterior installation and performance of ACM panels and ACM Panel System components.

C. Related Sections:

- 1. Division 03 – Concrete: Cast-In-Place Concrete
- 2. Division 04 – Masonry: Unit Masonry
- 3. Division 05 – Metals: Cold-Formed Metal Framing
- 4. Division 05 – Metals: Structural Aluminum Framing
- 5. Division 06 – Wood, Plastics, and Composites: Sheathing
- 6. Division 07 – Thermal and Moisture Protection: Continuous Insulation on ACM
- 7. Division 07 – Thermal and Moisture Protection: Fluid-Applied Membrane Air Barriers
- 8. Division 07 – Thermal and Moisture Protection: Sheet Metal Flashing and Trim
- 9. Division 07 – Thermal and Moisture Protection: Joint Sealants
- 10. Division 08 – Openings: Aluminum Windows

11. Division 08 – Openings: Glazing

12. Division 08 – Openings: Glazed Aluminum Curtain Walls

I.03 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed have either been identified by the International Building Code (IBC) or local building code or are specific requirements for this building construction type.
- B. Aluminum Association (AA):
 - 1. Aluminum Design Manual (ADM)
 - 2. AA-M12C23A31: Anodized – Clear Coating
 - 3. AA-M12C23A34: Anodized – Color Coating
- C. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 501.1 Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
 - 2. AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems
 - 3. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
- D. ASTM International:
 - 1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 3. ASTM C920 Standard Specification for Elastomeric Joint Sealants
 - 4. ASTM C1193 Standard Guide for Use of Joint Sealants
 - 5. ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
 - 6. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials

7. ASTM E283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
8. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls By Uniform Static Air Pressure Difference

E. National Fire Protection Association (NFPA):

- I. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

I.04 SYSTEM DESCRIPTION

A. Performance Requirements:

- I. Provide installed ACM Panel System designed to withstand project-specific design loads while maintaining System Requirements; Deflection and Thermal Movement; and Fire Performance without defects, damage, or failure as defined by the [Manufacturer] [Fabricator] and required by this section.

B. System Requirements:

I. Wet Seal System

- a. ASTM E283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen – Air flow measurement across the ACM Panel System (excluding jamb conditions) shall not be more than 0.06 cfm per sf of wall area when tested to a pressure difference of 6.24 psf.
- b. ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls By Uniform Static Air Pressure Difference – ACM Panel System must be engineered to meet the project-specific design loads for strength and serviceability requirements. In addition, the ACM Panel System must meet or exceed the Deflection and Thermal Movement criteria when tested to a minimum pressure of 40.0 psf.
- c. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls By Uniform Static Air Pressure Difference – Water penetration across the ACM Panel System shall not occur when tested to a pressure difference of 12.0 psf.

2. Pressure-Equalized Rainscreen (PER) System

- a. AAMA 508 Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems
 - i. ASTM E283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen – The air flow measurement across the ACM Panel System

(excluding jamb conditions) shall not be more than 0.12 cfm per sf of wall area when tested to a pressure difference of 1.57 psf.

- ii. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls By Uniform Static Air Pressure Difference – When tested to a pressure difference of 6.24 psf:
 - 1) All water that penetrates the exterior rainscreen cladding, including condensation, shall be controlled and drained to the exterior.
 - 2) Water mist or droplets that contact(s) the air/water barrier shall not exceed 5% of the surface.
 - 3) There shall not be any continuous streaming of water on the air/water barrier surface.
- iii. AAMA 501.1 Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure – When tested to a pressure difference of 6.24 psf:
 - 1) All water that penetrates the exterior rainscreen cladding, including condensation, shall be controlled and drained to the exterior.
 - 2) Water mist or droplets that contact(s) the air/water barrier shall not exceed 5% of the surface.
 - 3) There shall not be any continuous streaming of water on the air/water barrier surface.
- iv. ASTM E1233 Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Cyclic Air Pressure Differential – When tested from a positive pressure loading of 5 psf to 25 psf to 5 psf based on a maximum average of 100 three-second cycles:
 - 1) The lag between the cavity and cyclic wind pressure shall not exceed 0.08 seconds.
 - 2) The maximum differential between the cavity and cyclic wind pressure shall not exceed 50% of the maximum test pressure.

C. Deflection and Thermal Movement: Provide installed ACM Panel System that has been designed to resist project-specific wind loads, acting both inward and outward:

- 1. Perimeter Framing Deflection: Deflection of the panel perimeter framing member shall not exceed $L/175$ normal to plane of the wall, where L is the unsupported span of the perimeter framing member between fastener locations.
- 2. Panel Deflection: Deflection of the panel face shall not exceed $L/60$ normal to plane of the wall, where L is the unsupported span of the panel between load transfer locations.

3. At 150% pressure, no permanent deformation exceeding L/1000 or failure to structural members is permitted.
4. Thermal Movements: Allow for free and noiseless horizontal and vertical thermal movement due to expansion and contraction of component parts over a temperature range of -20°F to +180°F at the material surface.
 - a. Buckling, opening of joints, undue stress on fasteners, failure of sealants, or any other detrimental effects of thermal movement are not permitted.
 - b. Field-fabrication and installation procedures shall take into account the ambient temperature range at the time of the respective operation.
- D. Fire Performance: Wall assemblies containing ACM Panel System shall meet the requirements of NFPA 285 using the Intermediate-Scale Multi-Story Test Apparatus (ISMA), where required by code based on the design of this project.

I.05 SUBMITTALS

- A. General: Provide submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section as follows:
- B. Product Data: Submit material descriptions, dimensions of individual components and profiles, and finishes for each type of ACM Panel System.
- C. ACM Panel System:
 1. Submit system-specific design details including, but not limited to, ACM panel, clip, extrusion, stiffener, adhesive, fastener, and sealant components.
 2. Submit design data including, but not limited to, material properties, section properties, and capacities for each ACM Panel System component. Design data shall be supported by a qualified Design Professional licensed in the state of primary research and development, design, and manufacturing of the ACM Panel System.
 3. Submit system-specific installation guide information.
 4. Submit Shop Drawings indicating, but not limited to, elevations and reflected ceiling plans with joint locations and panel sizes; sections with thicknesses and dimensions of components; edge conditions; interfaces with dissimilar materials; corners and transitions; flashings, trims, venting, fasteners, sealants, caulks, and adhesives; accessories; and/or colors.
- D. Samples:
 1. Selected Samples: Submit Manufacturer's color charts or chips illustrating full range of colors, finishes, patterns, and textures available for ACM panels with factory-applied finishes. Custom color

selection requires color sample to be submitted for approval. Approval signature(s) are required by **[Architect]**.

2. Verification Samples:

- a. ACM Panel System assembly: Submit 12 inches x 12 inches, or size as required, demonstrating system assembly. Samples to be provided in thickness specified, including ACM panel, molding, clip, adhesive, fastener, and sealant components. Sample need not be provided in the specified color.
- b. Submit two samples of each color or finish selected that measure approximately 3 inches x 4 inches, minimum.

E. Quality Assurance Submittals:

1. ACM Panel System Certification: Submit an official written statement from the Manufacturer documenting that the ACM Panel System complies with specified Performance Requirements indicated in this specification. Certification shall be backed by test reports.

F. Closeout Submittals:

1. Warranty: Submit Manufacturer and Installer warranty documents as specified within the Warranty section of this specification.
2. Maintenance: Submit Manufacturer's recommendations document for Cleaning and Maintenance of the ACM Panel System.

I.06 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Company with a minimum of 20 years of continuous experience manufacturing ACM panels in the United States of America of the type specified:
 - a. Able to provide specified warranty on finish.
 - b. Able to provide a list of other projects of similar size including approximate date of installation for each.
2. Fabricator Qualifications:
 - a. The Fabricator shall have:
 - i. Been in business of a similar trade and under the present company name for at least five (5) years prior to the start of this project, and

- ii. Experience with similar sized ACM Panel System projects, and
 - iii. Fabricated at least three (3) successful projects of the specified ACM Panel System within the last five (5) years
 - 1) Acceptable, varying combinations of successful projects and/or years of experience shall be determined at the discretion of the Manufacturer.
 - b. The Fabricator must be capable of providing field service representation during installation.
3. Installer Qualifications:
- a. The Installer shall have:
 - i. Been in business of a similar trade and under the present company name for at least five (5) years prior to the start of this project, and
 - ii. Experience with similar sized ACM Panel System projects, and
 - iii. Installed at least three (3) successful projects of the specified ACM Panel System within the last five (5) years
 - 1) Acceptable, varying combinations of successful projects and/or years of experience shall be determined at the discretion of the **[Manufacturer]** **[Fabricator]**.
 - b. The Installer must be capable of providing field service representation during installation.
- B. Regulatory Code Agencies Requirements: Provide ACM Panel System that has been evaluated and is in compliance with the following, where required:
- I. International Code Council (ICC)
- C. Mock-Ups: Install a mock-up at the project jobsite using acceptable products and **[Manufacturer]** **[Fabricator]**-approved details. Obtain **[Architect's]** acceptance of finish color (drawdown samples to be used for color approval of nonstandard coil coated colors), texture and pattern, and workmanship standard. Comply with Division 01 Quality Control, Mock-Up Requirements Section.
- 1. Mock-Up Size: Provide as detailed in the construction documents if a stand-alone Mock-Up is required.
 - 2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
 - 3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.
 - 4. Additional Cost: Material required for custom color mock-ups may require special small quantity runs that increase cost and require additional time to obtain material.

- D. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, and system [**Manufacturer's**] [**Fabricator's**] installation details.

I.07 DELIVERY AND STORAGE

- A. Upon receipt, perform visual inspection of ACM panels and inventory to identify any damages that may have occurred during shipping or any missing panels.
- B. Storage:
 - 1. Store ACM panels horizontally on pallets in a dry, well-ventilated environment under the protection of a temporary or permanent structure. If required to be stored in an exterior area, ACM panels must be placed under a well-ventilated, waterproof covering.
 - 2. Store ACM panels a minimum of 4" above ground level to avoid contact with standing moisture (e.g. water, snow, etc.).
 - 3. Store ACM panels in an area protected from other construction activities and associated debris.
 - 4. Storage temperatures are not to exceed 120°F. Protect ACM panels from moisture and direct sunlight while on the job-site.
 - 5. Do not stack more than 1500 pounds of ACM panels on one pallet. Other materials shall not be stacked on, or placed in contact with, ACM panels to prevent staining, denting, or other damages.

I.08 PROJECT CONDITIONS

- A. Substrate Tolerances: The General Contractor is responsible for providing an acceptable substrate per [**Manufacturer's**] [**Fabricator's**] requirements including:
 - 1. Adjacent substrate faces out-of-plane offset: +/- 1/8 inch, and
 - 2. Level, plumb, and location control lines as indicated: 1/4 inch in any 20 feet, and
 - 3. Any building elevation direction deviation: +/- 1/2 inch
- B. Field Measurements: Verify locations of wall framing members and wall opening dimensions by field measurements prior to the shop-fabrication of the ACM Panel System. Field measurements to be taken once all substrate materials and adjacent materials are installed.

I.09 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. ACM Manufacturer's Material Warranty: Submit, to the Owner, the Manufacturer's standard warranty.

I. Warranty Period:

- a. Material and Product Integrity: Five (5) years against delamination at any manufactured bond line
- b. Coil-Coated PVDF/Kynar 500 Painted Finish: Thirty (30) years against:
 - i. Chalking in excess of a numerical rating of eight (8) when measured in accordance with ASTM D4214, Method A
 - ii. Fading or change color in excess of five (5) E units (NBS) when calculated in accordance with ASTM D2244, paragraph 6.3
 - iii. Cracking, chipping, splitting, blistering, peeling, or loss of adhesion. Minute fracturing (i.e. crazing or cracking) as a result of routing and bending of the ACM panels shall be excluded.
- c. Spray-Applied PVDF/Kynar 500 Painted Finish: Five to Twenty (5-20) years against:
 - i. Chalking in excess of a numerical rating of eight (8) when measured in accordance with ASTM D4214, Method A
 - ii. Fading or change color in excess of five (5) E units (NBS) when calculated in accordance with ASTM D2244, paragraph 6.3
 - iii. Cracking, chipping, splitting, blistering, peeling, or loss of adhesion. Minute fracturing (i.e. crazing or cracking) as a result of routing and bending of the ACM panels shall be excluded.
- d. Polyester Painted Finish: Ten (10) years against:
 - i. Chalking in excess of a numerical rating of eight (8) when measured in accordance with ASTM D4214, Method A
 - ii. Fading or change color in excess of five (5) E units (NBS) when calculated in accordance with ASTM D2244, paragraph 6.3
 - iii. Cracking, chipping, splitting, blistering, peeling, or loss of adhesion. Minute fracturing (i.e. crazing or cracking) as a result of routing and bending of the ACM panels shall be excluded.
- e. Anodized Aluminum Finish:
 - i. Ten (10) years against fading or change color in excess of six (6) E units (NBS) when calculated in accordance with ASTM D2244, paragraph 6.3

- ii. Twenty (20) years against cracking, chipping, splitting, blistering, peeling, or loss of adhesion. Minute fracturing (i.e. crazing or cracking) as a result of routing and bending of the ACM panels shall be excluded.
- C. Shop-Fabrication Warranty: Fabricator shall submit to the Owner a standard warranty document executed by an authorized company official. The warranty shall be in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.
 - I. Warranty Period:
 - a. Workmanship: One (1) year warranty period commencing on Date of Substantial Completion.
- D. Installation Warranty: Installer shall submit to the Owner a standard warranty document executed by an authorized company official. The warranty shall be in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.
 - I. Warranty Period:
 - a. Workmanship: One (1) year warranty period commencing on Date of Substantial Completion.

PART 2 – PRODUCTS

2.01 ACM MANUFACTURERS AND SHOP-FABRICATED ACM PANEL SYSTEM SUPPLIERS

- A. ACM Manufacturers:
 - 1. Omega-Lite panels manufactured by Laminators Inc. – www.laminatorsinc.com
 - 2. Other ACM manufacturer who meets the requirements of this specification
- B. Shop-Fabricated ACM Panel System Suppliers:
 - 1. Laminators Inc. – www.laminatorsinc.com
 - 2. Other Field-Fabricated ACM Panel System supplier who meets the requirements of this specification

2.02 ALUMINUM COMPOSITE MATERIAL (ACM)

- A. ACM Panel Description
 - I. Construction:
 - a. Two sheets of aluminum bonded to a core of extruded thermoplastic manufactured in a laminated batch (i.e. discontinuous) process using adhesive(s) between dissimilar materials. The core material shall not contain foam plastic insulation.

2. Thickness: 0.236 inch (6 mm)
3. Sheets:
 - a. Face Thickness: 0.020 inch nominal or thicker
 - b. Backer Thickness: 0.0125 inch nominal or thicker
 - c. Combined Minimum Thickness: 0.0365 inch nominal (Face + Backer)
4. Product:
 - a. On Types I, II, III, and IV Construction to any height above grade in accordance with the provisions of IBC Section 1407.10.
5. Fire Performance: Class A Material
 - a. ASTM E84: ACM panels shall have a Flame Spread Index (FSI) of not more than 25 when tested in the maximum thickness intended for use.
 - b. ASTM E84: ACM panels shall have a Smoke Developed Index (SDI) of not more than 450 when tested in the maximum thickness intended for use.
6. Bond Integrity:
 - a. ASTM D1781 Climbing Drum Peel Strength: 22.5 in-lb/in minimum as manufactured
 - b. Chemically-bonded to the core material in a laminated batch process

2.03 FINISH

- A. Exterior Finish: Finish shall meet the performance criteria of AAMA 2605.
 - I. Standard and Standard Metallic Finishes:
 - a. Selected from a Manufacturer's standard color chart – **dark bronze**
- B. Exterior Finish: Finish shall meet the performance criteria of the AA.
 - I. Anodized:
 - a. Clear Coating: AA-M12C23A31 Architectural Class
 - b. Color Coating: AA-M12C23A34 Architectural Class

2.04 SYSTEM COMPONENTS

- A. General: Provide Manufacturer's standard ACM Panel System-specific components, including, but not limited to, mountings, adhesives, connections, and fasteners for specific applications indicated on contract documents.

2.05 RELATED MATERIALS

- A. General: Refer to Related Sections specified herein for other materials, including concrete, masonry, framing, sheathing, barriers, flashing and trim, sealants, windows, glazing, and/or curtain walls.

2.06 SHOP-FABRICATION

A. General:

- 1. Fabricate panels to sizes and joint configurations indicated on approved Shop Drawings based on an assumed design temperature of 70°F. Allow for ambient temperature range at time of fabrication.
- 2. Fabricate panels with sharply cut edges and no displacement of face or backer sheets or protrusion of core. Form panel angles, breaks, corners, lines, and returns to be sharp, true, and free of buckle and/or warp.

B. Fabrication Tolerances:

- 1. Width: +/- 1/16- inch @ 70°F
- 2. Length: +/- 1/16 inch @ 70°F
- 3. Squareness: +/- 1/16 inch @ 70°F

C. System Type:

- 1. A wet seal system shall provide caulked panel joints and a means for water to drain to the exterior face in order to address any leakage at joints and/or condensation that may occur within the drainage cavity. The system shall be tested per AAMA 501.I. The sealant type shall be as specified in Section 079200; in conformance with Manufacturer's recommendations; and combined with foam type backer rod, as indicated on architectural drawings.
- 2. A Pressure-Equalized Rainscreen (PER) system shall allow air to quickly pass through panel joints while minimizing and controlling water infiltration at the air/water barrier. The system must be properly compartmentalized to prevent internal cavity air from moving between different pressure zones of the building surfaces. The system shall be tested per AAMA 508.

D. System Components:

- 1. Panel perimeter components shall be extruded or formed aluminum as indicated on system-specific design details to meet the Performance Requirements according to the **[Manufacturer's]**

[**Fabricator's**] design. Galvanized cold-formed steel clips or staggered aluminum angles are not acceptable for panel to panel attachment.

PART 3 – EXECUTION

3.01 INSTALLER INSTRUCTIONS

- A. Compliance: Comply with Manufacturer's product data, including, but not limited to, installation guides, design details, product technical bulletins, supplemental technical instructions, and any other product packaging instructions.

3.02 PREPARATION

- A. Site Verification of Conditions: Verify that conditions of substrate previously installed under other sections are acceptable for the ACM Panel System installation. Documentation should be provided to the Architect & **General Contractor** indicating any conditions detrimental to the performance of the ACM Panel System.
- B. Field measurements of site conditions shall be verified with approved Shop Drawings prior to beginning of installation. Notification of any product modifications and resulting schedule adjustment shall be documented to the [**Architect & General Contractor**].

3.03 INSTALLATION

- A. General:

- I. Handling:

- a. Protective masking should be left on the field of each ACM panel during installation to minimize potential damages from construction activities. Note that all masking must be removed within 2 weeks of installation.
 - b. Handle ACM panels with clean work gloves to avoid hand injury from any sharp edges and to prevent staining of surfaces with contaminants.
 - c. Glazing suction cups are recommended to handle ACM panels whenever possible.
 - 2. Install the ACM Panel System plumb, level, and true in accordance with [**Manufacturer's**] [**Fabricator's**] Installation Requirements and approved Shop Drawings.
 - 3. Comply with [**Manufacturer's**] [**Fabricator's**] instructions for installation of concealed fasteners; provisions of Section 079200; and recommendations for installation of joint sealants.
 - 4. Panel stiffeners shall be extruded or formed aluminum or cold-formed steel as indicated on system-specific design details to meet the Performance Requirements according to the [**Manufacturer's**] [**Fabricator's**] design. Unless required during shop-fabrication, stiffeners shall be mechanically

fastened to the substrate and secured to the rear face of ACM panels with adhesive of sufficient size and strength.

5. Installation Tolerances:

- a. Adjacent vertical or horizontal panel out-of-plane offset: +/- 1/16 inch
- b. Vertical or horizontal joint width: +/- 1/16 inch
- c. Adjacent vertical or horizontal panel edge alignment: +/- 1/16 inch
- d. Adjacent vertical or horizontal joint deviation: +/- 1/16 inch
- e. Maximum vertical or horizontal joint deviation: 1/4 inch in any 20 feet

- 6. Do not cut, trim, weld, or braze ACM Panel System-specific components during installation in a manner which would damage the finish, decrease strength, or result in visual imperfection or a failure in performance.
- 7. Separate contact of dissimilar metals with approved methods as defined by the **[Manufacturer]** **[Fabricator]** in order to eliminate the possibility of corrosive or electrolytic action between metals.

- B. Related Products Installation Requirements: Refer to other sections in Related Sections for installation of related products.

3.04 FIELD QUALITY REQUIREMENTS

- A. Field Quality Control: When required, mock-up shall be constructed and tested at the direction of the **[Owner]** **[Architect]** **[General Contractor]**. Water-spray testing on the mock-up of the ACM Panel System shall be in accordance with AAMA 501.2.
- B. Testing Agency: If required, the **[Owner]** **[Architect]** **[General Contractor]** shall engage a qualified testing agency to perform tests and inspections.

3.05 REMEDIATION AND CLEANING

- A. Remediation:
 - 1. Remove and replace ACM Panel System-specific components damaged as a direct result of activities in the Panel Installation section.
 - 2. Remove protective masking immediately after installation of ACM Panel System. Masking intentionally left in place after Panel Installation on an elevation at the direction of the General Contractor shall become the responsibility of the General Contractor.

3. Panel Installation completion shall be agreed-upon between the Installer and the General Contractor.
4. Following Panel Installation completion, any determination of repair or replacement of ACM Panel System-specific components is at the discretion of the Architect. Such repair or replacement shall become the responsibility of the General Contractor.
 - a. At the discretion of the Architect, repair damaged ACM Panel System-specific components such that repairs are not discernible at a distance of 10 feet from the surface at a 90° angle per AAMA 2605.
5. Removal and replacement of ACM Panel System-specific components damaged by other trades shall be the responsibility of the General Contractor.
6. If required after Panel Installation, any additional protection of the ACM Panel System shall be the responsibility of the General Contractor.
7. Remove from project site damaged ACM Panel System-specific components, protective masking, and other debris attributable to work of this section.

B. Cleaning:

1. Final Cleaning shall not be part of the work of this section.
2. Cleaning and Maintenance of the BD&V ACM Panel System shall be performed at least once a year in accordance with AAMA 609 & 610.

END OF SECTION

SECTION 07 46 23 - ENGINEERED BAMBOO RAINSCREEN, CLADDING AND SIDING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Exterior Lamboo Rainscreen Cladding System:
 - 1. Concealed Rainscreen Lamboo Titanclips and starter rail.
 - 2. Pre-drilled furring board (if applicable)
 - 3. Milled Lamboo cladding/siding.
 - 4. Milled Lamboo corner trim and termination trim.

1.2 RELATED SECTIONS

- A. Section 012300 - Alternates
- B. Section 04200 - Masonry Units
- C. Section 05400 - Cold Formed Metal Framing.
- D. Section 06201 - Exterior Finish Carpentry.
- E. Section 07060 - Rainscreen Drainage Mat.
- F. Section 07600 - Flashing and Sheet Metal.
- G. Section 07620 - Sheet Metal Flashing and Trim.
- H. Section 07650 - Flexible Flashings.
- I. Section 07900 - Joint Sealers.
- J. Section 08500 - Exterior Windows.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data:
 - 1. Manufacturer's data sheets on each product to be used.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Verification Samples: Two representative units of each finish product specified.
 - 1. Sample Size: 12 inches (305 mm) boards of chosen wood species milled to rainscreen clip pattern for use on soffits and ceilings.
 - 2. Rainscreen system to be used with tinted finish applied to 12-inches (305 mm) long sample.

- D. Shop Drawings: Provide manufacturer's standard details referenced to exterior and interior elevations of the project drawings; include details of materials, construction and finish. Include relationship with adjacent construction.

I.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum 8 years documented experience.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum 5 years documented experience with projects of similar scope and complexity.
- C. Source Limitations: Each type of product from a single manufacturing source to ensure uniformity.

I.6 PREINSTALLATION CONFERENCE

- A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.
 - 1. Meet at project site prior to delivery of finish carpentry materials and review condition and environmental controls required for proper installation and ambient conditioning in areas to receive work.
 - 2. Proceed with finish carpentry when everyone concerned agrees that required ambient conditions can be properly maintained.
 - 3. Sequencing: Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

I.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's packaging bearing the brand name and manufacturer's identification until ready for installation.
 - 1. Include in delivery of material a complete list of items shipped to include Lamboo Rainscreen, board length, hardware, finish and any other product accessories delivered with the rainscreen system.
 - 2. Rainscreen system shall be delivered on a tarped flatbed truck or an enclosed van for small quantities. Keep rainscreen tarped or store indoors until installation.
 - 3. Do not deliver finish carpentry materials until painting, wet work, grinding, and similar operation which could damage, soil or deteriorate rainscreen have been completed in installation areas. If finish carpentry must be stored in other than the installation areas, store only in areas meeting requirements specified for installation areas.
- B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
- C. Protect from damage due to weather, excessive temperature, and construction operations.
 - 1. Protect finish carpentry during transit, delivery, storage and handling to prevent damage, soiling, and deterioration.
 - 2. Do not allow finish carpentry to get wet.

I.8 PROJECT CONDITIONS

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

I.9 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against defects in materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Lamboo, which is located at: P. O. Box 195; 311 West Edwards Street; Litchfield, IL 62056; ASD Toll Free: 866-966-2999; Fax: 866-966-2999; Email: sales@lamboo.us; Web: www.lamboo.us
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 WOOD MATERIALS

- A. Engineered Bamboo: Lamboo Rainscreen for exterior and interior applications.
 - 1. Fire Resistance: ASTM E84 Class A.
 - 2. Toxicity: Low VOC adhesives, does not produce off-gassing when sanding, profiling or handling materials.
 - 3. Anti-Microbial Properties: Naturally anti-bacterial materials.
 - 4. Pests and Insects: Bamboo includes silica fibers to help resist insects and wood eating pests.
 - 5. Density and Buoyancy:
 - a. Janka Rating: 1,900 lbf (8.45 kN).
 - b. Average Weight: 44 lbs/cubic foot (704 kg/cubic meter).
 - c. Specific Gravity: 0.60.
 - 6. Workability: Adhesives, binders and treatments specific to application as recommended by manufacturer.

2.3 EXTERIOR RAINSCREEN WALL CLADDING AND SIDING SYSTEMS

- A. Exterior Finished Rainscreen Cladding Boards: Lamboo Exterior Rainscreen Wall Cladding and Siding Systems as manufactured by Lamboo.
 - 1. Milled groove separating cladding boards.
 - 2. Board Length: 8 ft (2438 mm) lengths; EXT-8.
 - 3. Board Length: 10 ft (3048 mm) lengths; EXT-10.
 - 4. Board Length: 12 ft (3858 mm) lengths; EXT-12.
 - 5. Board Length: 16 ft (4879 mm) lengths; EXT-16.
 - 6. Board Thickness: 1 1/16 inch (17 mm) thick for all board widths.
 - 7. Rainscreen Cladding: 5 inches (127 mm). Face Width: 4-3/4 inches (120 mm). Finish to be selected from options below:
 - a. Finish: LAMRSH-106-EXT Finished Vertical Hazel.
 - b. Finish: LAMRSG-106-EXT Finished Vertical Golden Honey.
 - c. Finish: LAMRSA-106-EXT Finished Vertical Deep Amber.
 - d. Finish: LAMRSF-106-EXT Finished Vertical Butternut.
 - e. Finish: LAMRSO-106-EXT Finished Vertical Fawn.
 - 8. Aluminum Fasteners:
 - a. Architectural grade extruded aluminum rainscreen 'wall clips' with a T6-6063 corrosion resistant coating; TitanClip0716.
 - b. Architectural grade extruded aluminum rainscreen 'starter rail' with a T6-6063 corrosion resistant coating; TitanRail0716.
 - 9. Anchorages for Exterior Rainscreens: Pan Head No. 3 Square Drive Stainless Steel Rainscreen Clip Screws, No. 10 x 1 inch (25 mm); SS-3SQ-10x1.
- B. Trim System: Lamboo Trim System as manufactured by Lamboo.
 - 1. Inside Corners: 8 ft (2438 mm) lengths; LAMRS-IC-EXT-8.

2. Inside Corners: 10 ft (3048 mm) lengths; LAMRS-IC-EXT-10.
 3. Inside Corners: 12 ft (3858 mm) lengths; LAMRS-IC-EXT-12.
 4. Inside Corners: 16 ft (4879 mm) lengths; LAMRS-IC-EXT-16.
 1. Outside Corners: 8 ft (2438 mm) lengths; LAMRS-OC-EXT-8.
 2. Outside Corners: 10 ft (3048 mm) lengths; LAMRS-OC-EXT-10.
 3. Outside Corners: 12 ft (3858 mm) lengths; LAMRS-OC-EXT-12.
 4. Outside Corners: 16 ft (4879 mm) lengths; LAMRS-OC-EXT-16.
- C. Touch-up Finishing:
1. Stain: LAMRS-TU-(finish selected from standard finishes), 1 Quart

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions. Clean surfaces thoroughly prior to installation.
- B. Condition wood material for a minimum of 48 hours to average prevailing humidity conditions in installation areas prior to installing.
- C. Do not begin installation until substrates have been properly constructed and prepared.
- D. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions, approved submittals and in proper relationship with adjacent construction.
 1. Refer to Drawings for information pertaining to dimensions of milled siding, treatment of corners; mitered boards or wood corner boards with built-in furring for concealed fastening, and trim for doors and windows with built in furring for concealed fastening.
 2. Discard units of material which are unsound, warped, bowed, twisted, not adequately seasoned, or which are of defective manufacture with respect to surface, size, or pattern.
 3. Install the work plumb, level, and true with no distortions. Shim as required using concealed shims.
 4. Install inside and outside corners with fasteners through the attached flanges directly to sheathing. Fasteners provided by others.
 - a. Starter rail.
 - b. Siding Ventilation System.
 - c. Initial bottom board.
 5. Wall Clips: Add to anchor top of initial bottom board at 20 inches (508 mm) on center for 3 and 5 inch (76 and 127 mm) Rainscreen system and 16 inches (406 mm) on center for 7 inch (178 mm) Rainscreen system.
 - a. Add second board.
 - b. Add wall clips and repeat until reaching the top of the wall.
 - c. Add Siding Ventilation System to top of wall termination for entire length of Rainscreen.
 - d. Add Last board and face fasten through Lamboo and Siding Ventilation System then into sheathing.
 6. Use Finish Touch-Up on field cut ends of the rainscreen cladding, transition boards, inside and outside corners.
- B. Anchorage of Finish Carpentry:

1. Install engineered corners and window/door trim prior to installation of milled siding boards.
 2. Exterior Installation: Install extruded aluminum concealed clips securing with supplied pan head square drive stainless steel rainscreen clip screws, No. 10 1 inch (25 mm).
 3. Interior Installation: Install extruded aluminum concealed clips securing with supplied pan head, zinc coated steel, Phillips drive, rainscreen rail screws, No. 10, 3/4-inch (19 mm).
- C. Coordinate electrical requirements and wiring with millwork installation.
- 3.3 FIELD QUALITY CONTROL
- A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.
- 3.4 CLEANING AND PROTECTION
- A. Clean and protect products in accordance with the manufacturer's recommendations. Clean finish carpentry work on exposed and semi-exposed surfaces. Apply a complete topcoat of wood finish to all exposed and semi-exposed surfaces.
- B. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionality and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.
- C. Protect installed products until completion of project. Installer of finish carpentry shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at the time of acceptance.
- D. Touch-up, repair or replace damaged products before Substantial Completion.
- E. Refinish field cuts by applying the final coat of wood finish directly on the cut ends prior to abutting an additional panel and before adding corner trim system.

END OF SECTION

SECTION 07 54 23 - TPO THERMOPLASTIC SINGLE-PLY ROOFING

GENERAL

I.1 SECTION INCLUDES

- A. TPO Thermoplastic Single-Ply Roofing.
- B. Membrane Flashings.
- C. Metal Flashings.
- D. Roof Insulation.

I.2 RELATED SECTIONS

- A. Section 05 31 23 - Steel Roof Decking.
- B. Section 06 10 00 - Rough Carpentry
- C. Section 07 54 00 - Thermoplastic Membrane Roofing.
- D. Section 07 62 00 - Sheet Metal Flashing and Trim.
- E. Section 07 70 00 - Roof and Wall Specialties and Accessories.
- F. Section 08 60 00 - Roof Windows and Skylights.
- G. Section 22 30 00 - Plumbing Equipment.

I.3 REFERENCES

- A. American Society of Civil Engineers (ASCE) - ASCE 7 - Minimum Design Loads for Buildings and Other Structures, Current Revision.
- B. ANSI/SPRI WD-I "Wind Design Standard for Roofing Assemblies".
- C. ASTM International (ASTM):
 - 1. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 2. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 - 3. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 4. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - 5. ASTM D 1079 - Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.

6. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
 7. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 8. ASTM D 4869 - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
 9. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
 10. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
- D. International Code Council (ICC):
1. International Building Code (IBC).
- E. National Roofing Contractors Association (NRCA) - Low Slope Roofing and Waterproofing Manual, Current Edition.
- F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.
- G. Underwriters Laboratories (UL):
1. TGFU R1306 - "Roofing Systems and Materials Guide".
 2. UL-790 - Standard Test Method for Fire Tests of Roof Coverings.
- H. ANSI/ASHRAE/IESNA Standard 9.1 (2007): Energy Standard for Buildings Except Low-Rise Residential Buildings.

I.4 DESIGN CRITERIA

- A. Wind Uplift Performance:
1. Roof system is designed to withstand wind uplift forces as calculated using the current revision of ASCE-7.
 2. Carlisle offers a 120 mph wind speed warranty. Please follow all required system enhancements to achieve this rating.
- B. Fire Resistance Performance:
1. Roof system will achieve a UL Class A rating when tested in accordance with UL-790.
- C. Thermal Performance: Roof system will achieve a minimum R value not less than 30.
- D. Drainage: Provide a roof system with positive drainage where all standing water dissipates within 48 hours after precipitation ends.
- E. Building Codes:
1. Roof system will meet the requirements of all federal, state and local code bodies having jurisdiction.

I.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.

3. Installation methods.
- C. Detail Drawings:
 1. Submit approved plan, section, elevation or isometric drawings which detail the appropriate methods for all flashing conditions found on the project.
 2. Coordinate approved drawings with locations found on the Contract Drawings.
- D. Selection Samples: For each finish product specified, two complete sets of chips representing manufacturer's full range of available colors, membranes, and thicknesses.
- E. Verification Samples: For each finish product specified, two samples, minimum size 4 inches (100 mm) square representing actual product, color, and patterns.

I.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of twenty (20) years experience.
- B. Installer Qualifications:
 1. All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.
 2. Installer must be capable of extending the Manufacturer's Labor and Materials guarantee.
 3. Installer must be capable of extending the Manufacturer's No Dollar Limit guarantee.

I.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.
- C. Safety Data Sheets (SDS) must be on location at all times during the transportation, storage and application of materials.
- D. When loading materials onto the roof, the Carlisle Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.

I.8 PROJECT CONDITIONS

- A. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.
- B. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.
- C. Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.
- D. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth,

dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.

- E. New roofing shall be complete and weather tight at the end of the work day.
- F. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

I.9 WARRANTY

- A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's Total System warranty, outlining its terms, conditions, and exclusions from coverage.
 - I. Duration: 20 Years / Wind Speed 120 mph.
- B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Carlisle SynTec Systems, or equal

2.2 SCOPE / APPLICATION

- A. Roof System: Provide a waterproof roof system, capable of withstanding uplift forces as specified in the Design Criteria article of this section.
 - I. Membrane Attachment: Fully Adhered.
- B. Base Flashing: Provide a waterproof, fully adhered base flashing system at all penetrations, plane transitions and terminations.
- C. Insulation: Provide a roof insulation system beneath the finish membrane.

2.3 INSULATION

- A. Polyisocyanurate InsulBase: Rigid board with glass fiber reinforced facers (GRF) on both sides, meeting or exceeding the requirements of ASTM C 1289, Type II, Class I. Carlisle InsulBase.
 - I. Compressive Strength: Grade 2, 20 psi (138 kPa).
 - 2. Density: 2 lb per cubic foot (24 kg/cu m) minimum.
- B. Moisture, mold and impact-resistant, non-structural fiber-reinforced gypsum panel made from 95 percent recycled materials. Securock, distributed by Carlisle.
 - I. Board Thickness: 5/8 inch (15 mm).

2.4 THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE

- A. Sure-Weld Membrane:
 - I. Color: White.
 - 2. Membrane Thickness: 60 mil nominal.
 - a. Thickness over Scrim: 0.020 inches (0.508 mm).
 - b. Breaking Strength (ASTM D 751): 250 lbf/in (1.1 kN/m) minimum.

- c. Tear Resistance (ASTM D 751): 55 lbf/in (245 N/m) minimum.
 - d. Elongation (ASTM D 751): 25 percent.
- 3. Field Sheet Dimensions:
 - a. Width: 12 feet (3.65 m) maximum.
 - b. Length: 100 feet (30.5 m) maximum.

2.5 FLASHING ACCESSORIES

- A. Inside Corners: Pre-molded corner flashing for inside corners. 60 mil thickness. Color to match membrane. Special colors require custom fabrication process.
- B. Outside Corners: Injection molded corner used for flashing outside corners. 60 mil thickness. Color to match membrane. Special colors require custom fabrication process.
- C. TPO T-Joint Covers: Injection molded 60 mil thick TPO formed into a 4.5 inch (114 mm) diameter circle used to seal step-offs at splice intersections. Color to match membrane. Special colors require custom fabrication process.
- D. TPO Universal Corners: A pre-molded flashing for use in a variety of corner details, including inside and outside corners. Available in white, gray and tan and are 60-mil thick.
- E. Molded Pipe Seals: A pre-molded flashing and clamping ring used for pipe penetrations. Available for 0.75 inch to 8 inch (19 - 203.2 mm) diameter pipes. Color to match membrane. Special colors not available.
- F. Pre-Fabricated Sealant Pockets: A two-piece, pre-fabricated, custom sized, sealant pocket that utilizes reinforced TPO membrane and coated metal to form a rigid, oversized sealant pocket with a weldable horizontal deck flange. Color - White. Gray, tan and special colors require custom order fabrication.
- G. Pressure-Sensitive Cover Strip: A nominal 6 inch (152 mm) wide by 40 mil thick non-reinforced TPO membrane laminated to nominal 35-mil thick cured synthetic rubber pressure-sensitive adhesive. Used in conjunction with TPO Primer to strip in flat metal flanges (i.e., drip edges or rows of fasteners and plates). Color to match membrane. Special colors not available.
- H. TPO Pressure-Sensitive RUSS:
 - I. 6 inch (152 mm) RUSS: A nominal 6 inch (152 mm) wide, 45 mil thick reinforced TPO membrane with nominal 3 inch (76 mm) wide 35mil thick cured synthetic rubber pressure-sensitive adhesive laminated along one end. This product allows a continuous piece of membrane to be run up a parapet wall without fastener penetration through the field sheet at angle changes.
- I. Sure-Weld Heat Weldable Walkway Rolls: Superior tear, puncture and weather resistance and designed to protect Sure-Weld membrane in those areas exposed to repetitive foot traffic or other hazards. Walkway material may be heat welded to Sure-Weld membrane using an automated heat welder or hand held heat welder. Walkway Rolls are 34 inches (864 mm) wide by 50 feet (15.2 m) long and are nominal 180 mils thick. Color - White, gray and tan.
- J. Non-Reinforced Flashing: Non-reinforced TPO flashing is a 60-mil thick non-reinforced TPO based membrane used for detail work where the use of pre-molded or pre-fabricated accessories are not feasible. Color - White, gray and tan. Special colors require lead time and 5,000 square foot

minimum.

2.6 CLEANERS, PRIMERS, ADHESIVES AND SEALANTS

- A. CAV-GRIP III Low-VOC Aerosol Contact Adhesive/Primer: A low-VOC, methylene chloride-free adhesive that can be used for a variety of applications including: Bonding Sure-Weld membrane to various surfaces, priming unexposed asphalt prior to applying Flexible FAST Adhesive, adhering Sure-Weld TPO membrane, horizontally, for the field of the roof, and for adhering Sure-Weld FleeceBACK and Sure-Weld TPO membrane to vertical walls. Coverage rate is approximately 2,000-2,500 sq. ft. per 40 lb cylinder and 4,000-5,000 sq. ft. per 85 lb cylinder as a primer, in a single-sided application; 750 sq. ft. per 40 lb cylinder and 1,500 sq. ft. per 85 lb cylinder as an adhesive for vertical walls, in a double-sided application; 1,000 sq. ft. per 40 lb cylinder and 2,000 sq. ft. per 85 lb cylinder as an adhesive, horizontally, for the field of the roof, in a double-sided application.
- B. Water Cut-Off Mastic: A one-component, low viscosity, self wetting, Butyl blend mastic used as a compression sealing agent between membrane and applicable substrates.
- C. Low VOC Primer: Manufacturer's recommended low VOC primer.
- D. Carlisle Weathered Membrane Cleaner: Clear, solvent-based cleaner used to loosen and remove contaminants from the surface of exposed membrane.

2.7 FASTENING COMPONENTS

- A. HP-X Fasteners: Heavy-duty #15 threaded fastener with a Phillips head for standard TPO seam fastening (Mechanically Fastened Roofing Systems) and where increased pullout resistance is necessary for steel and wood decks (Fully Adhered Roofing Systems).
- B. InsulFast Fasteners: Threaded, #12 fastener with a #3 Phillips head used with 3 inch (76 mm) diameter Insulation Plates. For insulation attachment into steel or wood decks.
- C. Piranha Plates: A 2 3/8 inch (60 mm) diameter metal barbed fastening plate used with Carlisle HP-X, CD-10 or HD 14-10 Fasteners for membrane securement. This plate can be used for insulation securement.
- D. Seam Fastening Plates: A 2 inch (52 mm) diameter metal plate used for insulation attachment on Mechanically Fastened Roofing Systems or membrane securement on Adhered Roofing Systems in conjunction with the appropriate Carlisle Fastener. Not for use on Sure-Weld systems.
- E. Insulation Fastening Plates: A nominal 3 inch (76 mm) diameter metal plate used for insulation attachment in conjunction with the appropriate Carlisle Fastener.

2.8 EDGINGS AND TERMINATIONS

Elements listed below are proprietary to Carlisle's TPO being employed, should another manufacturer be submitted the manufacturer must be able to provide all edgings and terminations from their own system.

- A. SecurEdge 2000: An anchor bar roof edge fascia system consisting of 0.100 inch (2.5 mm) thick extruded aluminum bar, corrosion resistant stainless steel fasteners and snap-on fascia cover.
- B. Sure-Seal Drip Edge: A 22 gauge pre-punched 90-degree angle cleat and 12 foot (3658 mm) long fascia sections. Kynar 500 or aluminum finish as noted on the Finish Schedule of the Contract

Drawings.

- C. SecurEdge 200 Coping: An anchor cleat with pre-slotted holes, a concealed joint cover, and 10 or 12 foot sections of coping cap. Kynar 500 finish as noted on the Finish Schedule of the Contract Drawings.
- D. Sure-Seal Termination Bar: 1 inch (13 mm) wide, .098 inch (2.5 mm) thick extruded aluminum bar pre-punched 6 inches (152 mm) on center with sealant ledge to support Lap Sealant.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Do not commence work until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment.
- D. A vapor retarder / temporary roof (Carlisle VapAir Seal 725 TR Air and Vapor Barrier/Temporary Roof or Carlisle VapAir Seal MD Air and Vapor Barrier) may be applied to protect the inside of the structure prior to the roof system installation.

3.3 INSULATION - SYSTEM DESIGN

- A. Base Layer & Second Layer of Polyiso:
 - 1. Type: Insulbase Polyiso.
 - 2. Thickness: 2.6 inches (___ mm).
 - 3. Attachment Method: loose layed on metal deck
- B. Tapered System:
 - 1. Type: Tapered Insulbase crickets.
 - 2. Field Slope: .25 inch per foot.
 - 3. Sump Slope: .5inch per foot.
 - 4. Cricket Slope: .5 inch per foot.
 - 5. Attachment Method: loose laid.
- C. Cover Board
 - 1. Type: Securock
 - 2. Thickness: 5/8"
 - 3. Attachment Method: mechanically fasten through top layer of Securock and all layers of polyiso into the metal deck

3.4 INSULATION PLACEMENT

- A. Install insulation or membrane underlayment in multiple layers over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch (6 mm). Stagger joints both horizontally and vertically if multiple layers are provided.
- B. Secure insulation to the substrate with the required mechanical fasteners or insulation adhesive in accordance with the manufacturer's current application guidelines.
- C. Do not install wet, damaged or warped insulation boards.
- D. Stagger joints in one direction unless joints are to be taped. Install insulation boards snug. Gaps between board joints shall not exceed 1/4 inch (6 mm). Fill all gaps in excess of 1/4 inch (6 mm) with same insulation material.
- E. Wood nailers must be at least 3 1/2 inches (89 mm) wide or 1 inch (25 mm) wider than adjacent metal flange. Thickness must equal that of insulation but not less than 1 inch (25 mm) thickness.
- F. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.
- G. Do not install any more insulation than will be completely waterproofed each day.

3.5 INSULATION ATTACHMENT

- A. Securely attach insulation to the roof deck for Adhered Roofing Systems. Attachment must have been successfully tested to meet or exceed the calculated uplift pressure required by the International Building Code (ASCE-7) or ANSI/SPRI WD-I.

3.6 MEMBRANE PLACEMENT AND ATTACHMENT (Fully Adhered)

- A. Position Sure-Weld membrane over the acceptable substrate. Fold membrane sheet back lengthwise so half the underside of the membrane is exposed.
- B. Apply Cav Grip Adhesive in accordance with the manufacturer's published instructions, to the exposed underside of the membrane and the corresponding substrate area. Do not apply Adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
 - 1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.
 - 2. Fold back the unbonded half of the sheet lengthwise and repeat the bonding procedures.
- C. Position adjoining sheets to allow a minimum overlap of 2 inches.
- D. Hot-air weld the Sure-Weld membrane sheets using the Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's hot air welding procedures. Carlisle recommends a test weld sample be made from a piece of scrap TPO to eliminate the need to remove a section from a completed seam. At all splice intersections, roll the seam with a silicone roller to ensure a continuous hot air welded seam.
- E. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of

2 inches and complete the bonding procedures as stated previously.

3.7 SEAM WELDING

- A. Hot-air weld membrane using an Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's current guidelines. At all splice intersections, roll the seam with a silicone roller to ensure a continuous hot air welded seam.
- B. When utilizing membrane greater than 45-mil thickness, overlay all splice intersections with Sure-Weld T-Joint Cover.
- C. Probe all seams once the hot air welds have thoroughly cooled (approximately 30 minutes).
- D. Repair all seam deficiencies the same day they are discovered.
- E. Apply Cut Edge Sealant on all cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete. Cut Edge Sealant is not required on vertical splices.

3.8 FLASHING

- A. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using Sure-Weld reinforced membrane or prefabricated accessories. Sure-Weld non-reinforced membrane may be used for flashing pipe penetrations, Sealant Pockets, and scuppers, as well as inside and outside corners, when the use of pre-molded or prefabricated accessories is not feasible.
- B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

3.9 DAILY SEALS

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
- B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.

3.10 CLEAN UP

- A. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

3.11 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 077100 - ROOF SPECIALTIES

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:

- 1. Copings.
- 2. Roof-edge specialties.
- 3. Roof-edge drainage systems.
- 4. Reglets and counterflashings.

- B. Related Requirements:

- 1. See Civil & Plumbing drawings for downspout boots.
- 2. **[Section 061000 "Rough Carpentry"] [Section 061053 "Miscellaneous Rough Carpentry"]** for wood nailers, curbs, and blocking.
- 3. Section 075423 "TPO for roof-edge drainage-system components (copings, roof edge specialties, etc) provided by TPO manufacturer.
- 4. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
- 5. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

- C. Preinstallation Conference: Conduct conference at Project Site

- 1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
- 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
- 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

I.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 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 each type of roof specialty and for each color and texture specified.
- D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- E. 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 **[copings]** **[roof-edge specialties]** **[roof-edge drainage systems]** **[reglets and counterflashings]** made from **12-inch (300-mm)** lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

I.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of roof specialty.
- C. Product Test Reports: For **[copings]** **[and]** **[roof-edge flashings]**, for tests performed by a qualified testing agency.
- D. Sample Warranty: For manufacturer's special warranty.

I.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

I.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are **[FM Approvals listed for specified class]** **[and]** **[SPRI ES-I tested to specified design pressure]**.
- B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 075423 TPO

I.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

I.8 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

I.9 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section **075423 TPO**
- 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 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **[20]** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install **[copings]** **[roof-edge specialties]** that are listed in FM Approvals' "RoofNav" and approved for windstorm classification of location of Project. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install **[copings]** **[roof-edge specialties]** tested according to SPRI ES-I and capable of resisting the following design pressures:
 - 1. Design Pressure: **[As indicated on Drawings]**

- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - I. Temperature Change (Range): [**120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**] <Insert temperature range>, material surfaces.

2.2 COPINGS

- A. Metal Copings: See Section 075423 TPO

2.3 ROOF-EDGE SPECIALTIES

- A. Canted Roof-Edge [**Fascia**] Manufactured, two-piece, roof-edge fascia consisting of [**snap-on**] [**compression-clamped**] metal fascia cover in section lengths not exceeding [**12 feet (3.6 m)**] <Insert dimension> and a continuous formed galvanized-steel sheet cant, **0.028 inch (0.71 mm)** thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
 - I. Provided by TPO manufacturer
- B. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding [**12 feet (3.6 m)**] <Insert dimension> and a continuous metal receiver with integral drip-edge cleat to engage fascia cover [**and secure single-ply roof membrane**]. Provide matching corner units.
 - I. Provided by TPO manufacturer

2.4 ROOF-EDGE DRAINAGE SYSTEMS

- A. **ATAS** International, or equal.
- B. Gutters: Manufactured in uniform section lengths not exceeding [**12 feet (3.6 m)**] <Insert dimension>, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least **1 inch (25 mm)** above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Aluminum Sheet: [**0.050 inch (1.27 mm)**] thick.
 - 2. Gutter Profile: [**Half-round highback**] according to SMACNA's "Architectural Sheet Metal Manual."
 - 3. Corners: Factory mitered and [**soldered**]
 - 4. Gutter Supports: [**Gutter brackets or Straps**] with finish matching the gutters.
- C. Downspouts: [**Plain rectangular**] complete with [**machine-crimped**] [**mitered**] [**smooth-curve**] elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - I. Zinc-Coated Steel: Nominal [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] <Insert value> thickness.

2. Formed Aluminum: [0.032 inch (0.81 mm)] [0.040 inch (1.02 mm)] [0.050 inch (1.27 mm)] [0.063 inch (1.60 mm)] <Insert value> thick.
 3. Extruded Aluminum: [0.125 inch (3.18 mm)] <Insert value> thick.
 4. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert value>.
- D. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge, and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout[, exterior flange trim,] [and] [built-in overflow].
1. Zinc-Coated Steel: Nominal [0.028-inch (0.71-mm)] <Insert value> thickness.
 2. Formed Aluminum: [0.032 inch (0.81 mm)] <Insert value> thick.
 3. Stainless Steel: [0.016 inch (0.40 mm)] <Insert value> thick.
 4. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight (thickness)>.

2.5 REGLETS AND COUNTERFLASHINGS

- A. **BY** TPO manufacturer
- 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 [0.022-inch (0.56-mm)] [0.028-inch (0.71-mm)] <Insert value> thickness.
 2. Formed Aluminum: [0.024 inch (0.61 mm)] [0.050 inch (1.27 mm)] <Insert value> thick.
 3. Stainless Steel: [0.019 inch (0.48 mm)] [0.025 inch (0.64 mm)] <Insert value> thick.
 4. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight (thickness)>.
 5. Corners: Factory mitered and [soldered] [continuously welded] [mechanically clinched and sealed watertight].
 6. 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.
 7. Stucco Type, Embedded: Provide reglets with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
 8. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 9. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
 10. Multiuse Type, Embedded: For multiuse embedment in [cast-in-place concrete] [masonry mortar joints].
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding [12 feet (3.6 m)] <Insert dimension> designed to snap into [reglets] [or] [through-wall-flashing receiver] and compress against base flashings with joints lapped, from the following exposed metal:
1. Zinc-Coated Steel: Nominal [0.022-inch (0.56-mm)] [0.028-inch (0.71-mm)] <Insert value> thickness.
 2. Formed Aluminum: [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] <Insert value> thick.
 3. Stainless Steel: [0.019 inch (0.48 mm)] [0.025 inch (0.64 mm)] <Insert value> thick.
 4. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight (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.

2.6 MATERIALS

- A. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.7 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 Aluminum: Aluminum or Series 300 stainless steel.

2.8 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 Aluminum Sheet Finishes:
 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Two-Coat Mica Fluoropolymer: AAMA 2605. Fluoropolymer finish with suspended mica flakes 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.
- d. Three-Coat Metallic Fluoropolymer: AAMA 2605. Fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - e. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.
2. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**] [**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
 3. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**] [**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
- E. Aluminum Extrusion Finishes:
1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA [2604] [2605]. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Three-Coat Fluoropolymer: AAMA [2604] [2605]. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Two-Coat Mica Fluoropolymer: AAMA [2604] [2605]. Fluoropolymer finish with suspended mica flakes 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.
 - d. Three-Coat Metallic Fluoropolymer: AAMA [2604] [2605]. Fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - e. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.
 2. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**] [**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
 3. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**] [**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of **[uncoated aluminum] [and] [stainless-steel]** roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of **[12 feet (3.6 m)]** **<Insert dimension>** with no joints within **[18 inches (450 mm)]** **<Insert dimension>** of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between **40 and 70 deg F (4 and 21 deg C)**, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate **[wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws]** **[substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance]** **<Insert size requirement>**.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below **40 deg F (4 deg C)**.
- 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 (38 mm)**; 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 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.4 ROOF-EDGE SPECIALITIES INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to 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 [12 inches (305 mm)] [24 inches (610 mm)] [30 inches (762 mm)] <Insert dimension> apart. Attach ends with rivets and [seal with sealant] [solder] to make watertight. Slope to downspouts.
 - I. Install gutter with expansion joints at locations indicated but not exceeding [50 feet (15.2 m)] <Insert dimension> 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 (25 mm) away from walls; locate fasteners at top and bottom and at approximately [60 inches (1500 mm)] o.c.
 - I. Connect downspouts to underground drainage system indicated.

3.6 REGLET AND COUNTERFLASHING INSTALLATION

- A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Embedded Reglets: See [Section 033000 "Cast-in-Place Concrete"] [and] [Section 042000 "Unit Masonry"] for installation of reglets.

- C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap **4 inches (100 mm)** over top edge of base flashings.
- D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap **4 inches (100 mm)** over top edge of base flashings. Lap counterflashing joints a minimum of **4 inches (100 mm)** and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 07 92 00 - JOINT SEALANTS

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Latex joint sealants.
 - 4. Acoustical joint sealants.
- B. Related Sections:
 - 1. Section 04 20 00 "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
 - 2. Section 09 29 00 "Gypsum Board" for sealing perimeter joints.
 - 3. Section 09 30 00 "Tiling" for sealing tile joints.

I.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-(13-mm-)wide joints formed between two 6-inch-(150-mm-)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.

I.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Field-Adhesion Test Reports: For each sealant application tested.
- F. Warranties: Sample of special warranties.

I.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- E. Preinstallation Conference: Conduct conference at Project site.

I.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 (5 deg C).
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

I.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

- I. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - I. Warranty Period: 5 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - I. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - I. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - I. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

- F. Colors of Exposed Joint Sealants: Custom for exterior joints, As selected by Architect from manufacturer's full range for interior joints..

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Non Staining, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 - I. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation;
 - b. GE Construction Sealants; Momentive Performance Materials Inc;
 - c. Pecora Corporation;

2.3 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - I. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; Dynatrol I-XL.
 - b. Sika Corporation; Sikaflex - Ia.
 - c. Tremco Incorporated;

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - I. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc; Chem-Calk 600.
 - b. DAP Products Inc.
 - c. Pecora Corporation; AC-20+.
 - d. Tremco Incorporated; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - I. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant.
 - b. Pecora Corporation; AC-20 FTR.
 - c. Sherwin-Williams Company (The); Sher-Max Urethanized Elastomeric Sealant
 - d. United States Gypsum Company; SHEETROCK Acoustical Sealant.

2.6 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin 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.

2.7 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 joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing

optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

- a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. 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 according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix XI in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces
- I. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints in between new and existing components of the building.
 - c. Joints in exterior insulation and finish systems.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - f. Control and expansion joints in ceilings.
 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 50.
 3. Urethane Joint Sealant: Single component, nonsag, Class 25.
 4. Joint-Sealant Color: Custom color for exterior sealant; Manufacturer's full range for interior sealants. Custom color.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
- I. Joint Locations:

- a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of walls.
 - e. Joints on underside of plant-precast structural concrete planks.
 - f. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 2. Joint Sealant: Latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal non-traffic surfaces
 1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing Silicone..
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal non-traffic surfaces
 1. Joint Location:
 - a. Acoustical joints where indicated.
 - b. Other joints as indicated.
 2. Joint Sealant: Acoustical.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 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.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.

6. Details of anchorages, joints, field splices, and connections.
 7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of conduit and preparations for power, signal, and control systems.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification:
1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).
 2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately 8 by 10 inches (203 by 254 mm) to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
- E. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

I.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

I.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [Amweld International, LLC.](#)
2. [Meskar Opening Group](#)
3. [Ceco Door; ASSA ABLOY.](#)
4. [Curries Company; ASSA ABLOY.](#)
5. [Gensteel Doors, Inc.](#)
6. Pioneer Industries.

- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations all interior locations unless noted otherwise..
1. Physical Performance: Level A according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - d. Edge Construction: Model 2, Seamless
 - e. Core: Manufacturer's mineral-board, or vertical steel-stiffener core at manufacturer's discretion. Provide fire rated cores as indicated.
 3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Knock-down
 4. Exposed Finish: Prime & paint, see finish schedule.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4. At all exterior locations unless noted otherwise.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm.)
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Polyisocyanurate
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
 - b. Construction: Full profile welded.
 - 4. Exposed Finish: Prime and paint, as per finish schedule.

2.5 BORROWED LITES

- A. Hollow-metal frames of uncoated steel sheet, minimum thickness of [0.053 inch (1.3 mm)] [0.042 inch (1.0 mm)].
- B. Construction: Full profile welded.

2.6 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum **3/8-inch- (9.5-mm-)** diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of **0.042 inch (1.0 mm)**, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than **2-inch (51-mm)** height adjustment. Terminate bottom of frames at finish floor surface.

2.8 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), **04Z (12G)** coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. 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.
- G. Grout: ASTM C 476, except with a maximum slump of **4 inches (102 mm)**, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.9 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble

units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness **0.026 inch (0.66 mm)**, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than **6 inches (152 mm)** apart. Spot weld to face sheets no more than **5 inches (127 mm)** o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum **3/4 inch (19 mm)** beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than **16 inches (406 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to **60 inches (1524 mm)** high.
 - 2) Three anchors per jamb from **60 to 90 inches (1524 to 2286 mm)** high.
 - 3) Four anchors per jamb from **90 to 120 inches (2286 to 3048 mm)** high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each **24 inches (610 mm)** or fraction thereof above **120 inches (3048 mm)** high.
 - b. Stud-Wall Type: Locate anchors not more than **18 inches (457 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c. and as follows:
 - 1) Three anchors per jamb up to **60 inches (1524 mm)** high.
 - 2) Four anchors per jamb from **60 to 90 inches (1524 to 2286 mm)** high.
 - 3) Five anchors per jamb from **90 to 96 inches (2286 to 2438 mm)** high.

- 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 - 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 - 7. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.10 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.11 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
 - I. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - I. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

- a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
- 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
- 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
- 6. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
- 8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus $1/16$ inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus $1/16$ inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus $1/16$ inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus $1/16$ inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - I. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: $1/8$ inch (3.2 mm) plus or minus $1/32$ inch (0.8 mm).
 - b. Between Edges of Pairs of Doors: $1/8$ inch (3.2 mm) to $1/4$ inch (6.3 mm) plus or minus $1/32$ inch (0.8 mm).
 - c. At Bottom of Door: [$3/4$ inch (19.1 mm)] [$5/8$ inch (15.8 mm)] plus or minus $1/32$ inch (0.8 mm).
 - d. Between Door Face and Stop: $1/16$ inch (1.6 mm) to $1/8$ inch (3.2 mm) plus or minus $1/32$ inch (0.8 mm).
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - I. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 || 13

SECTION 08 14 16 - FLUSH WOOD 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. Solid-core doors with wood-veneer.
 - 2. Factory finishing flush wood doors.
- B. Related Requirements:
 - 1. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
 - 1. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - a. Provide Samples for each species of veneer and solid lumber required.

- b. Provide Samples for each color, texture, and pattern of plastic laminate required.
- c. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

I.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification certificates.

I.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

I.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

I.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

I.9 WARRANTY

- A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than **1/4 inch (6.4 mm)** in a **42-by-84-inch (1067-by-2134-mm)** section.
 - b. Telegraphing of core construction in face veneers exceeding **0.01 inch in a 3-inch (0.25 mm in a 76.2-mm)** span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Exterior Doors: Five years from date of Substantial Completion.
 - 4. Warranty Period for Solid-Core Interior Doors: Life of installation.

5. Warranty Period for Hollow-Core Interior Doors: Two year(s) 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. VT Industries
 2. Eggers Industries.
 3. Lambton Doors.
 4. Mohawk Flush Doors, Inc.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards"
 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.I-A Performance Grade: Extra Heavy Duty.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 6. Pairs: Provide formed-steel edges and astragals with intumescent seals.
 - a. Finish steel edges and astragals with baked enamel same color as doors.
 - b. Finish steel edges and astragals to match door hardware (locksets or exit devices).

- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-2.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
 - b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - 3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- F. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 400 lbf (1780 N).
- G. Mineral-Core Doors:
 - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
 - a. 5-inch (125-mm) top-rail blocking.
 - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
 - d. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
 - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 - 1. Grade: Premium, with Grade AA faces
 - 2. Species: Oak, to match color, grain and finish to PLAM-1.
 - 3. Stain: BOD VT Industries (Onyx, ON15)
 - 4. Cut: Plain sliced (flat sliced)
 - 5. Match between Veneer Leaves: Book match.
 - 6. Assembly of Veneer Leaves on Door Faces: Running match.
 - 7. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 - 8. Exposed Vertical (and Top Edges when visible in multi-story spaces): Same species as faces or a compatible species - edge Type A.

9. Core: Particleboard.
10. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
11. WDMA I.S.I-A Performance Grade: Extra Heavy Duty.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
 3. Louvers: Factory install louvers in prepared openings.
 4. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 1. Grade: Premium.
 2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane
 3. Staining: None required.
 4. Effect: Filled.
 5. Sheen: Semi-gloss

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware"
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide **1/8 inch (3.2 mm)** at heads, jambs, and between pairs of doors. Provide **1/8 inch (3.2 mm)** from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide **1/4 inch (6.4 mm)** from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock and hinge edges.
 - 2. Bevel fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 31 13.53 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.
- D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 - 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
1. JL Industries, Inc.; a division of the Activar Construction Products Group.
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Exterior Flush Access Doors.:
1. Basis-of-Design Product: Babcock-Davis Stainless Steel Flush Access Doors..
 2. Assembly Description: Fabricate door to be weatherproof and fit flush to frame. Provide manufacturer's standard **2-inch-(50-mm-)**thick fiberglass insulation and extruded door gaskets. Provide manufacturer's standard-width frame for surface mounting, proportional to door size.
 3. Locations: Wall.
 4. Door Size: As indicated..
 5. Stainless-Steel Sheet for Door: Nominal **0.062 inch (1.59 mm)**, 16 gage.
 - a. Finish: No. 2b.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Hinges: Manufacturer's standard.
 8. Hardware: Lock.
- D. Medium-Security Flush Access Doors.:
1. Basis-of-Design Product: Babcock-Davis, Medium Security.
 2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's concealed flange, proportional to door size.
 3. Locations: Wall and ceiling.
 4. Door Size: As indicated.
 5. Uncoated Steel Sheet for Door: Nominal **0.105 inch (2.66 mm)**, 12 gage.
 - a. Finish: Factory prime.
 6. Frame Material: Minimum **3/16-by-1-1/2-by-1-1/2-inch (4.7-by-38-by-38-mm)** angle welded with joints ground smooth; factory prime.
 7. Hinges: Manufacturer's standard security hinge.
 8. Hardware: Tamper-resistant latch.
- E. Fire-Rated, Flush Access Doors with Concealed Flanges.:
1. Basis-of-Design Product: Bobcock-Davis; Fire-Rated Access Doors.
 2. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide frame with gypsum board beads for concealed flange installation.
 3. Locations: Wall and ceiling.
 4. Fire-Resistance Rating: Not less than that of adjacent construction.
 5. Temperature-Rise Rating: **450 deg F (250 deg C)** at the end of 30 minutes.
 6. Uncoated Steel Sheet for Door: Nominal **0.036 inch (0.91 mm)**, 20 gage.
 - a. Finish: Factory prime.

7. Frame Material: Same material, thickness, and finish as door.
8. Hinges: Manufacturer's standard.
9. Hardware: Latch, tamper resistant.

F. Hardware:

1. Latch: Self-latching bolt operated by pinned-hex-head wrench with interior release.
2. Lock: Mortise cylinder.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.
- D. Frame Anchors: Same type as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 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 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 board securely attached to perimeter of frames.
 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
 3. Provide mounting holes in frame for attachment of masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder locks, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

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. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- E. Stainless-Steel Finishes:
 - 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - 2. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
- F. Exposed Access Panel Finishes:
 - 1. At the discretion of the Architect, exposed access panels are to be powder-coated to color selected by Architect from manufacturer's full range.

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.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13.53

SECTION 08 41 13 ALUMINUM-FRAMED ENTRANCES & STOREFRONTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Aluminum Storefront, including:
 - 1. YKK AP Series YES 45 TU Center Set Storefront System.
- B. Related Sections:
 - 1. Sealants: Refer to Division 7 Joint Treatment Section for sealant requirements.
 - 2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.
 - 3. Single Source Requirement: All products listed below shall be by the same manufacturer.
 - a. Section 08 51 13 Aluminum Windows.
 - b. Section 08 44 13 Glazed Aluminum Curtain Walls.

1.02 SYSTEM PERFORMANCE DESCRIPTION

- A. Performance Requirements: Provide aluminum storefront systems that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test method indicated.
 - 1. Air Infiltration: Completed storefront systems shall have 0.06 CFM/FT² (1.10 m³/h·m²) maximum allowable infiltration when tested in accordance with ASTM E 283 at differential static pressure of 6.24 PSF (299 Pa).
 - 2. Water Infiltration: No uncontrolled water when tested in accordance with ASTM E 331 at test pressure differential of 12 PSF (575 Pa) (or when required, field tested in accordance with AAMA 503). Fastener Heads must be seated and sealed against Sill Flashing on any fasteners that penetrate through the Sill Flashing.
 - 3. Wind Loads: Completed storefront system shall withstand wind pressure loads normal to wall plane indicated:
 - a. Exterior Walls:
 - 1) Positive Pressure:
 - 2) Negative Pressure:
 - b. Interior Walls (Pressure Acting in Either Direction):
 - 4. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures.
 - a. Without Horizontals: L/175 maximum.
 - b. With Horizontals: L/175 or L/240 + 1/4" (6.4mm) for spans greater than 13'-6" (4.1m) but less than 40'-0" (12.2m).
 - 5. Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.
 - 6. Thermal Performance: When tested in accordance with AAMA 507, AAMA 1503 and NFRC 100:
 - a. Condensation Resistance Factor (CRF_f): A minimum of 60.
 - b. Thermal Transmittance -Factor: 0.45 BTU/HR/FT²/°F or less.

Note: Thermal Performance for the glazed system as a whole will be affected by the characteristics of the glass specified and percentage of vision area.

- 7. Acoustical Performance: Acoustical Performance: When tested in accordance with AAMA 1801:
 - a. Sound Transmission Class (STC) shall not be less than 35 laminated.
 - b. Outdoor-Indoor Transmission Class (OITC) shall not be less than 29 laminated.

1.03 SUBMITTALS

- A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."
- B. Product Data: Submit product data for each type storefront series specified.
- C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples, and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.
- D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.
- E. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected

in installed system.

F. Quality Assurance / Control Submittals:

1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
2. Installer Qualification Data: Submit installer qualification data.

G. Closeout Submittals:

1. Warranty: Submit warranty documents specified herein.
2. Project Record Documents: Submit project record documents for installed materials in accordance with Division I Project Closeout (Project Record Documents) Section.

I.04 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.

B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, and workmanship standard.

1. Mock-Up Size:
2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

I.05 PROJECT CONDITIONS / SITE CONDITIONS

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

I.06 WARRANTY

- A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official.
1. Warranty Period: Manufacturer's one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.

EDITOR NOTE: Longer warranty periods are available at additional cost.

PART 2 PRODUCTS

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

- A. Acceptable Manufacturers:
- YKK AP America Inc.
270 Riverside Parkway, Suite 100
Austell, GA 30168
Telephone: (678) 838-6000; Fax: (678) 838-6001

1. Storefront System: YKK AP YES 45 TU Center Set Storefront System.
Additional manufacturer's may be considered, but this is our basis of design.

B. Storefront Framing System:

1. Description: Center set, exterior flush glazed; jambs and vertical mullions continuous; head, sill, intermediate horizontal attached by screw spline joinery or shear block attachment.
2. Components: Manufacturer's standard extruded aluminum mullions, 90 degree corner posts, entrance door framing, and indicated shapes.
3. Thermal Barrier: Provide continuous thermal barrier by means of a poured and debridged pocket consisting of a

two-part, chemically curing high density polyurethane which is bonded to the aluminum by YKK ThermaBond Plus®. Systems employing non-structural thermal barriers are not acceptable.

2.02 MATERIALS

- A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.
- B. Aluminum Sheet:
 - 1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.
 - 2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" (1.95 mm) minimum thickness.

2.03 ACCESSORIES

- A. Manufacturer's Standard Accessories:
 - 1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners.
 - 2. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.
 - 3. 0.050 Aluminum Sill Flashing End Dams must have 3 point attachment.

2.04 RELATED MATERIALS (Specified In Other Sections)

- A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.05 FABRICATION

- A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
 - 1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
 - 2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.06 FINISHES AND COLORS

- A. YKK AP America Anodized Plus® Finish:
- | CODE | DESCRIPTION |
|------|----------------------------|
| YB5N | Dark Bronze Anodized Plus® |

Anodized Plus® is an advanced sealing technology that completely seals the anodic film yielding superior durability (See AAMA 612).

- B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:
 - 1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
 - a. Exposed Surfaces shall be free of scratches and other serious blemishes.
 - b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
 - c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
 - d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.
 - 2) CASS Corrosion Resistance Test, CASS 240/ASTM B368 Test Method.
 - 3) Other AAMA 2605 Performance Tests specified in these specifications, such as: 7.3 Dry Film Hardness; 7.8.2 Salt Spray Resistance; 7.9.1.2 Color Retention, South Florida; 7.9.1.4 Gloss Retention, South Florida.

C. High Performance Organic Coating Finish:

1. Type Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with YKK AP procedures and meeting AAMA 2605 specifications.
2. Colors: Selected by Architect from the following:
 - a. Standard coating color charts.
 - b. Custom coating color charts.
 - c. Color Name and Number:

D. Finishes Testing:

1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
2. Submit samples with test area noted on each sample.

PART 3 EXECUTION**3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS**

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest installation manual is available at www.ykkap.com.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
 1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.04 INSTALLATION

- A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
 1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
 2. Shim and brace aluminum system before anchoring to structure.
 3. Provide sill flashing at exterior storefront systems. Extend extruded flashing continuous with splice joints; set in continuous beads of sealant.
 4. Verify storefront system allows water entering system to be collected in gutters and wept to exterior. Verify metal joints are sealed in accordance with manufacturers installation instructions.
 5. Locate expansion mullions where indicated on reviewed shop drawings.
 6. Seal metal to metal storefront system joints using sealant recommended by system manufacturer.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.
- B. Field Test: Conduct field test to determine watertightness of storefront system. Conduct test in accordance with AAMA 501.2.

3.06 ADJUSTING AND CLEANING

- A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.
- B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to owner's acceptance, and remove construction debris from project site. Legally dispose of debris.
- C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALL**PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes: Aluminum Curtain Wall Systems
 - 1. YKK AP Series YCW 750 Four Side SSG Aluminum Curtain Wall System
- B. Related Sections:
 - 1. Sealants: Refer to Division 7 Joint Treatment Section for sealant requirements.
 - 2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.
 - 3. Single Source Requirement: All products listed below shall be by the same manufacturer.
 - a. Section 08 32 13 Sliding Aluminum - Framed Glass Doors.
 - b. Section 08 41 13 Aluminum - Framed Entrances and Storefronts.
 - c. Section 08 44 33 Sloped Glazing Assemblies.
 - d. Section 08 51 13 Aluminum Windows.

1.02 SYSTEM PERFORMANCE DESCRIPTION

- A. Performance Requirements: Provide aluminum curtain wall systems that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test method indicated.
 - 1. Air Infiltration: Completed curtain wall systems shall have 0.06 CFM/FT² (1.10 m³/h·m²) maximum allowable infiltration when tested in accordance with ASTM E 283 at differential static pressure of 6.24 PSF (299 Pa).
 - 2. Water Infiltration: No uncontrolled water on indoor face of any component when tested in accordance with:
 - a. ASTM E 331 at a static pressure of 15 PSF (718 Pa).
 - b. AAMA 501 at a dynamic pressure of 15 PSF (718 Pa).
 - 3. Wind Loads: Completed curtain wall system shall withstand wind pressure loads normal to wall plane indicated:
 - a. Exterior Walls:
 - 1) Positive Pressure:
 - 2) Negative Pressure:
 - b. Interior Walls (Pressure Acting in Either Direction):
 - 4. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AAMA Specifications for Aluminum Structures.
 - a. For spans up to and including 13'-6" (4.1m) deflection shall be limited to L/175.
 - b. For spans greater than 13'-6" (4.1m), but less than 40'-0" (12.2m), deflection shall be limited to L/175 or L/240 + 1/4" (6.4mm).
 - c. Single lite edge of glass deflection shall be limited to 3/4" along any length of supported glass edge.
 - 5. Thermal Movement: Provide for thermal movement caused by 180 degrees F (82.2 degrees C) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.
 - 6. Thermal Performance for YCW 750 SSG when tested in accordance with AAMA 1503 and NFRC 102:
 - a. Thermal Transmittance U Value:
 - Shop Glazed: 0.36 BTU/HR/FT²/°F or less.
 - Field Glazed: 0.38 BTU/HR/FT²/°F or less.
 - b. Condensation Resistance Factor (CRF_f):
 - Shop Glazed: A minimum of 80.
 - Field Glazed: A minimum of 76.
- Note: Performance based on lab testing and will vary by glass type; see actual test reports.
- 7. Acoustical Performance: When tested in accordance with ASTM E 90 and AAMA 1801:
 - a. Sound Transmission Class (STC) shall not be less than:
 - 1" IGU; 33, 1" Laminated; 37 (Shop Glazed)
 - 1" IGU; 33, 1" Laminated; 36 (Field Glazed)
 - b. Outdoor-Indoor Transmission Class (OITC) shall not be less than:
 - 1" IGU; 26, 1" Laminated; 31 (Shop Glazed)
 - 1" IGU; 27, 1" Laminated; 31 (Field Glazed)

1.03 SUBMITTALS

- A. General: Prepare, review, approve, and submit specified submittals in accordance with “Conditions of the Contract” and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in “Conditions of the Contract.”
- B. Product Data: Submit product data for each type curtain wall series specified.
- C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.
- D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.
- E. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected in installed system.
- F. Quality Assurance / Control Submittals:
 - 1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
 - 2. Installer Qualification Data: Submit installer qualification data.
- G. Closeout Submittals:
 - 1. Warranty: Submit warranty documents specified herein.
 - 2. Project Record Documents: Submit project record documents for installed materials in accordance with Division 1 Project Closeout (Project Record Documents) Section.

1.04 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.
 - 2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.
- B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner’s and Architect’s acceptance of finish color, and workmanship standard.
 - 1. Mock-Up Size:
 - 2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
 - 3. Incorporation: Mock-up may be incorporated into final construction upon Owner’s approval.
- C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer’s installation instructions, and manufacturer’s warranty requirements.

1.05 PROJECT CONDITIONS / SITE CONDITIONS

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.06 WARRANTY

- A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official.
 - 1. Warranty Period: Manufacturer’s one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.

PART 2 PRODUCTS**CURTAIN WALL FRAMING**

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

- A. Acceptable Manufacturers: YKK AP America Inc.
 270 Riverside Parkway, Suite 100
 Austell, GA 30168
 Telephone: (678) 838-6000; Fax: (678) 838-6001
1. Curtain Wall System: YKK AP YCW 750 SSG Curtain Wall System.
 2. Substitutions are acceptable but system must meet full criteria and have storefront system in accordance with Section 08 41 13.
- B. Curtain Wall Framing System Description:
1. Two Side SSG – framing shall be thermally improved. Intermediate vertical mullions shall be structural silicone glazed with no exposed exterior aluminum. Horizontal members and jambs shall have a nominal face dimension of 2-1/2”.
 2. Four Side SSG - Intermediate vertical mullions and horizontal members shall be structural silicone glazed with no exposed exterior aluminum. Perimeter members shall include perimeter trim with 1” face dimension.

2.02 MATERIALS

- A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 and 6063-T6 Aluminum Alloys.
- B. Aluminum Sheet:
1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050” (1.27 mm) minimum thickness.
 2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080” (1.95 mm) minimum thickness.

2.03 ACCESSORIES

- A. Manufacturer’s Standard Accessories:
1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.
 2. Sealant: System sealants selected by installer are to be permanently elastic, non-shrinking, non-migrating type recommended by sealant manufacturer for joint size, movement, and compatibility.
 3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; glazing gaskets in accordance with ASTM C 864.

2.04 RELATED MATERIALS (Specified In Other Sections)

- A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.05 FABRICATION

- A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer’s recommendations.

2.06 FINISHES AND COLORS

- A. YKK AP America Anodized Plus® Finish:
- | CODE | DESCRIPTION |
|------|----------------------------|
| YB5N | Dark Bronze Anodized Plus® |

Anodized Plus® is an advanced sealing technology that completely seals the anodic film yielding superior durability (See AAMA 612).

- B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:
1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
 - a. Exposed Surfaces shall be free of scratches and other serious blemishes.
 - b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
 - c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic

Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.

d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. High Performance Organic Coating Finish:

1. Fluoropolymer Type: Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with YKK AP procedures and meeting AAMA 2605 specifications.
2. Colors: Selected by Architect from the following:
 - a. Standard coating color charts.
 - b. Custom coating color charts.
 - c. Color Name and Number:

D. Finishes Testing:

1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
2. Submit samples with test area noted on each sample.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest installation instructions are available at www.ykkap.com.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 INSTALLATION

- A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using neoprene gaskets or bituminous coating.
 2. Shim and brace aluminum system before anchoring to structure.
 3. Verify curtain wall system allows water entering system to be collected in gutters and wept to the exterior. Verify weep holes are open, and metal joints are sealed in accordance with manufacturer's installation instructions.
 4. Seal metal to metal curtain wall system joints using sealant recommended by system manufacturer.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.
- B. Field Test: Conduct field test to determine watertightness of curtain wall system. Conduct test in accordance with AAMA 501.2.

3.06 ADJUSTING AND CLEANING

- A. Adjusting: Adjust operating items as recommended by manufacturer.
- B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance, and remove construction debris from project site. Legally dispose of debris.
- C. Protection: The General Contractor shall protect installed product's finish surfaces from damage during construction.

END OF SECTION

04-3014-03

This document supersedes all previous versions.

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:
 - a. Swinging doors.
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - c. "Stile and Rail Wood Doors"
 - d. "Interior Aluminum Doors and Frames"
 - e. "Aluminum-Framed Entrances and Storefronts"
 - f. "Stainless Steel Doors and Frames"
 - g. "Special Function Doors"
 - h. "Entrances"
6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
7. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
8. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL - Underwriters Laboratories

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1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
 - b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.

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- 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
 4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
 5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.
- C. Informational Submittals:
1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.
- D. Closeout Submittals:
1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Factory order acknowledgement numbers (for warranty and service)

- d. Name, address, and phone number of local representative for each manufacturer.
- e. Parts list for each product.
- f. Final approved hardware schedule edited to reflect conditions as installed.
- g. Final keying schedule
- h. Copies of floor plans with keying nomenclature
- i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
- j. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

- 1. Submit a written report of the results of functional testing and inspection for fire door assemblies, in compliance with NFPA 80.
 - a. Written report to be provided to the Owner and be made available to the Authority Having Jurisdiction (AHJ).
 - b. Report to include the door number for each fire door assembly, door location, door and frame material, fire rating, and summary of deficiencies.
- 2. Submit a written report of the results of functional testing and inspection for required egress door assemblies, in compliance with NFPA 101.
 - a. Written report to be provided to the Owner and be made available to the Authority Having Jurisdiction (AHJ).
 - b. Report to include the door number for each required egress door assembly, door location, door and frame material, fire rating, and summary of deficiencies.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

- 1. Supplier: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 - a. Warehousing Facilities: In Project's vicinity.
 - b. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - c. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies like those indicated for this Project.
 - d. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - 1) Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- 2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
- 3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

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- a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
 4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- B. Certifications:
1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
 2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
 3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
 4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
1. Pre-installation Conference
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
 2. Electrified Hardware Coordination Conference:

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- a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) Schlage L Series: 3 year
 - b) Schlage ND Series: 10 year
 - c) Falcon: 10 year
 - 2) Exit Devices
 - a) Von Duprin: 3 year
 - 3) Closers
 - a) LCN 4000 Series: 30 year
 - 4) Automatic Operators
 - a) LCN: 2 year
 - 5) Accessories
 - a) Ives Continuous Hinges: Lifetime
 - b. Electrical Warranty
 - 1) Locks
 - a) Schlage: 1 year
 - 2) Exit Devices
 - a) Von Duprin: 1 year
 - 3) Closers
 - a) LCN: 2 year

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
2. Acceptable Manufacturers and Products:
 - a. Hager BB1191/1279 series
 - b. Bommer BB5000 series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

- a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.
11. .

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Select
 - b. Roton

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.

5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10
2. Acceptable Manufacturers and Products:
 - a. ABH PT1000
 - b. Securitron CEPT-10

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. DCI

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 MORTISE LOCKS

A. Manufacturers and Products:

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1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
8. Provide motor based electrified locksets with electrified options as scheduled in the hardware sets and comply with the following requirements:
 - a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
 - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
 - c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
 - d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate "hot levers" in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
 - e. Connections – provide quick-connect Molex system standard.
9. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: 07 (Athens)

2.08 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage ND series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

2.09 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin 99/33A series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Provide dogging indicators (CDSI/HDSI) for visible indication of dogging status.
13. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
15. Provide electrified options as scheduled.

2.10 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage/Von Duprin PS900 Series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.

2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
 - a. 12/24 VDC Output, field selectable.
 - b. Class 2 Rated power limited output.
 - c. Universal 120-240 VAC input.
 - d. Low voltage DC, regulated and filtered.
 - e. Polarized connector for distribution boards.
 - f. Fused primary input.
 - g. AC input and DC output monitoring circuit w/LED indicators.
 - h. Cover mounted AC Input indication.
 - i. Tested and certified to meet UL294.
 - j. NEMA 1 enclosure.
 - k. Hinged cover w/lock down screws.
 - l. High voltage protective cover.

2.11 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage FSIC
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide cylinders/cores, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.
 - a. Where specified, provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - 1) 3 construction control keys
 - 2) 12 construction change (day) keys.
 - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.12 KEYING

- ### A. All permanent FSIC cores, keys and keying by Owner.

2.13 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4040XP series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.14 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4600 series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide touchless actuator switches and hardwired receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.
8. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.15 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives.
2. Acceptable Manufacturers:
 - a. Trimco
 - b. Burns

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.16 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.

2. Sizes plates 1 1/2 inches (38 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.17 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
 - a. Glynn-Johnson
2. Acceptable Manufacturers:
 - a. Rixson
 - b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

2.18 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Trimco
 - b. Burns

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.19 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Zero International

2. Acceptable Manufacturers:

- a. National Guard
- b. KN Crowder

B. Requirements:

- 1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
- 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
- 3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
- 4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.20 SILENCERS

A. Manufacturers:

- 1. Scheduled Manufacturer:
 - a. Ives
- 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

- 1. Provide "push-in" type silencers for hollow metal or wood frames.
- 2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
- 3. Omit where gasketing is specified.

2.21 ROLLER LATCHES

A. Manufacturers:

- 1. Scheduled Manufacturer:
 - a. Ives
- 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

- 1. Provide roller latches with 4-7/8 inches (124 mm) strike at single doors to fit ANSI frame prep. If dummy levers are used in conjunction with roller latch mount roller latch at a height as to not interfere with proper mounting and height of dummy lever.

2. Provide roller latches with 2-1/4 inches (57 mm) full lip strike at pair doors. Mount roller in top rail of each leaf per manufacturer's template.

2.22 MAGNETIC HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. LCN
2. Acceptable Manufacturers:
 - a. No Substitute
 - b. Rixson
 - c. Sargent

B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.23 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Schlage
2. Acceptable Manufacturers:
 - a. GE-Interlogix
 - b. Securitron

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.24 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)

6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, 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. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Where on-site modification of doors and frames is required:
 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 2. Field modify and prepare existing doors and frames for new hardware being installed.
 3. When modifications are exposed to view, use concealed fasteners, when possible.
 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

- A. 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.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 4. Installation Guide for Doors and Hardware: DHI TDH-007-20

MSMC Guzman Hall Community Wellness Center

- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- H. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
 - 3. Owner to furnish permanent cores.
- I. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- N. 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 may impede traffic or present tripping hazard.
- O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

- Q. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Provide functional testing and inspection of fire door assemblies by a qualified person in accordance with NFPA 80.
 - a. Schedule fire door assembly inspection within 90 days of Substantial Completion of the Project.
 - b. Submit a signed, written final report as specified in Paragraph 1.03.E.1.
 - c. Correct all deficiencies and schedule a reinspection of fire door assemblies noted as deficient on the inspection report.
 - d. Inspector to reinspect fire door assemblies after repairs are made.
2. Provide inspection of required egress door assemblies by a qualified person in accordance with NFPA 101.
 - a. Schedule egress door assembly inspection within 90 days of Substantial Completion of the Project for the required openings.
 - b. Submit a signed, written final report as specified in Paragraph 1.03.E.2.
 - c. Correct all deficiencies and schedule a reinspection of egress door assemblies noted as deficient on the inspection report.
 - d. Inspector to reinspect required egress door assemblies after repairs are made.

3.05 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. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.07 DOOR HARDWARE SCHEDULE







- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

Hardware Group No. 01

For use on Door #(s):

1/001 1/035 1/101

Each To Have:





3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-BE-F-07		626	VON
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	PROTECTION PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 02

For use on Door #(s):

1/002	1/005	1/006	1/012	1/015	1/016
1/102	1/103	1/114	1/115	1/117	1/118
1/119	1/120				

Each To Have:

3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE LOCK	ND53JD ATH		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE





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Hardware Group No. 03

For use on Door #(s):

1/003

Each To Have:





3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	ENTRANCE LOCK	ND53JD ATH		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 04

For use on Door #(s):

1/004 1/031A 2/031A

Each To Have:





3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80JD ATH		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	OH STOP & HOLDER	450H		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 05

For use on Door #(s):

1/007 1/026B-ALT 1/033

Each To Have:





3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80JD ATH		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	OH STOP & HOLDER	450H		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 06

For use on Door #(s):

1/008 1/009 1/010 1/114A 1/122

Each To Have:

3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70JD ATH		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

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Hardware Group No. 07

For use on Door #(s):

1/014 1/023 1/024 1/028

Each To Have:

3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY W/DEADBOLT	L9440 07A 09-544 L283-722		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	PROTECTION PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 08

For use on Door #(s):

1/018

Each To Have:

2	EA	CONT. HINGE	112HD		628	IVE
2	EA	DUMMY PUSH BAR	330		626	VON
2	EA	TRIM	990-DT		626	VON
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP TOP JAMB		689	LCN
2	EA	TOP JAMB MTG PLATE	4040XP-18TJ		689	LCN
1	EA	PERIMETER GASKETING	BY ALUMINUM DOOR MANUFACTURER			
2	EA	DOOR SWEEP	8192AA		AA	ZER

Hardware Group No. 09

For use on Door #(s):

1/019

Each To Have:

2	EA	CONT. HINGE	112HD EPT		628	IVE
2	EA	POWER TRANSFER	EPT10		✓ 689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC		✓ 626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC		✓ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	MORTISE CYLINDER HOUSING	20-059 X K510-730		626	SCH
2	EA	PERMANENT CORE	BY OWNER		626	SCH
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP TOP JAMB		689	LCN
2	EA	TOP JAMB MTG PLATE	4040XP-18TJ		689	LCN
2	EA	DOOR SWEEP	8198AA		AA	ZER
1	EA	THRESHOLD	625A-223		A	ZER
1	EA	CREDENTIAL READER	BY OWNER		✓ BLK	
2	EA	DOOR CONTACT	679-05HM/WD		✓ BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK		✓	VON

MSMC Guzman Hall Community Wellness Center

Hardware Group No. 10

For use on Door #(s):

1/021 1/030

Each To Have:

1







HARDWARE BY DOOR
MANUFACTURER

Hardware Group No. 11

For use on Door #(s):

1/022

Each To Have:





3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE LOCK	ND53JD ATH		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	PROTECTION PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 12

For use on Door #(s):

1/025 1/105 1/124 1/120A

Each To Have:










3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80JD ATH		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 13

For use on Door #(s):

1/026

Each To Have:

2	EA	CONT. HINGE	112HD		628	IVE
2	EA	DUMMY PUSH BAR	330		626	VON
2	EA	TRIM	990-DT		626	VON
2	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP TOP JAMB		689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS	 ⚡	689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ		689	LCN
2	EA	ACTUATOR, TOUCHLESS	8310-813	 ⚡		LCN
1	EA	PERIMETER GASKETING	BY ALUMINUM DOOR MANUFACTURER			
2	EA	DOOR SWEEP	8192AA		AA	ZER

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Hardware Group No. 14

For use on Door #(s):

1/027 1/107

Each To Have:

2	EA	CONT. HINGE	112HD EPT		628	IVE
2	EA	POWER TRANSFER	EPT10	⚡	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	⚡	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	⚡	626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	MORTISE CYLINDER HOUSING	20-059 X K510-730		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
2	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP TOP JAMB		689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS	⚡	689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ		689	LCN
2	EA	ACTUATOR, TOUCHLESS	8310-813	⚡		LCN
2	EA	DOOR SWEEP	8198AA		AA	ZER
1	EA	THRESHOLD	625A-223		A	ZER
1	EA	CREDENTIAL READER	BY OWNER		⚡ BLK	
2	EA	DOOR CONTACT	679-05HM/WD	⚡	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK	⚡		VON
1			PROVIDE FACTORY POINT TO POINT WIRING DIAGRAMS			
1			PROVIDE RISER DIAGRAMS			

Hardware Group No. 15

For use on Door #(s):

1/026A 1/027A

Each To Have:

3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80JD ATH		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	PROTECTION PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE











MSMC Guzman Hall Community Wellness Center

Hardware Group No. 16

For use on Door #(s):

1/029

Each To Have:






1	EA	CONT. HINGE	112HD EPT		628	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	RIM HOUSING	20-079		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	PERIMETER GASKETING	BY ALUMINUM DOOR MANUFACTURER			
1	EA	DOOR SWEEP	8198AA		AA	ZER
1	EA	THRESHOLD	625A-223		A	ZER
1	EA	CREDENTIAL READER	BY OWNER		BLK	
1	EA	DOOR CONTACT	679-05HM/WD		BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK			VON

Hardware Group No. 17

For use on Door #(s):

1/026B

Each To Have:





6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
2	EA	ROLLER LATCH	RL36		630	IVE
2	EA	SINGLE DUMMY TRIM	ND170 ATH		626	SCH
2	EA	OH STOP & HOLDER	450H		630	GLY
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 18

For use on Door #(s):

1/031 1/032 1/104

Each To Have:

3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE LOCK	ND53JD ATH		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	OH STOP & HOLDER	90H		630	GLY
3	EA	SILENCER	SR64		GRY	IVE







MSMC Guzman Hall Community Wellness Center

Hardware Group No. 19

For use on Door #(s):

1/034 1/121

Each To Have:








3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-F-07		626	VON
1	EA	RIM HOUSING	20-079		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	PROTECTION PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 20

For use on Door #(s):

1/032A

Each To Have:












6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
2	EA	MANUAL FLUSH BOLT	FB358		626	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM LOCK	ND70JD ATH		626	SCH
1	EA	SINGLE DUMMY TRIM	ND170 ATH		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
2	EA	OH STOP & HOLDER	450H		630	GLY
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 21

For use on Door #(s):

1/111

Each To Have:

6	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	PANIC HARDWARE	CI-99-L-2SI-07		626	VON
1	EA	PANIC HARDWARE	LD-99-EO		626	VON
1	EA	MORTISE CYLINDER HOUSING	20-059 X K510-730		626	SCH
1	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948		626	SCH
2	EA	RIM HOUSING	20-079		626	SCH
4	EA	PERMANENT CORE	BY OWNER		626	SCH
2	EA	SURFACE CLOSER	4040XP HCUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	SET	MEETING STILE ASTRAGAL	328AA-S		AA	ZER
1	SET	GASKETING	870AA-S		AA	ZER
2	EA	DOOR BOTTOM	360AA		AA	ZER
2	EA	MOUNTING BRACKET	870SPB			ZER





MSMC Guzman Hall Community Wellness Center

Hardware Group No. 22

For use on Door #(s):

1/111A 1/111B 1/111C 1/125

Each To Have:








3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80JD ATH		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 23

For use on Door #(s):

1/112 1/113

Each To Have:







3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	PULL PLATE	8305 6" 4" X 16"		630	IVE
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	PROTECTION PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 24

For use on Door #(s):

1/123

Each To Have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10		✂ 689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-99-L-M996-07-FS		✂ 626	VON
1	EA	RIM HOUSING	20-079		626	SCH
1	EA	PERMANENT CORE	BY OWNER		626	SCH
1	EA	CREDENTIAL READER	BY OWNER		✂ BLK	
1	EA	DOOR CONTACT	679-05HM/WD		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC		✂	VON
1			PROVIDE FACTORY POINT TO			
1			POINT WIRING DIAGRAMS			
1			PROVIDE RISER DIAGRAMS			









MSMC Guzman Hall Community Wellness Center

Hardware Group No. 25

For use on Door #(s):

2/111

Each To Have:

1	EA	CONT. HINGE	224HD		628	IVE
1	EA	PANIC HARDWARE	LD-99-DT		626	VON
1	EA	SURFACE CLOSER	4040XP HCUSH		689	LCN
1	EA	PROTECTION PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP	8198AA		AA	ZER
1	EA	THRESHOLD	626A-223		A	ZER
1	EA	DOOR CONTACT	679-05HM/WD	 ✈	BLK	SCE

END OF SECTION

SECTION 08 80 00 - GLAZING

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes:
 - 1. Glass for windows, doors, interior borrowed lites, storefront framing, and glazed curtain walls.
 - 2. Glazing sealants and accessories.
- B. Related Requirements:
 - 1. Section 08 41 13 "Aluminum Framed Entrances and Storefronts".
 - 2. Section 08 41 26 "All Glass Entrances".

I.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

I.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

I.5 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 temporary protection requirements for glazing during and after installation.

I.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.
 - 1. Coated glass.
 - 2. Laminated glass.
 - 3. Insulating glass.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

I.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturers of insulating-glass units with sputter-coated, low-E coatings, glass testing agency and sealant testing agency.

Product Test Reports: For coated glass, insulating glass and glazing sealants, for tests performed by a qualified testing agency.

- I. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- C. Preconstruction adhesion and compatibility test report.
- D. Sample Warranties: For special warranties.

I.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP I Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

Comment [TAE1]:
These do not exist.

- I. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" and Section 084413 "Glazed Aluminum Curtain Walls to match glazing systems required for Project, including glazing methods.

I.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Use only materials with reliable aesthetic and functional compatibility over the design service life of the application. Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - I. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

I.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

I.11 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.
 - I. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

I.12 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - I. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - I. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - I. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products that meet the listed qualifications.
- B. Basis-of-Design Product: Guardian® Glass, LLC; SunGuard SN 68 on Clear.
- C. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
 - 1. Obtain tinted glass from single source from single manufacturer.
 - 2. Obtain reflective-coated glass from single source from single manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

- a. Wind Design Data: As indicated on Drawings.
 - b. Basic Wind Speed: As indicated on Drawings
 - c. Importance Factor: As indicated on Drawings.
 - d. Exposure Category: As indicated on Drawings.
- 3. Design Snow Loads: As indicated on Drawings.
- 4. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
- 5. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or **1 inch (25 mm)**, whichever is less, and keeps glazing retained in place with a suitable margin of safety under all design conditions. Additionally, limit the deflection of overhead glazing as necessary to prevent ponding.
- 6. Thermal Stress: Specify the glazing, under all design conditions, to resist breakage related to thermal stress.
- D. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with enhanced-protection testing requirements in ASTM E 1996 for Wind Zone I when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.
 - 1. Large-Missile Test: For glazing located within **30 feet (9.1 m)** of grade.
 - 2. Small-Missile Test: For glazing located more than **30 feet (9.1 m)** above grade.
- E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 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, according to NFRC 100 and based on latest version of LBL's WINDOW computer program, expressed as **Btu/sq. ft. x h x deg F (W/sq. m x K)**.
 - 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on latest version of LBL's WINDOW computer program.
 - 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

Comment [TAE2]:
CR Lawrence

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."
 - FGIA Publications: "AAMA GDSG-I, Glass Design for Sloped Glazing and Skylights"; "AAMA TIR A7, Sloped Glazing Guidelines"; and "IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 2. FGIA Publication for Insulating Glass: "IGMA TM-3000: North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - I. Minimum Glass Thickness for Exterior Lites: 6 mm.
- E. Strength: Provide annealed, heat-strengthened, and fully tempered glass as specified unless advance written approval of substitutions is provided by the Project Architect.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3.
- B. Low-Iron Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and solar heat gain coefficient of not less than 0.87 for a 6mm thick lite.
- C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - I. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented upon installation.
- D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - I. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented upon installation.
- E. Ceramic-Coated Spandrel Glass: ASTM C 1048, Type I, Condition B, Quality-Q3.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - I. Construction: Laminate glass with polyvinyl butyral interlayer or, ionomeric polymer interlayer to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with one of the following to comply with interlayer manufacturer's written instructions:
1. Polyvinyl butyral interlayer.
 2. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
 3. Ionomeric polymer interlayer.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 2. Spacer: Manufacturer's standard spacer material and construction.
 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

- A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Field-applied sealants shall have a VOC content of not more than 250 g/L.
 4. Sealants shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: As recommended by glazing manufacturer.

2.8 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- 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 according to 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.
- 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 by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with 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 by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in

position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE (ADD #2)

- A. Glass Type: Clear fully tempered float glass.

- 1. Minimum Thickness: 16 mm (5/8").
- 2. Safety glazing required.

Comment [TAE3]:

Upon further review of CR Lawrence

You can probably take out laminated references if you only need monolithic glass.

3.9 INSULATING GLASS SCHEDULE

- A. Glass Type: Low-E-coated, clear insulating Vision glass.
 - 1. Basis-of-Design Product: Guardian Glass, LLC; **SunGuard SuperNeutral 68 on Clear**.
 - 2. Overall Unit Thickness: 1 inch.
 - 3. Thickness of Each Glass Lite: 1/4 inch (6 mm).
 - 4. Outboard Lite: Sputter-coated Guardian clear glass.
 - a. Coating on Surface No. 2: Guardian SunGuard SN 68.
 - b. Heat Treatment: Provide Annealed glass unless otherwise identified as Heat Strengthened (H) or Fully Tempered (T) on drawings.
 - 5. Interspace Content: Argon filled, 12 mm (1/2 inch) wide, hermetically sealed.
 - 6. Inboard Lite: Guardian clear float glass.
 - a. Heat Treatment: Provide Annealed glass unless otherwise identified as Heat Strengthened (H) or Fully Tempered (T) on drawings.
 - 7. Glass Unit Performance Characteristics:

- a. Visible Light Transmittance: 68 percent minimum.
 - b. Solar Heat Gain Coefficient: 0.37 maximum.
 - c. Winter Nighttime U-Factor: 0.25 percent maximum.
 - d. Summer Daytime U-Factor: 0.22 maximum.
8. Safety glazing as required.

END OF SECTION 08 80 00

SECTION 09 29 00 - GYPSUM BOARD

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
 - 3. Texture finishes.
- B. Related Requirements:
 - 1. Section 06 16 00 "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Section 09 30 13 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

I.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

I.4 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.

I.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or 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 according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Low Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 75 percent.
- B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- C. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site.
- D. 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. 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. CertainTeed Corporation;
 - 2. Georgia-Pacific Building Products.
 - 3. National Gypsum Company;
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 1/2 inch (12.7 mm).
 - 2. Long Edges: Tapered.

- D. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, Level 2.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
 - 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 Gypsum; AquaBloc® Gypsum Wallboard.
 - b. CertainTeed Corporation; GlasRoc Tile Backer.
 - c. Georgia-Pacific Building Products.
 - 2. Core: As indicated on Drawings.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
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. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 75 percent.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant.
 - b. Pecora Corporation; AC-20 FTR.
 - c. United States Gypsum Company; SHEETROCK Acoustical Sealant.
 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-)wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-)wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: As indicated on Drawings.
 - 2. Type X: As indicated on Drawings.
 - 3. Ceiling Type: As indicated on Drawings.
 - 4. Abuse-Resistant Type: All interior walls.
 - 5. Moisture- and Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying face layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

- A. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 - 2. Level 5: All gypsum wall board facing and adjacent to clerestory windows, in rooms or spaces that feature multiple mulled window units.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.7 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 30 00 - TILING

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - 1. Ceramic tile.
 - 2. Stone thresholds.
 - 3. Waterproof membrane.
 - 4. Crack isolation membrane.
 - 5. Tile backing panels.
 - 6. Metal edge strips.
- B. Related Sections:
 - 1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Section 09 29 00 "Gypsum Board" for cementitious backer units.

I.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

I.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
 - 3. Full-size units of each type of trim and accessory for each color and finish required.
 - 4. Stone thresholds in 6-inch (150-mm) lengths.
 - 5. Metal edge strips in 6-inch (150-mm) lengths.

I.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product, signed by product manufacturer.
- D. Material Test Reports: For each tile-setting and -grouting product.

I.6 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

I.7 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - 1. Stone thresholds.

2. Waterproof membrane.
3. Crack isolation membrane.
4. Joint sealants.
5. Cementitious backer units.
6. Metal edge strips.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of floor tile installation.
2. Build mockup of wall tile installation.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

I.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

I.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

- C. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.
- D. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - I. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

- A. Tile Type: Factory-mounted unglazed porcelain tile.
 - I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Daltile
 - 2) Refer to Architectural Finish Schedule (A11.X)
 - 2. Composition: Porcelain.
 - 3. Module Size: Indicated on Drawings
 - 4. Thickness: Indicated on Drawings
 - 5. Tile Color and Pattern: as indicated..
 - 6. Grout Color: As selected by Architect from manufacturer's full range.
 - 7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cove: Cove, module size
 - b. Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size as selected from full range of choices..
 - c. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 2 by 1 inch (50.8 by 25.4 mm).
 - d. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - e. External Corners for Thin-Set Mortar Installations: Surface bullnose, module size 2 by 1 inch (50.8 by 25.4 mm).
 - f. Internal Corners: Field-buttet square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
 - g. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.

2.3 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - I. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
- B. Granite Thresholds: ASTM C 615, with honed finish.
 - I. Description: Uniform, medium-grained, gray stone without veining.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.
 - I. Products: Subject to compliance with requirements, provide the following:
 - a. Custom Building Products; Wonderboard.
 - b. Georgia-Pacific Building Products.
 - c. United States Gypsum Company; DUROCK Cement Board.
 - d. National Gypsum.
 - 2. Thickness: 5/8 inch (15.9 mm).

2.5 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 - I. Products: Subject to compliance with requirements, provide the following:
 - a. Bonsal American, an Oldcastle company.
 - b. Bostik, Inc; Durabond D-222 Duraguard Membrane.
 - c. Laticrete International, Inc; LATICRETE Hydro Ban.
 - d. MAPEI Corporation; Mapelastic AquaDefense.
 - e. Custom Building Products; Red Gard.

2.6 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

I. Products: Subject to compliance with requirements, provide the following:

- a. Bostik, Inc; Durabond D-222 Duraguard Membrane.
- b. Custom Building Products; Red Gard.
- c. Laticrete International, Inc; LATICRETE Hydro Ban.
- d. MAPEI Corporation; Mapelastic CI.

2.7 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
4. For tiles with facial dimension of 15" , provide (LHT Mortar) that complies with requirements for nonsagging mortars in addition to other requirements meeting both ANSI 118.4 and 118.15, Improved Dry-Set Cement mortars.

2.8 GROUT MATERIALS

A. High Performance Cement Tile Grout: ANSI A118.7.

1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
2. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

2.9 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 079200 "Joint Sealants."

1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

I. Products: Subject to compliance with requirements, provide the following:

- a. DAP Products Inc; Titanium Enriched Kitchen and Bath Sealant.

- b. Dow Corning Corporation; Dow Corning 786.
 - c. GE Silicones; Sanitary 1700.
 - d. Laticrete International, Inc; Latasil Tile & Stone Sealant.
 - e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - f. Tremco Incorporated; Tremsil 600 White.
 - g. Custom Building Products; 100% Silicone Caulk.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
- I. Products: Subject to compliance with requirements, provide the following:
- a. Bostik, Inc; Chem-Calk 550.
 - b. Degussa Building Systems; Sonneborn Sonolastic SL 2.
 - c. Pecora Corporation; Dynatrol II-SG.
 - d. Sika Corporation; Sikaflex-2c SL.
 - e. Tremco Incorporated; Vulkem 245.
- E. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.

2.10 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
- C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
- 1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
 - 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.
- I. Products: Subject to compliance with requirements,
- a. Bonsal American, an Oldcastle company; Grout Sealer.
 - b. Bostik, Inc; CeramaSeal Grout & Tile Sealer.
 - c. MAPEI Corporation.
 - d. Aqua Mix; Sealers Choice Gold.

- e. Custom Building Products; Grout and Tile Sealer.
- f. Summitville Tiles, Inc; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.provide the following:

2.11 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and

match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

- A. Comply with TCNA's latest 2016 "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - I. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Exterior tile floors.
 - b. Tile floors in wet areas.
 - c. Tile swimming pool decks.
 - d. Tile floors in laundries.
 - e. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - f. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tilesheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
- F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated and as noted in ANSI and TCNA EJ171-16. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
 2. Do not extend waterproofing or crack isolation membrane under thresholds set in latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on, waterproofing, or crack isolation membrane with elastomeric sealant.
- I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

- A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove latex-portland cement grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 00

SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS

PART I - GENERAL

I.1 RELATED DOCUMENTS

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

I.2 SUMMARY

- A. This Section includes the following:
 - 1. Ceilings consisting of acoustical tiles and suspension systems.
 - 2. Edge moldings.

I.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Verification: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
 - 1. Full-size samples of each acoustical tile type, pattern, and color.
 - 2. Set of 12-inch- long samples of exposed moldings for each color and system type required.
- C. Product Test Reports: Indicate compliance of acoustical tile ceilings and components with requirements based on comprehensive testing of current products.

I.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed acoustical tile ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations for Ceiling Units: Obtain each acoustical ceiling tile from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Source Limitations for Suspension System: Obtain each suspension system from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
 - 1. Obtain both acoustical ceiling tiles and suspension system from the same manufacturer.

I.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

I.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

I.7 COORDINATION

- A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

I.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of amount installed.
 - 2. Suspension System Components: Quantity of each grid and exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Refer to Architectural Finish Schedule (A11.1) for basis of design products.
 - a. Armstrong World Industries, Inc.

2.2 ACOUSTICAL TILES, GENERAL

- A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

- I. Mounting Method for Measuring Noise Reduction Coefficient: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
- C. Antimicrobial Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial solution consisting of a synergistic blend of substituted ammonium salts of alkylated phosphoric acids admixed with free alkylated phosphoric acid that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.
- D. Tile Characteristics: Comply with requirements indicated in the Finish Key Schedule located on Construction Drawings, including those referencing ASTM E 1264 classifications.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 - I. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- C. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table I, Direct Hung, unless otherwise indicated.
 - I. Postinstalled Powder-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 per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class I zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table I, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- E. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical tile edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
 - I. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.4 EDGE MOLDING

- A. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's product designations, including splice plates, corner pieces, and attachment and other clips, complying with the following requirements:
 - I. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong World Industries, Inc.

2.5 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and the following requirements:
 - I. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - I. Acoustical Sealant for Exposed and Concealed Joints:
 - a. PL Acoustical Sealant; ChemRex, Inc., Contech Brands.
 - b. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
 - c. SHEETROCK Acoustical Sealant; United States Gypsum Co.
 - 2. Acoustical Sealant for Concealed Joints:
 - a. BA-98; Pecora Corp.
 - b. Tremco Acoustical Sealant; Tremco, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical tile ceilings.
 - I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips and other ceiling anchors whose installation is specified in other sections.
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical tile ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
 - 2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - 3. U.B.C.'s "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings": U.B.C. Standard 25-2.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. 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.
 - 4. 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 6. 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 structure to which hangers are attached and 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.
 - 7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
 - 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; and provide hangers not more than 8 inches from ends of each member.
- 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 tile ceiling area and where necessary to conceal edges of acoustical units.
 - 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, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. 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. Arrange directionally patterned acoustical tiles as follows:
 - 1. As indicated on reflected ceiling plans.
- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
 - 1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
 - 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches o.c.
 - 3. Fabricate access units for special suspension system access members and tile units modified as required to allow for removal of access units.
 - 4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23

SECTION 09 68 13 - TILE CARPETING

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes modular, tufted carpet tile.
- B. Related Requirements:
 - 1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

I.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

I.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.

8. Type, color, and location of insets and borders.
 9. Type, color, and location of edge, transition, and other accessory strips.
 10. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet Tile: Full-size Sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-(300-mm-)long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- E. Sustainability: Provide the Statement of the Achievement Level the carpet has attained for Gold, 52 to 70 points, based on specific Sustainable Attribute Performance for all product stages according to ANSI/NSF 140.

I.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

I.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

I.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

I.8 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Master II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

I.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

I.10 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

I.11 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, loss of tuft bind strength, loss of face fiber,, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE.

- A. Products: Subject to compliance with requirements, provide the following
 - 1. Basis of Design Product: products as listed on the finish schedule.
- B. Primary Backing/Backcoating: Reinforced polyurethane composite cushion.
- C. Size: 24 by 24 inches (610 by 610 mm).
- D. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- E. Antimicrobial Treatment: Manufacturer's standard material.
- F. See schedules for design products which are to be matched for Color, Pattern, Fiber Type, Pile Characteristic, Yarn Twist, Yarn Count, Density, Pile Thickness, Stitches, Gage, Surface Pile Weight, Total Weight, Primary Backing, Secondary Backing, Backing System and performance characteristics.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - I. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - I. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions **1/8 inch (3 mm)** wide or wider and protrusions more than **1/32 inch (0.8 mm)** unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 91 23 - INTERIOR PAINTING

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Cast iron.
 - 5. Galvanized metal.
 - 6. Aluminum (not anodized or otherwise coated).
 - 7. Wood.
 - 8. Gypsum board.
- B. Related Requirements:
 - 1. Section 09 91 13 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 2. Section 09 93 00 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

I.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

I.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. 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 (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

I.5 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

I.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. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

I.7 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
 - 1. Product name and type (description).
 - 2. Batch date.
 - 3. Color number.
 - 4. VOC content.
 - 5. Environmental handling requirements.
 - 6. Surface preparation requirements.
 - 7. Application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

I.9 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
 - 1. Sherwin Williams
- B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
 - 1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Dry-Fog Coatings: 400 g/L.
 4. Primers, Sealers, and Undercoaters: 200 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
 8. Floor Coatings: 100 g/L.
 9. Shellacs, Clear: 730 g/L.
 10. Shellacs, Pigmented: 550 g/L.
- D. Colors: As selected by Architect from manufacturer's full range unless indicated in the finish schedule.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Gypsum Board: 12 percent.
 - e. Plaster: 12 percent.
 2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

3. Plaster Substrates: Verify that plaster is fully cured.
 4. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated, also refer to notes on finish schedule.
- 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.
- I. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
- I. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- I. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 2. Sand surfaces that will be exposed to view, and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 23

SECTION 101423.13 - ROOM-IDENTIFICATION SIGNAGE

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 room-identification signs that are directly attached to the building.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements[, **including raised characters and Braille**], and layout for each sign at least [**half size**]
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Room-Identification Signs: [**Full-size Sample**] <Insert size>.

2. Variable Component Materials: [**Full-size Sample**] [**8-inch (200-mm) Sample**] <Insert size> of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
 3. Exposed Accessories: [**Full-size Sample**] [**Half-size Sample**] <Insert size> of each accessory type.
 4. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials[, **from the same product run,**] that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Variable Component Materials: [**12**] <Insert number> replaceable text inserts and interchangeable characters (letters, numbers, and graphic elements) of each type.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: [**Manufacturer of products**]

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify locations of [**anchorage devices**] embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 2. Warranty Period: [**Five**] <Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in [**the USDOJ's "2010 ADA Standards for Accessible Design"**] [**and**] [**ICC A117.1**]

2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Signage: [**Sign**] to be installed with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles. Refer to A10 series for additional information.

2.3 SIGN MATERIALS

- A. Aluminum Sheet and Plate: **ASTM B 209 (ASTM B 209M)**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- D. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings[**and suitable for exterior applications**].
- E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
 - b. Fastener Heads: Use [**flathead**] [**or**] [**oval countersunk**] <Insert shape> screws and bolts with tamper-resistant [**Allen-head**] [**spanner-head**] [**or**] [**one-way-head**] <Insert slot design> slots unless otherwise indicated.
 - 3. Sign Mounting Fasteners:

- a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
 - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.
- D. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.
- E. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [Class I, 0.018 mm] [Class II, 0.010 mm] or thicker.
- B. Color Anodic Finish: AAMA 611, [Class I, 0.018 mm] [Class II, 0.010 mm] or thicker.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls [**as indicated on Drawings**] [**and**] [**according to the accessibility standard**]
- C. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 - 2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 - 3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 - 4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support

- weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
5. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips [**0.250 inch (6.35 mm)**] <Insert dimension> away from edges to prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.
 6. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.

3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423.13

SECTION 10 23 10 - GLAZED INTERIOR WALL AND DOOR ASSEMBLIES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Frameless glazed interior wall and door assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
 - 1. Require attendance by representatives of installer, other entities directly affecting, or affected by, construction activities of this section.
 - 2. Notify Architect four calendar days in advance of scheduled meeting date.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each component in partition assembly.
- C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
 - 1. Include field measurements of openings.
 - 2. Include Elevations Showing:
 - a. Locations and identification of manufacturer-supplied door hardware and fittings.
 - b. Locations and sizes of cut-outs and drilled holes for other door hardware.
 - 3. Include Details Showing:
 - a. Requirements for support and bracing of overhead track.
 - b. Installation details.
 - c. Appearance of manufacturer-supplied door hardware and fittings.
- D. Selection Samples: Two sets, representing manufacturer's full range of available metal materials and finishes.
- E. Verification Samples: Two samples, minimum size 2 by 3 inches (50 by 75 mm), representing actual material and finish of exposed metal.
- F. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, showing loads at points of attachment to the building structure.
- G. Certificates: Contractor to certify that installer of partition assemblies meets specified qualifications.

- H. Operation and Maintenance Data: For manufacturer-supplied operating hardware.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Specimen Warranty.
- K. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Minimum three years of experience designing, assembling, and installing partition assemblies similar to those specified in this section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until installation.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after date of Substantial Completion.
- C. Provide five year manufacturer warranty against excessive degradation of metal finishes. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Frameless Glazed Interior Wall and Door Assemblies:
 - 1. C.R. Laurence Co., Inc; CRL Clear View Series Frameless Glass Wall Office System: www.crl-arch.com.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMELESS GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

- A. Frameless Glazed Interior Wall Assembly: Factory fabricated assemblies consisting of full-width and height glass panels fastened with low profile sidelite aluminum rail fittings on top and bottom edge of glass wall.
 - 1. Configuration: As indicated on drawings.
 - 2. Full Length Top and Bottom Sidelite Rails: 2-5/16 inch (59 mm) high by 1-1/2 inch (38 mm) deep with end caps.
 - 3. Sidelite Fittings, Clad Finish: Satin Anodized.
 - 4. Glass Thickness: 1/2 inch (12.7 mm), tempered.
 - 5. Designed to withstand normal operation without damage, racking, sagging, or deflection.
 - 6. Coordinate wall and door assembly preparation and provide hardware as necessary for fully operable installation.
 - 7. Finished metal surfaces protected with strippable film.
 - 8. Factory assembled to greatest extent practical; may be disassembled to accommodate shipping constraints.
- B. Pivoting Glass Doors: Full length dry glazed rail fittings.
 - 1. Door Configuration: As indicated on drawings.
 - 2. Full Length Top and Bottom Rails: 2-5/16 inch (59 mm) high by 1-1/2 inch (38 mm) deep with end caps.
 - 3. Glass Thickness: 1/2 inch (12.7 mm), tempered.
 - 4. Sidelite Rails: Match door rail sightlines and finish.
 - 5. Aluminum Finish: Satin Anodized
 - 6. Door Hardware: Locking ladder pulls, brushed stainless steel.
 - 7. Provide accessories as required for complete installation.
 - 8. Basis of Design: C.R. Laurence Co., Inc; CRL Wedge-Lock Low Profile Door Rail System: www.crl-arch.com.

- D. Other Manufacturers: Not permitted; provide the product identified as "Basis of Design".

2.03 FITTINGS AND HARDWARE

- A. Operable Panel Hardware: Coordinate with additional requirements as specified in Section 08 7100.

2.04 MATERIALS

- A. Glass: Flat glass meeting requirements of ASTM C1036, Type I - Transparent Flat Glass, Class 2 - Tinted, Quality Q3, fully tempered in accordance with ASTM C1048, Kind FT, and as follows:
 - 1. Thickness: As indicated.
 - 2. Color: Grey tint; low iron.
 - 3. Prepare glazing panels for indicated fittings and hardware before tempering.
 - 4. Polish edges that will be exposed in finished work to bright flat polish.
 - 5. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.
- B. Aluminum Components: Conforming to ASTM B221 (ASTM B221M), Alloy 6063, T5 Temper.
- C. Sealant: One-part silicone sealant, conforming to ASTM C920, clear.

2.05 FINISHES

- A. Class I Anodized Aluminum Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that track supports are properly braced, level within 1/4 inch (6 mm) of required position and parallel to the floor surface.
- C. Verify floor flatness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.
- D. Do not begin installation until supports and adjacent substrates have been properly prepared.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean substrates thoroughly prior to installation.
- B. Prepare substrates using the methods recommended by the manufacturer for achieving acceptable result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with glazed interior wall and door assembly manufacturer's instructions.
- B. Fit and align glazed interior wall and door assembly level and plumb.

3.04 ADJUSTING

- A. Adjust glazed interior wall and door assembly to operate smoothly from sliding or pivoting positions.
- B. Adjust swing door hardware for smooth operation.

3.05 CLEANING

- A. Clean installed work to like-new condition.
- B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. Demonstrate operation of glazed interior wall and door assembly and identify potential operational problems.

3.07 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before date of Substantial Completion.

END OF SECTION

SECTION 10 44 00 – FIRE EXTINGUISHERS & FIRE PROTECTION CABINETS

PART I - GENERAL

I.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.

I.2 SUMMARY

- A. Section Includes:
 - I. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - I. Section 21 12 00 "Fire-Suppression Standpipes" for fire-hose connections.

I.3 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - I. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

I.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
 - I. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches (150 by 150 mm) square.

- F. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

I.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

I.6 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.

I.7 SEQUENCING

- A. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FIRE EXTINGUISHER

- A. Provide fire extinguishers to meet NFPA Standards. The extinguisher shall be the dry power type, ten pound, rated 4A.60B.C., unless authorities having jurisdiction specify otherwise.

2.3 FIRE-PROTECTION CABINET

Recessed Canopy Cabinet Type: Suitable for fire extinguisher

- I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Fire Equipment, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division.
 - d. Larsens Manufacturing Company.
- B. Cabinet Construction: Non Rated unless in fire rated walls, then the cabinet fire rating to match walls rating.

- I. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
 - I. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
 - I. In GWB walls: Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
 2. In Masonry: Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Steel sheet
- G. Door Style: Full acrylic bubble, frameless
- H. Door Glazing: Molded acrylic bubble.
 - I. Acrylic Bubble Color: Clear, transparent.
- 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 recessed 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. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 3. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 4. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 5. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate [as indicated] [as directed by Architect] <Insert location>.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: White.
 - 4) Orientation: Vertical

6. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.

K. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.
2. Transparent Acrylic Sheet: ASTM D 4802, Category A-I (cell-cast sheet), [1.5] [3] [6] mm thick, with Finish I (smooth or polished).

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum **1/2 inch (13 mm)** thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for 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 Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply vinyl lettering at locations indicated.

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 44 13

SECTION 10 21 00 - COMPARTMENTS AND CUBICLES

GENERAL

I.1 SECTION INCLUDES

- A. Compartments and Cubicles of the Following Types:
 - 1. High-density polymer compartments and cubicles.

I.2 RELATED SECTIONS

- A. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.
- B. Section 22 40 00 - Plumbing Fixtures.

I.3 REFERENCES

- A. ADA - Americans with Disabilities (ADA) Standards for Accessible Design.
- B. ANSI A117.1 - American National Standard for Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
- C. ANSI A208.1 - Mat Formed Wood Particleboard.
- D. ASTM International (ASTM)
 - 1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM A666 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 3. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- E. NEMA LD-3 - High Pressure Decorative Laminates.
- F. UFAS - Uniform Federal Accessibility Standards.

I.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Literature indicating typical panel, pilaster, door, hardware and fastening.
 - 2. Preparation instructions and recommendations. Storage and handling requirements and recommendations.
 - 3. Installation methods. Maintenance instructions.
- C. Shop Drawings: Dimensioned plans indicating layout of toilet partitions. Dimensioned elevations indicating heights of doors, pilasters, separation partitions, and other components; indicate locations and sizes of openings in compartment separation partitions for toilet and bath accessories to be installed in partitions; indicate floor and ceiling clearances. Details indicating anchoring components (bolt layouts) and methods for project conditions; indicate components required for installation, but

not supplied by compartment and cubicle manufacturer.

- D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, texture and pattern.

I.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Lay cartons flat, with adequate support to ensure flatness and to prevent damage to pre-finished surfaces. Do not store where ambient temperature exceeds 120 degrees F (49 degrees C).

I.6 PROJECT CONDITIONS

- A. Do not deliver materials or begin installation until building is enclosed, with complete protection from outside weather, and building temperature maintained at a minimum of 60 degrees F (15.6 degrees C).

I.7 QUALITY ASSURANCE

- A. Products and installation shall comply with the following: ADA Standards, ANSI A117.1, as applicable to the Project.
- B. Coordinate Work with placement of support framing and anchors in walls and ceilings.

I.8 WARRANTY

- A. Manufacturer's Warranty for Partitions: Provide manufacturer's standard limited warranty and as follows.
 - I. High Density Polymer Partitions: 25 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: General Partitions Mfg. Corp., which is located at: 1702 Peninsula Dr. P. O. Box 8370; Erie, PA 16505; Tel: 814-833-1154; Fax: 814-838-3473; Email: [request info \(info@generalpartitions.com\)](mailto:requestinfo@generalpartitions.com); Web: <https://www.generalpartitions.com>
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 HIGH DENSITY POLYMER (HDP) UNITS

- A. Toilet Partitions:
 - I. Privacy Door Configuration: Continuous aluminum hinge with overlapping strike, no sight gaps at doors.
- B. Urinal Screens:
 - I. Model FBS-7, Floor Braced Screens: Screens attached to wall and braced by pilasters anchored to floor.
 - a. Urinal Screen Height: 54 inches (1372 mm).
 - b. Urinal Screen Width: 24 inches (457 mm).

- c. Pilaster Height: 70 inches (1778 mm). 75.5 inches (1918 mm) for Eastern Max Pilaster Thickness: 1 inch (25 mm). Pilaster Trim: Minimum 3 inches high 0.031 inch thick (76 mm by 0.76 mm thick) stainless steel or solid plastic shoe.

C. Construction:

- 1. High density polymer panels and doors, molded under pressure from high density polymer resin with uniform color throughout.
- 2. Absorption: Resistant to delamination, water, steam, corrosion, soaps, detergents, and mildew. Material shall not absorb odors.
- 3. Graffiti Resistance: Self-lubricating surface that is graffiti resistant to markings from pen, pencil, marker, and paint.
- 4. Edges: Machine radius eliminating sharp edges.
- 5. Surface texture: Orange peel.
- 6. Finishes: Refer to finish schedule.
- 7. Heat Sinks: Provide 1/8 inch (3 mm) aluminum strips integral to bottom edges of panels and doors to protect panel from being ignited by vandals.

2.3 FITTINGS AND ANCHORS

A. Fittings:

- 1. Connection Brackets: Heavy duty continuous extruded aluminum, or plastic 54 inches (1372 mm) high.
- 2. Pilaster Trim: Minimum 3 inches high 0.031 inch thick (76 mm by 0.76 mm thick) stainless steel shoe.
- 3. Pilaster Trim: Minimum 3 inches high 0.031 inch thick (76 mm by 0.76 mm thick) stainless steel or solid plastic shoe.

2.4 HARDWARE

A. Hinges:

- 1. Aluminum continuous hinges.

B. Combination Latch Keeper and Door Stop with Rubber Bumper: Extruded aluminum. cast alloy, chrome plated or Cast Stainless

PART 3 EXECUTION

3.1 INSTALLATION

- A. Examine existing conditions prior to installation. Do not begin installation until installation conditions and substrates have been properly prepared.
- B. Install compartments and cubicles in accordance with manufacturer's instructions and approved submittals. Pilasters intersecting adjacent walls shall extend to finished floor. Attach panels and pilasters to brackets with sheet metal screws.
 - 1. Anchor pilaster to floor with two 3/8 inch (10 mm) threaded steel studs and leveling nuts and washers. Adjust pilaster support to compensate for floor variations. Conceal floor fastenings with pilaster shoes.
- C. Door Installation: Hang doors from pilasters. Equip each door with the following:
 - 1. Hinges: Full length continuous hinge.

2. Door latch.
 3. Door strike and keeper.
- D. Erection Tolerances: Maximum variation from true position: 1/4 inch (6 mm). Maximum variation from plumb: 1/8 inch (3 mm).

3.2 ADJUSTING AND CLEANING

- A. Carefully remove and dispose all protective vinyl from partitions.
- B. Adjust hinges and align hardware to uniform clearance at vertical edge of doors.
- C. Clean surfaces and wash with mild soap. Do not use abrasives.

END OF SECTION

SECTION 12 24 13 - WINDOW ROLLER SHADES

GENERAL

1.1 SECTION INCLUDES

- A. Roller shades for manual operation and accessories.
- B. Shade fabric.

1.2 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.
- B. Section 09 21 16 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.
- C. Section 09 51 00 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
 - 2. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- C. Underwriters Laboratories (UL):
 - 1. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
- D. Window Covering Manufacturers Association (WCMA):
 - 1. WCMA A100.1 - Safety of Window Covering Products; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Preinstallation Meeting: One week prior to commencing work related to this section. Require attendance of all affected installers.
- C. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog pages and data sheets for products specified including materials, finishes, dimensions, profiles, mountings, and accessories.
 - 1. Preparation instructions and recommendations.
 - 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, accessories, and operating instructions.
 - 3. Storage and handling requirements and recommendations.
 - 4. Mounting details and installation methods.
 - 5. Manufacturer's Instructions: Include storage, handling, protection, examination, preparation, and installation.
 - 6. Project Record Documents: Record actual locations of control system components and show interconnecting wiring.
 - 7. Operation and Maintenance Data: Component list with part numbers, and operation and maintenance instructions.
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
 - 1. Prepare shop drawings on AutoCad or MicroStation format using base sheets provided electronically by the Architect.
- D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
- E. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements.
 - 1. Shadecloth Sample: Mark face of material to indicate interior faces.
 - a. Test reports indicating compliance with specified fabric properties.
 - b. Verification Samples: 6 inches (150 mm) square, representing actual materials, color and pattern.
- F. Maintenance Data: Bill of materials for all components with part numbers. Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- G. Warranty: Provide manufacturer's warranty documents as specified in this Section.
- H. Warranty: Manufacturer's warranty documents as specified in this Section.

1.6 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- B. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.
- C. Installer for Roller Shade System - Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

- D. Product Listing Organization Qualifications: Organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- F. Shadecloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC9644, ATCC9645.
- G. Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified. Initial submittals, which do not include the Environmental Certification will be rejected. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.
- H. Third Party Evaluation: Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.
- I. Recycling Characteristics: Provide documentation that the shade cloth can, and is part of a closed loop of perpetual use and not be required to be down cycled, incinerated or otherwise thrown away. Scrap material can be sent back to the mill for reprocessing and recycling into the same quality yarn and woven into new material, without down cycling. Certify that this process is currently underway and will be utilized for this project.
- J. Perpetual Use Certification: Certify that at the end of the useful life of the shade cloth, that the material can be sent back to the manufacturer for recapture as part of a closed loop of perpetual use and that the material can and will be reconstituted into new yarn, for weaving into new shade cloth. Provide information on each shade band indicating that the shade band can be sent back to the manufacturer for this purpose.

1.7 MOCK-UP

- A. Provide a mock-up of one roller shade assembly for evaluation of mounting, appearance and accessories.
 - 1. Locate mock-up in window designated by Architect.
 - 2. Mockup Size: Full size.
 - 3. Mockup Size (WxH): 3 x 3 feet (0.94 x 0.94 m) minimum.
 - 4. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
 - 5. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
 - 6. Do not proceed with remaining work until, mock-up is accepted by Architect.
 - 7. Retain mock-up during construction as a standard for comparison with completed work.
 - 8. Do not alter or remove mock-up until work is completed or removal is authorized.
 - 9. Full-sized mock-up may become part of the final installation.
 - 10. Full-sized mock-up will become the property of the Owner to be used for spare parts.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in Window Treatment Schedule.
- B. Store and handle products per manufacturer's recommendations.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 WARRANTY

- A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating warranty for interior shading.
 - 1. Shade Hardware: 10 years unless otherwise indicated.
 - a. Mecho/5 and Mecho/5X with ThermoVeil, EuroVeil, EuroTwill, Soho, Equinox, Midnite, Chelsea, or Classic Blackout shade fabric: 25 years.
 - b. Mecho/7 including bead chain with ThermoVeil, EuroVeil, EuroTwill, Soho, Equinox, Midnite, Chelsea, or Classic Blackout shade fabric: 25 years.
 - 2. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.
 - 3. Ecoveil Shadecloth: Manufacturer's standard ten year warranty.
 - 4. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas, which are deemed owner's responsibility.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Mecho, which is located at: 42-03 35th St.; Long Island City, NY 11101; ASD Tel: 718-729-2020; Fax: 718-729-2941; Email: marketing@mechoshade.com; Web: www.mechoshade.com.
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 ROLLER SHADES, MANUAL OPERATION AND ACCESSORIES

- A. Shade System; General:
 - 1. Components capable of being removed or adjusted without removing mounted shade brackets, or cassette support channel.
 - 2. Smooth operation raising or lowering shades.
 - 3. Cradle-to-Cradle certified for the complete shade system including operating hardware and shadecloth. Listed in C2C (DIR).
- B. Basis of Design: Mecho/7 System as manufactured by Mecho.
 - 1. Description: Manually operated fabric window shades.
 - a. Shade Type: Single Roller.
 - b. Shade Type: Double Roller.
 - c. Universal drive capability to offset drive chain for reverse or regular roll shades.

- d. Drop Position: Regular roll.
 - e. Drop Position: Reverse roll.
 - f. Mounting: Ceiling mounted.
 - g. Mounting: Recessed in ceiling pocket.
 - h. Mounting: Wall Mounted.
 - i. Mounting: Window Jamb Mounting.
 - j. Mounting: _____.
 - k. Size (WxH): _____.
 - l. Size: As indicated on drawings.
 - m. Fabric: As indicated under Shade Fabric article.
2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
- a. Material: Steel, 1/8 inch (3 mm) thick.
 - b. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
 - 1) Light-Filtering Fabric: Room-side of opening.
 - 2) Light-Filtering Fabric: Glass-side of opening.
 - 3) Room-Darkening Fabric: Room-side of opening.
 - 4) Room-Darkening Fabric: Glass-side of opening.
 - 5) Operating chain pulls for both fabrics configured for the same side of the window.
 - 6) Operating chain pulls for each fabric configured for opposite sides of the window.
 - c. Single Shade Operation Width: Up to 180 inches (4572 mm) dependent on fabric.
 - d. Multiple Shade Band Operation: Provide hardware as necessary to operate a maximum of six shade bands, totaling up to 50lbs hanging weight or 360 inches (9144 mm) wide; depending on fabric weight whichever is greater, using a single clutch operator.
 - e. Radiused Center Support Brackets: Provide brackets and connectors for radiused window applications.
 - 1) Maximum Offset: Eight degrees on each side for a 16 degree total offset.
3. Roller Tubes:
- a. Material: Extruded aluminum.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
 - d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
4. Hembars: Designed to maintain bottom of shade straight and flat.
- a. Style: Full wrap fabric-covered bottom bar, flat profile with heat sealed closed ends.
 - b. Style: Exposed aluminum bottom bar with matching finials.
 - 1) Profile: Rectangular.
 - 2) Profile: _____.
 - 3) Color: Manufacturer's standard color coordinated with shade fabric selected.

- 4) Color: To be selected by Architect from manufacturer's standard color selection.
 - 5) Color: _____.
 - 6) Color: As indicated on the Drawings.
- c. Style: _____.
- d. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
 - a. Heavy-duty, 1/8" steel mounting bracket and integrated steel brake, clutch and sprocket assembly rigidly affix the shade support and user control to the building structure fully independent of the roller tube components.
 - b. Permanently lubricated maintenance-free brake assembly employs an oil-impregnated steel hub with wrapped spring clutch.
 - c. Brake must withstand minimum pull force of 50 pounds (22.7 kg) in the stopped position.
 - d. Direct drive clutch requires no interstitial gear stages or plastic parts between the building structure and clutch ensuring reliable operation across the full range of shade sizes.
 - e. Urethane dampened clutch protects bead chain and clutch from failure due to high shock loads during shade operation minimizing down time.
 - f. Maximum shade hanging weight of 50 pounds (22.7 kg).
 - g. Clutch shall be upgradable to motorized drive on compatible tubes without requiring change in mounting attachment method/location, roller tube or fabric band.
 - h. Motorized drive options available require no additional wiring to be added for power or communication capability for switch or automated operation.
6. Drive Chain: Continuous loop T304 stainless steel beaded ball chain, 100 pound (45 kg) minimum breaking strength warranted from breaking for the life of the shade system hardware under prescribed operation. Provide upper and lower limit stops.
 - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
 - b. Limit stops: Bead stops affixed to the chain maintain consistent shadeband alignment at the top and bottom of shade travel across multiple shades, and help prevent shade damage resulting from unmanaged user control.
7. Mecho/7, Managed Lift Force, Hardware: Lifts single band or multiband shade assemblies:
 - a. Lifting Force: 3 to 8.5 pounds (1.4 to 3.9 kg) max pull force to lift shade assemblies with a shade band hanging weight, not including mounting hardware, of up to 50 pounds (22.7 kg).
 - b. Direct drive clutch with Managed Lift Force provides the best user experience by managing the user pull force while using the fewest number of chain pulls to position a shade.
 - c. Backward compatible to Mecho/5 components including fascia, regular and reverse roll, pockets, and wall-mounting accessories.
 - d. Includes offset drive capability, left/right, front, or back to allow for utilization of blackout channels.
 - e. Allows for ease of operation when obstructions do not allow for direct drive chain access.
 - f. Offset chain drive shall not cause an increase of friction or pull force when operated up to a 26 degree angle from vertical.
8. Accessories:
 - a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.

- 1) Finish: Baked enamel.
 - a) Color: Black.
 - b) Color: White.
 - c) Color: Bronze.
 - d) Color: Gray.
 - e) Color: _____.
- 2) Finish: Clear anodized.
- 3) Finish: Fabric wrapped to match shade.
- 4) Finish: _____.
- 5) Can be installed across two or more shade bands in one piece.
- 6) Single Fascia: Accommodate regular roll shades.
- 7) Single Fascia: Accommodate reverse roll shades.
- 8) Profile: Square.
- 9) Profile: Radiused.
- 10) Profile: _____.
- 11) Configuration: Captured, fascia stops at captured bracket end.
- 12) Configuration: Continuous, fascia extends past continuous bracket.
- 13) Configuration: Captured and continuous, as indicated on drawings.
- b. Ceiling Pockets: Premanufactured metal shade pocket for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
 - 1) Removable closure panel.
 - 2) Ceiling tile support.
 - 3) _____.
- c. Room-Darkening Channels: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.
- d. Adjustable Multi-band Coupler: Field-adjustable coupler positioned between adjacent shadebands driven by the same clutch facilitates hembar alignment between the bands while maintaining the light gap between the shade bands to no more than 1.25 inch (32mm).

C. Basis of Design: Mecho/5x System as manufactured by Mecho.

1. Description: Manually operated fabric window shades.
 - a. Shade Type: Single Roller.
 - b. Shade Type: Double Roller.
 - c. Universal drive capability to offset drive chain for reverse or regular roll shades.
 - d. Drop Position: Regular roll.
 - e. Drop Position: Reverse roll.
 - f. Mounting: Ceiling mounted.
 - g. Mounting: Recessed in ceiling pocket.
 - h. Mounting: Wall Mounted.
 - i. Mounting: Window Jamb Mounting.
 - j. Mounting: _____.
 - k. Size (WxH): _____.
 - l. Size: As indicated on drawings.
 - m. Fabric: As indicated under Shade Fabric article.
2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Steel, 1/8 inch (3 mm) thick.

- b. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
 - 1) Light-Filtering Fabric: Room-side of opening.
 - 2) Light-Filtering Fabric: Glass-side of opening.
 - 3) Room-Darkening Fabric: Room-side of opening.
 - 4) Room-Darkening Fabric: Glass-side of opening.
 - 5) Operating chain pulls for both fabrics configured for the same side of the window.
 - 6) Operating chain pulls for each fabric configured for opposite sides of the window.
 - c. Single Shade Operation Width: Up to 180 inches (4572) dependent on fabric.
 - d. Multiple Shade Band Operation: Provide hardware as necessary to operate more five shade bands, up to 360 inches (9144 mm) wide; depending on fabric weight, using a single clutch operator.
 - e. Radiused Center Support Brackets: Provide brackets and connectors for radiused window applications.
 - 1) Maximum Offset: Eight degrees on each side for a 16 degree total offset.
3. Roller Tubes:
- a. Material: Extruded aluminum.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
 - d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
4. Hembars: Designed to maintain bottom of shade straight and flat.
- a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
 - b. Style: Exposed aluminum bottom bar with matching finials.
 - 1) Profile: Rectangular.
 - 2) Profile: _____.
 - 3) Color: Manufacturer's standard color coordinated with shade fabric selected.
 - 4) Color: To be selected by Architect from manufacturer's standard color selection.
 - 5) Color: _____.
 - 6) Color: As indicated on the Drawings.
 - c. Style: _____.
 - d. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
- a. Heavy-duty, 1/8" steel mounting bracket and integrated steel brake, clutch and sprocket assembly rigidly affix the shade support and user control to the building structure fully independent of the roller tube components.
 - b. Permanently lubricated maintenance-free brake assembly employs an oil-impregnated steel hub with wrapped spring clutch.
 - c. Brake must withstand minimum pull force of 50 pounds (22.7 kg) in the stopped position.

- d. Direct drive clutch requires no interstitial gear stages or plastic parts between the building structure and clutch ensuring reliable operation across the full range of shade sizes.
- e. Maximum shade hanging weight of 30 pounds (13.6 kg).
- 6. Drive Chain: Continuous loop stainless steel beaded ball chain, 100 pound (45 kg) minimum breaking strength. Provide upper and lower limit stops.
 - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
 - b. Limit stops: Bead stops affixed to the chain maintain consistent shadeband alignment at the top and bottom of shade travel across multiple shades, and help prevent shade damage resulting from unmanaged user control.
- 7. Mecho/5x, Managed Lift Force, Hardware: Lifts single band or multiband shade assemblies:
 - a. Lifting Force: 3 to 8.5 pounds (1.4 to 3.9 kg) max pull force to lift shade assemblies with a shade band hanging weight, not including mounting hardware, of 30 pounds (13.6 kg).
 - b. Direct drive clutch with Managed Lift Force provides the best user experience by managing the user pull force while using the fewest number of chain pulls to position a shade.
 - c. Backward compatible to Mecho/5 components including fascia, regular and reverse roll, pockets, and wall-mounting accessories.
 - d. Includes offset drive capability, left/right, front, or back to allow for utilization of blackout channels.
 - e. Allows for ease of operation when obstructions do not allow for direct drive chain access.
 - f. Offset chain drive shall not cause an increase of friction or pull force when operated up to a 26 degree angle from vertical.
- 8. Accessories:
 - a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
 - 1) Finish: Baked enamel.
 - a) Color: Black.
 - b) Color: White.
 - c) Color: Bronze.
 - d) Color: Gray.
 - e) Color: _____.
 - 2) Finish: Clear anodized.
 - 3) Finish: Fabric wrapped to match shade.
 - 4) Finish: _____.
 - 5) Can be installed across two or more shade bands in one piece.
 - 6) Single Fascia: Accommodate regular roll shades.
 - 7) Single Fascia: Accommodate reverse roll shades.
 - 8) Profile: Square.
 - 9) Profile: Radiused.
 - 10) Profile: _____.
 - 11) Configuration: Captured, fascia stops at captured bracket end.
 - 12) Configuration: Continuous, fascia extends past continuous bracket.
 - 13) Configuration: Captured and continuous, as indicated on drawings.
 - b. Ceiling Pockets: Premanufactured metal shade pocket for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
 - 1) Removable closure panel.
 - 2) Ceiling tile support.

- 3) _____.
 - c. Room-Darkening Channels: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.
 - d. Adjustable Multi-band Coupler: Field-adjustable coupler positioned between adjacent shadebands driven by the same clutch facilitates hembar alignment between the bands while maintaining the light gap between the shade bands to no more than 1.25 inch (32mm).
- D. Basis of Design: Mecho/5 System as manufactured by Mecho.
1. Description: Manually operated fabric window shades.
 - a. Shade Type: Single Roller.
 - b. Shade Type: Double Roller.
 - c. Universal drive capability to offset drive chain for reverse or regular roll shades.
 - d. Drop Position: Regular roll.
 - e. Drop Position: Reverse roll.
 - f. Mounting: Ceiling mounted.
 - g. Mounting: Recessed in ceiling pocket.
 - h. Mounting: Wall Mounted.
 - i. Mounting: Window Jamb Mounting.
 - j. Mounting: _____.
 - k. Size (WxH): _____.
 - l. Size: As indicated on drawings.
 - m. Fabric: As indicated under Shade Fabric article.
 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Steel, 1/8 inch (3 mm) thick.
 - b. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
 - 1) Light-Filtering Fabric: Room-side of opening.
 - 2) Light-Filtering Fabric: Glass-side of opening.
 - 3) Room-Darkening Fabric: Room-side of opening.
 - 4) Room-Darkening Fabric: Glass-side of opening.
 - 5) Operating chain pulls for both fabrics configured for the same side of the window.
 - 6) Operating chain pulls for each fabric configured for opposite sides of the window.
 - c. Multiple Shade Band Operation: Provide hardware as necessary to operate more than one shade band using a single clutch operator.
 - d. Radiused Center Support Brackets: Provide brackets and connectors for radiused window applications.
 - 1) Maximum Offset: Eight degrees on each side for a 16 degree total offset.
 3. Roller Tubes:
 - a. Material: Extruded aluminum.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.

- d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
- 4. Hembars: Designed to maintain bottom of shade straight and flat.
 - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
 - b. Style: Exposed aluminum bottom bar with matching finials.
 - 1) Profile: Rectangular.
 - 2) Profile: _____.
 - 3) Color: Manufacturer's standard color coordinated with shade fabric selected.
 - 4) Color: To be selected by Architect from manufacturer's standard color selection.
 - 5) Color: _____.
 - 6) Color: As indicated on the Drawings.
 - c. Style: _____.
 - d. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
- 5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
 - a. Heavy-duty, 1/8" steel mounting bracket and integrated steel brake, clutch and sprocket assembly rigidly affix the shade support and user control to the building structure fully independent of the roller tube components.
 - b. Permanently lubricated maintenance-free brake assembly employs an oil-impregnated steel hub with wrapped spring clutch.
 - c. Brake must withstand minimum pull force of 50 pounds (22.7 kg) in the stopped position.
 - d. Direct drive clutch requires no interstitial gear stages or plastic parts between the building structure and clutch ensuring reliable operation across the full range of shade sizes.
 - e. Maximum shade hanging weight of 18 pounds (8.2 kg).
- 6. Drive Chain: Continuous loop stainless steel beaded ball chain, 100 pound (45 kg) minimum breaking strength. Provide upper and lower limit stops.
 - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
 - b. Limit stops: Bead stops affixed to the chain maintain consistent shadeband alignment at the top and bottom of shade travel across multiple shades, and help prevent shade damage resulting from unmanaged user control.
- 7. Accessories:
 - a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
 - 1) Finish: Baked enamel.
 - a) Color: Black.
 - b) Color: White.
 - c) Color: Bronze.
 - d) Color: Gray.
 - e) Color: _____.
 - 2) Finish: Clear anodized.
 - 3) Finish: Fabric wrapped to match shade.
 - 4) Finish: _____.
 - 5) Can be installed across two or more shade bands in one piece.
 - 6) Single Fascia: Accommodate regular roll shades.
 - 7) Single Fascia: Accommodate reverse roll shades.
 - 8) Two-Piece Double Fascia: Front and rear double fascia.
 - 9) Profile: Square.

- 10) Profile: Radiused.
 - 11) Profile: _____.
 - 12) Configuration: Captured, fascia stops at captured bracket end.
 - 13) Configuration: Continuous, fascia extends past continuous bracket.
 - 14) Configuration: Captured and continuous, as indicated on drawings.
 - b. Ceiling Pockets: Premanufactured metal shade pocket for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
 - 1) Removable closure panel.
 - 2) Ceiling tile support.
 - 3) _____.
 - c. Room-Darkening Channels: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.
- E. Basis of Design: UrbanShade, manual operation. As manufactured by Mecho. Fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
1. Shade Type: Single roller.
 2. Shade Type: Double roller.
 3. Drop Position: Regular. Fabric falls off roller tube, close to glass.
 4. Drop Position: Reverse. Fabric falls off the room-side of the roller tube.
 5. Mounting: Ceiling mounted.
 6. Mounting: Recess mounted in ceiling pocket.
 7. Mounting: Wall mounted.
 8. Mounting: Window jamb mounted.
 9. Size (WxH): _____.
 10. Size: As indicated on drawings.
 11. Fabric: As indicated under Shade Fabric article.
 12. Brackets and Mounting Hardware: Stamped steel. As recommended by manufacturer for mounting indicated accommodating shade fabric roll-up size and weight.
 - a. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
 - 1) Light-Filtering Fabric: Room-side of opening.
 - 2) Light-Filtering Fabric: Glass-side of opening.
 - 3) Room-Darkening Fabric: Room-side of opening.
 - 4) Room-Darkening Fabric: Glass-side of opening.
 13. Roller Tubes: Extruded aluminum. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
 - a. Size: As recommended by manufacturer; for installation conditions, span, and weight of shades.
 - b. Fabric Attachment: Extruded channel in tube accepts vinyl spline welded to fabric edge.
 - 1) Shade Band: Removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
 14. Hembars: Maintains bottom of shade straight and flat.
 - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
 - b. Style: Exposed aluminum bottom bar with matching finials.
 - 1) Profile: Rectangular.
 - 2) Profile: _____.

- 3) Color: Manufacturer's standard coordinated with shade fabric selected.
 - 4) Color: To be selected from manufacturer's standard color selection.
 - 5) Color: _____.
- c. Room-Darkening Shades: Slotted bottom bar with wool-pile light seal.
- 15. Manual Operation:
 - a. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
 - 1) Brake Assembly: Mounted on a low-friction plastic hub with wrapped spring clutch.
 - a) Brake must withstand minimum pull force of 25 lbs (12 kg) in stopped position.
 - 2) Clutch/Brake Mounting: On support brackets, independent of roller tube components.
 - b. Drive Chain: Continuous loop beaded ball chain. Upper and lower limit stops.
 - 1) Breaking Force: 45 lbf (200 N) minimum.
 - 2) Chain Retainer per WCMA A100.1: Tensioning device.
 - c. Lift Assist Mechanism: Contained in idler end of roller tube. When hanging weights exceed roller tube weight limits. Manufacturer's standard.
- 16. Accessories:
 - a. Fascia: Removable extruded aluminum. Size as required to conceal shade mounting. Attachable to brackets without exposed fasteners.
 - 1) Finish: Baked enamel.
 - a) Color: Black.
 - b) Color: White.
 - c) Color: Bronze.
 - d) Color: Gray.
 - e) Color: _____.
 - 2) Finish: Clear anodized.
 - 3) Finish: Fabric wrapped to match shade.
 - 4) Finish: _____.
 - 5) Can be installed across two or more shade bands in one piece.
 - 6) Profile: Square.
 - 7) Profile: Radiused.
 - 8) Profile: _____.
 - 9) Configuration: Captured, fascia stops at captured bracket end.
 - 10) Configuration: Continuous, fascia extends past continuous bracket.
 - 11) Configuration: Captured and continuous, as indicated on drawings.
 - b. Ceiling Pockets: Manual Premanufactured metal shade pocket with removable closure panel, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
 - c. Room-Darkening Channels, Standard: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.

2.3 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill Opening from Head to Sill: 1/2 inch (13 mm) space between bottom bar and window stool.

2. Vertical Dimensions: Fill Opening from Head to Sill: 1/2 inch (13 mm) space between bottom bar and finished floor.
 3. Vertical Dimensions: Fill Opening from Head to Sill: 1/2 inch (13 mm) space between bottom bar and _____.
 4. Vertical Dimensions: Fill Opening from Head to Sill (inch/mm): _____ space between bottom bar and window stool.
 5. Vertical Dimensions: Fill Opening from Head to Sill (inch/mm): _____ space between bottom bar and finished floor.
 6. Vertical Dimensions: Fill Opening from Head to Sill (inch/mm): _____ space between bottom bar and _____.
 7. Horizontal Dimensions: Inside Mounting.
 - a. Fill openings from jamb to jamb. No light gap.
 - b. Symmetrical Light Gaps on Both Sides of Shade: 3/4 inch (19.05 mm) total.
 - c. Symmetrical Light Gaps on Both Sides of Shade (inch/mm): _____ total.
 - d. Symmetrical Light Gaps on Both Sides of Shade (inch/mm): As detailed on the Drawings.
 8. Horizontal Dimensions: Outside mounting.
 - a. Cover window frames, trim, and casings completely.
 - b. Extend shades beyond jambs on each side: 2 inches (50 mm).
 - c. Extend shades beyond jambs on each side (inch/mm): _____.
 - d. Extend shades beyond jambs on each side (inch/mm): As detailed on the Drawings.
- C. Openings Requiring Continuous Multiple Shade Units with Separate Rollers: Locate roller joints at window mullion centers; butt rollers end-to-end.

2.4 SHADE FABRIC

- A. Basis of Design: Shade fabric as manufactured by Mecho.
1. Solar Shadecloths:
 - a. Fabric: Soho: 1100 series. 1 percent open. 2 x 2 basket-weave pattern of fine yarn PVC and polyester blend, same colors as in 1600 (3 percent open) and 1900 series, (5 percent open).
 - b. Fabric: Soho: 1600 series. 3 percent open. 2 x 2 basket-weave pattern of fine yarn PVC and polyester blend, same colors as in 1100 (1 percent open) and 1900 series, (5 percent open).
 - c. Fabric: Soho: 1900 series. 5 percent open. 2 x 2 basket-weave pattern of fine yarn, PVC and polyester blend, same colors as in 1100 (1 percent open) and 1600 series, (3 percent open).
 - d. Fabric: ThermoVeil: 0900 series. 0 to 1 percent visually translucent extra-dense linear weave pattern.
 - e. Fabric: ThermoVeil: 1000 series. 2 to 3 percent open, dense linear-weave pattern.
 - f. Fabric: ThermoVeil Basket Weave: 1700 series. 1 percent open 2 by 2 dense basket-weave pattern, colors match 1300 (5 percent open), also 126 inches (3200 mm) wide.
 - g. Fabric: ThermoVeil Basket Weave: 1500 series. 3 percent open 2 by 2 dense basket-weave pattern, colors match 1300 (5 percent open), also 126 inches (3200 mm) wide.
 - h. Fabric: ThermoVeil Basket Weave: 1300 series. 5 percent open, 2 by 2 dense basket-weave pattern, colors match 1500 (3 percent open), also 126 inches (3200 mm) wide.

- i. Fabric: ThermoVeil Basket Weave: 2100 series. 10 percent open 2 by 2 open basket-weave pattern, colors match 1300 (5 percent open) and 1500 (3 percent open).
 - j. Fabric: ThermoVeil Reversible Satin Twill Weave: 3000 series. 1 to 2 percent open, with an alternating predominant color in the warp and weft (fill). Reverse side can be used facing interior if specified.
 - k. Fabric: ThermoVeil Reversible Satin Twill Weave: 3200 series. 1 to 2 percent open, with an alternating predominant color in the warp and weft (fill). Reverse side can be used facing interior if specified.
 - l. Fabric: ThermoVeil Reversible Satin/Diamond Earthtone Twill Weave: 3300 series. 1 to 2 percent open, with an alternating predominant color in the warp and weft (fill). Reverse side can be used facing interior if specified.
 - m. Fabric: EcoVeil Screens: 0950 series. TPO Cradle to Cradle Certified, fabric, non-PVC, 1 X 1 basket-weave pattern at 1 percent open. Colors match 1350 (5 percent open) and 1550 (3 percent open).
 - n. Fabric: EcoVeil Screens: 1350 series. TPO Cradle to Cradle Certified, fabric, non-PVC, 1 X 1, basket-weave pattern at 5 percent open. Colors match 0950 (1 percent open) and 1550 (3 percent open).
 - o. Fabric: EcoVeil Screens: 1550 series. TPO fabric, Cradle to Cradle Certified, non-PVC, 1 X 1, basket-weave pattern at 3 percent open. Colors match 0950 (1 percent open) and 1350 (5 percent open).
 - p. Fabric: EcoVeil Sheer: 6750 series. Cradle to Cradle Certified, woven 100 percent polyester, PVC-free, reversible face, (3 percent open). The first shade cloth to pass NFPA 701 flame tests without added chemical flame retardants.
 - q. Fabric: EcoVeil Sheer: 6850 series. Cradle to Cradle Certified, woven 100 percent polyester, PVC-free, reversible face, (1 percent open). The first shade cloth to pass NFPA 701 flame tests without added chemical flame retardants.
 - r. Fabric: Acoustiveil Dimout: 0890 series. 0-1 percent open.
 - s. Fabric: EuroVeil Basket Weave Pattern: 5300. Thin, fine, screen cloth in broad range of colors. 5 percent open.
 - t. Fabric: EuroTwill Reversible Weave: 6000. Finely woven. 3 percent open. Reverse side can be used facing interior if specified.
 - u. Fabric: EuroTwill Reversible Weave: 6200. Distinctive, tightly woven twill design, comprised of fine polyester with PVC coating. 1 percent open. Reverse side can be used facing interior if specified.
 - v. Fabric: EuroTwill Reversible Weave: 6450. A broke twill-weave design comprised of fine polyester with PVC coating. 3 percent open. Reverse side can be used facing interior if specified.
 - w. Color: Selected from manufacturer's standard colors.
 - x. Color: Custom color.
2. Blackout Shadecloths:
- a. Fabric: Equinox Blackout: 0100 series. Opaque.
 - b. Fabric: Midnite Blackout: 0200 series. Opaque. Acrylic backing, PVC-free, white color reverse side (for exterior). Available 98 inch (24789 mm).
 - c. Fabric: Mirrofilm: 0600 series. Transparent.
 - d. Fabric: Distinctive Blackout: 0800 series. Opaque.
 - e. Fabric: Chelsea: 0250 series. Opaque.
 - f. Fabric: Classic Blackout: 0700 series. Opaque. Vinyl coated fabric blackout material same color reverse side (for exterior).
 - g. Color: Selected from manufacturer's standard colors.

- h. Color: Custom color.
- 3. Fabric Properties: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 - a. Shade Type: Light filtering shades.
 - b. Shade Type: Room darkening shades.
 - c. Shade Type: _____.
 - d. Material Composition: PVC coated polyester yarns.
 - e. Material Composition: 100 percent polyester.
 - f. Material Composition: 100 percent TPO coated polyolefin yarn.
 - g. Material Composition: Polyester with acrylic backing.
 - h. Material Composition: Fiberglass with acrylic backing.
 - i. Material Composition: Vinyl coated fabric.
 - j. Material Composition: _____.
- 4. Material Certificates and Product Disclosures:
 - a. Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).
 - b. Cradle to Cradle Material Health Certificate:
 - 1) Achievement Level: Silver.
 - 2) Achievement Level: Bronze.
 - c. Health Product Declaration (HPD): Published declaration with full disclosure of known hazards.
 - d. Declare label.
- 5. Performance Requirements:
 - a. Flammability per NFPA 701: Pass. Large or small scale test.
 - b. Fungal Resistance: No growth when tested per ASTM G21.
 - c. Solar Transmittance: _____, nominal.
 - d. Visible Light Transmittance: _____, nominal.
 - e. Solar Absorption: _____, nominal.
 - f. Solar Reflectance: _____, nominal.
- 6. Openness Factor: _____ percent, nominal.
- 7. Weight: _____ oz per sq yd (_____ grams per sq m).
- 8. Roll Width: 63 inches (1600 mm) maximum.
- 9. Roll Width: 72 inches (1829 mm) maximum.
- 10. Roll Width: 78 inches (1981 mm) maximum.
- 11. Roll Width: 84 inches (2134 mm) maximum.
- 12. Roll Width: 96 inches (2438 mm) maximum.
- 13. Roll Width: 98 inches (2489 mm) maximum.
- 14. Roll Width: 126 inches (3200 mm) maximum.
- 15. Roll Width (in/mm): _____.
- 16. Color: As selected by Architect from manufacturer's full range of colors.
- 17. Color: _____.
- 18. Fabrication:
 - a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
 - b. Battens: Manufacturer's standard material, full width of shade, and enclosed in welded shade fabric pocket; locate as indicated on drawings.
 - c. Seams for Railroaded Fabric: Manufacturer's standard sewn seam; locate as indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- C. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

- A. Install shades level, plumb, square, and true per manufacturer's instructions and approved shop drawings. Locate so shade band is at least 2 inches (51 mm) from interior face of glass. Allow proper clearances for window operation hardware. Use mounting devices as indicated.
- B. Replace shades exceeding specified tolerances at no extra cost to Owner.
- C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric.
- D. Clean roller shade surfaces after installation, per manufacturer's written instructions.
- E. Demonstrate operation and maintenance of window shade system to Owner's personnel.
- F. Manufacturer's authorized personnel are to train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as a reference, supplemented with additional training materials as required.

3.4 PROTECTION AND CLEANING

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.
 - 1. Clean soiled shades and exposed components as recommended by manufacturer.
 - 2. Replace shades that cannot be cleaned to "like new" condition.

END OF SECTION

SECTION 12 25 13 MOTORIZED WINDOW ROLLER SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roller shades, motorized operation and accessories.
 - 1. Intelligent encoded electronic drive system
 - 2. Motor controls, interfaces, and accessories.
- B. Shade fabric.

1.2 RELATED SECTIONS

- A. Section 06100 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.
- B. Section 09260 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.
- C. Section 09510 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.
- D. Division 16 - Electrical: Electric service for motor controls.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. Cradle to Cradle Products Innovation Institute (C2C):
 - 1. C2C (DIR) - C2C Certified Products Registry.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
 - 2. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- D. Underwriters Laboratories (UL):
 - 1. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
 - 2. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.
- E. Window Covering Manufacturers Association (WCMA):
 - 1. WCMA A100.1 - Safety of Window Covering Products; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.

2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Preinstallation Meeting: One week prior to commencing work related to this section. Require attendance of all affected installers.
- C. Sequencing:
 1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
 2. Do not install shades until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog pages and data sheets for products specified including materials, finishes, dimensions, profiles, mountings, and accessories.
 1. Preparation instructions and recommendations.
 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, accessories, and operating instructions.
 3. Storage and handling requirements and recommendations.
 4. Mounting details and installation methods.
 5. Manufacturer's Instructions: Include storage, handling, protection, examination, preparation, and installation.
 6. Project Record Documents: Record actual locations of control system components and show interconnecting wiring.
 7. Operation and Maintenance Data: Component list with part numbers, and operation and maintenance instructions.
 8. Motorized Shades: Power requirements. Typical wiring diagrams including integration of EDU controllers with building management system, audiovisual and lighting control systems as applicable.
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
 1. Prepare shop drawings on AutoCad or MicroStation format using base sheets provided electronically by the Architect.
 2. Prepare control wiring diagrams based on zones, switching and operational requirements provided by the Architect in electronic format.
 3. Include one-line diagrams, wire counts, coverage patterns, and physical dimensions of each item.
 4. Provide location plan showing all switch and control zones as per the performance requirements of the specifications. All switches, sensors and other control accessories must clearly be shown and called out in a bill of materials.
- A. Shade Automation Schedule: For all shade control zones, provide a detailed schedule of all shade movements throughout the year for a theoretical clear sky. This schedule shall clearly show the time of date, time of day and shade position.
- B. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
- C. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements.
 5. Shadecloth Sample: Mark face of material to indicate interior faces.

- a. Test reports indicating compliance with specified fabric properties.
 - b. Verification Samples: 6 inches (150 mm) square, representing actual materials, color and pattern.
- D. Maintenance Data: Bill of materials for all components with part numbers. Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- E. Warranty: Manufacturer's warranty documents as specified in this Section.
- D. Maintenance contracts.

1.6 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- B. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.
- C. Installer for Roller Shade System - Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.
 - 1. Requirements for Roller Shade Installer/Contractor:
 - a. Roller Shade Hardware, shade fabric, motor, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.
 - b. Roller Shade Installer/Contractor shall list all components and systems included in their bid, including but not limited to, the prime manufacturer of the motor control and automated equipment and shall be financially responsible for any change orders and/or back charges required by the BMS, AV, or Lighting Control Systems contractors to interface with the automatic solar tracking system and the motorized roller shade system.
- D. Product Listing Organization Qualifications: Organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- F. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.
- G. Requirements for Electronic Hardware, Controls, and Switches: Roller shade hardware, shade fabric, EDU, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.

- H. ShadeCloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC9644, ATCC9645.
- I. Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified. Initial submittals, which do not include the Environmental Certification will be rejected. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.
- J. Third Party Evaluation: Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.
- K. Recycling Characteristics: Provide documentation that the shade cloth can, and is part of a closed loop of perpetual use and not be required to be down cycled, incinerated or otherwise thrown away. Scrap material can be sent back to the mill for reprocessing and recycling into the same quality yarn and woven into new material, without down cycling. Certify that this process is currently underway and will be utilized for this project.
- L. Perpetual Use Certification: Certify that at the end of the useful life of the shade cloth, that the material can be sent back to the manufacturer for recapture as part of a closed loop of perpetual use and that the material can and will be reconstituted into new yarn, for weaving into new shade cloth. Provide information on each shade band indicating that the shade band can be sent back to the manufacturer for this purpose.
- M. Turn-Key Single-Source Responsibility for Wiring Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:
 - 1. Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
 - 2. Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
 - 3. Roller shade installer/dealer shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
 - 4. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.

5. Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in Window Treatment Schedule.
- B. Store and handle products per manufacturer's recommendations.

1.8 PROJECT CONDITIONS

Power and control wiring shall be complete and certified, fully operational with uninterrupted communication on the lines and minimal noise certified by a commissioning agent specified in other sections.

1. 485, ICON, Lonmark and Dry Contract Network: Noise on the line not to exceed shade manufacturer's limits.

1.9 WARRANTY

- A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating warranty for interior shading.
 1. Shade Hardware: 10 years unless otherwise indicated.
 - a. Mecho/5 with ThermoVeil, EuroVeil, EuroTwill, Soho, Equinox, Midnite, Chelsea, or Classic Blackout shade fabric: 25 years.
 - b. ElectroShade with ThermoVeil, EuroVeil, EuroTwill, Soho, Equinox, Midnite, Chelsea, or Classic Blackout shade fabric: 25 years.
 - c. Magnashade with ThermoVeil, EuroVeil, EuroTwill, Soho, Equinox, Midnite, Chelsea, or Classic Blackout shade fabric: 25 years.
 2. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.
 3. Ecoveil Shadecloth: Manufacturer's standard ten year warranty.
 4. Roller Shade Motors, Motor Control Systems, and Accessories: Manufacturer's standard non-depreciating five year warranty.
 5. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas, which are deemed owners responsibility.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Mecho, which is located at: 42-03 35th St.; Long Island City, NY 11101; ASD Tel: 718-729-2020; Fax: 718-729-2941; Email: marketing@mechoshade.com; Web: www.mechoshade.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00.

2.2 ROLLER SHADES, MOTORIZED OPERATION AND ACCESSORIES

- A. Shade System; General:
 1. Motorized Shades: Comply with NFPA 70.

2. Components capable of being removed or adjusted without removing mounted shade brackets or cassette support channel
 3. Operates smoothly when raising or lowering shades.
 4. Cradle-to-Cradle certified and listed in C2C (DIR).
 5. Electrical Components: Listed, classified, and labeled as suitable for intended purpose. Test as total system. Individual component testing is acceptable.
 - a. Components: FCC compliant where applicable.
- B. Basis of Design: MagnaShade. As manufactured by MechoShade Systems LLC. Single Roller, motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
1. WhisperShade IQ2 EDU, line voltage (120 VAC)
 2. RTS wireless controls.
 3. Feature Requirements:
 - a. Hardware: Allows removal and remounting of shade motor without removing shade roller tube or drive from cassette support channel.
 - b. Shade Hardware System: Allow the following features.
 - 1) Field adjustment of EDU or replacement of operable hardware components without removal of installed cassette support channel.
 - 2) Allow access below motor head for setting or adjusting limits without disassembling the installed system.
 - 3) Factory assemble components to greatest extent possible.
 1. Drop Position: Per details.
 2. Mounting: Per details
 3. Size: As indicated on drawings.
 4. Fabric: As indicated under Shade Fabric article.
 5. Mounting Hardware:
 - a. Cassette Support Channel: Continuous channel attached to structure at manufacturer's recommended spacing; with bottom closure panel and end caps.
 - b. Roller Shade Cradle: Prefabricated extruded aluminum cradle. Clips into cassette support channel. Fully supports shade assembly. Low friction and wear-free surface.
 - c. Floating Hardware System: Manufacturer supplied device. Attaches to motor mounting plate and roller tube allowing tube to move horizontally and vertically as roll up diameter of shade system increases or decreases during operation. Floating design ensures roller tube is straight, with no deflection.
 6. Roller Tubes:
 - a. Size: 2-1/2 inch (63.5 mm) maximum diameter. Selected for suitability of installation conditions, span, and weight of shades.
 - b. Fabric Attachment: Manufacturer's method for securing shade fabric to roller tube.
 7. Hembars: Maintain bottom of shade straight and flat.
 - a. Style: Exposed aluminum bottom bar with matching finials.
 - 1) Color: Manufacturer's standard coordinated with shade fabric selected.
 8. MagnaShade, as specified.
 9. Accessories:
 - a. Fascia: Removable extruded aluminum. Size as required to conceal shade mounting. Attach to cassette support channel without exposed fasteners.
 - 1) Finish: Baked enamel.
 - a) Color: as selected from full range

2.3 INTELLIGENT ENCODED ELECTRONIC DRIVE SYSTEM

- A. Electronic Drive Unit (EDU) System General Requirements:
 - 1. A UL 325 listed solution.
 - a. Component certification in lieu of system testing is not acceptable.
 - 2. Listing Label and Motor Rating: To be visible for inspection without dismounting of shade assembly to remove motor or EDU from shade roller tube.
 - 3. Size and Configuration: As recommended by manufacturer for type, size, and arrangement of shades.
 - 4. Conceal EDU inside shade roller tube.
 - 5. EDU Rated Speed: The same nominal speed for shades in the same room.
 - 6. Hanging Weight of Shade Band: 80 percent of rated lifting capacity of shade EDU and tube assembly.
 - 7. Capable of upgrading firmware from anywhere on network without touching the motor.
- B. Line Voltage EDU (120 VAC):
 - 1. Basis of Design: MechoShade Systems LLC; WhisperShadeIQ2 System. Tubular, asynchronous, integral AC motor and reversible capacitor. 120 VAC, single phase, 60 Hz; temperature Class B, thermally-protected, totally enclosed, maintenance-free. Powered by line voltage power supply connection equipped with locking disconnect plug assembly furnished with EDU.
 - 2. Audible Noise: 46 dBA measured 3 ft (914 mm) from motor unit, depending on motor torque.
 - 3. Nominal Speed: 34 RPM. Not to vary due to load/lift capacity.
 - 4. Isolated, low voltage power supply for powering external accessories connected to either the dry contact or network port.
 - a. Products requiring accessories to be powered by a plug-in or externally-supplied power supply are not acceptable.
- C. Low Voltage EDU (24 VDC):
 - 1. Basis of Design: MechoShade Systems LLC; WhisperShade IQ2-DC System. Tubular, asynchronous, integral DC motor. 24 VDC; temperature Class B, thermally-protected, totally enclosed, maintenance-free. Powered by low voltage power supply connection equipped with disconnect plug assembly furnished with EDU.
 - 2. Audible Noise: 38 dBA measured 3 ft (914 mm) from motor unit, depending on motor torque.
 - 3. Nominal Speed: 10 to 28 RPM. Configurable. Speed managed such that it does not vary due to load/lift capacity.
 - 4. Low voltage power supply for powering external accessories connected to either the dry contact or network port.
 - a. Products that require accessories to be powered by a plug-in or externally-supplied power supply are not acceptable.
 - 5. Override Mode: Place motor into Override Mode when local switch commands shade to new position.
 - a. Local switch command sources:
 - 1) Keypad connected to EDU dry contact inputs.
 - 2) Third-party system connected to EDU dry contact inputs.
 - 3) Network keypad or other device that serially communicates with EDU and configured to issue override commands as if it were a local switch connected to EDU dry contact inputs.
 - b. Entering Override Mode: Monitor and log positioning commands from automation devices. Do not act until exiting Override Mode.

- c. Return from Override Mode: Position shade to last commanded position in log.
- d. Automated Return from Override Mode:
 - 1) Override Return Timer: When Override Mode is entered by changing shade position with local switch as described above, Enable override return timer to make these changes temporary such that automation can regain control of shade after configurable time duration (default of 60 minutes).
 - 2) Pocket temperature sensor integral to EDU to track pocket temperature.
 - a) When shade is in Override Mode and Heat Gain Sensing is Enabled: Sensor determines when direct sunlight and associated solar heat gain has left the window.
 - 1) When this condition occurs, after the shade has been overridden to cover the window, EDU to return from Override Mode if Override Return Timer has not done so already in order for automation controllers to once again optimize shade position for exposure to daylight.
- 6. Preventative Maintenance:
 - a. Internally monitor important operating parameters to ensure motor and its shade assembly are functioning properly.
 - b. Performance Degradation: Provide visual indication via feedback LED and communicate warnings on repetitive basis through its serial port.
 - c. Warning Conditions: Logged and queryable. Allow sending of multiple warnings until condition is acknowledged.
 - d. Stop shade rotation for parameters of critical concern until reset by trained technician after being serviced.
 - e. Devices capable of receiving warnings include SolarTrac automated solar-evaluation control system.
 - f. Tracked Parameters to include:
 - 1) Operating life (cycles, hours).
 - 2) Pocket temperature.
 - 3) Internal motor temperature.
 - 4) Vibration.
 - 5) Stall.
 - 6) Power reset.
 - 7) Maintenance Mode.
 - 8) Speed regulation.
 - 9) Position targeting.
 - 10) Movement without command.
 - 11) One Bus availability.
 - g. Detectable Potential Warning Conditions to Include:
 - 1) Assembly vibration/bearing wear warning.
 - 2) Tube/shade assembly drop.
 - 3) Fabric hung-up/telescoping.
 - 4) Motor mount warning.
 - 5) Lifecycle replacement warning.
 - 6) Brake/limit failure.
 - 7) Network warning.
 - 8) Motor internal temperature warning.
 - 9) Pocket temperature warning.

D. Modes of Operation:

1. Uniform Mode: Shades move to defined intermediate stop positions in order to maintain aesthetic uniformity.
 2. Normal Mode: Shades move to defined intermediate stop positions and any position between defined upper and lower limits.
 3. Maintenance Mode: Prevents shade from moving via dry contact or network control commands mode has been cleared/disabled.
- E. Control Methods: Local isolated dry contact input and network control.
1. Local Isolated Dry Contact Inputs:
 - a. Local switch control, third party system integration without separate interface.
 - b. Moving EDU/shade to upper and lower limits and local switch preset positions.
 - c. Configuration of upper and lower limits, custom presets, and key modes of operation without a PC or microprocessor-based tools.
 - d. Configuration under protected sequences to prevent changes by casual user.
 - e. Switch Personalities: Configuration of dry contact control port over network such that any type of dry contact keypad/third-party interface and actuation methodology (maintained and/or momentary actuation) can be used to operate shade.
 - f. Dry Contact Control Connection Options to Include:
 - 1) One-button.
 - 2) Two-button.
 - 3) Three-button. Able to support configuring limits, presets, and key operating modes (default).
 - 4) Three-button. No configuration capability to prevent accidental changes in settings.
 2. Network Control:
 - a. Bi-directional network communication to enable commanding operation of large groups of shades over a common backbone.
 - b. Each EDU:
 - 1) Support eight network addresses capable of being employed for various levels of group control.
 - 2) Dry Contact Ports: Assigned its own local switch address which can be matched by other EDUs within eight network addresses in order to support group control when dry contact commands are received.
 - a) The EDU receiving dry contact commands may or may not be configured to operate based on commands coming through its own dry contact input port.
 - 3) To have an independent unique identifier address (UID) enabling EDU to be independently controlled and configured over network via handheld configurator and/or PC controller.
 - c. Network Communication Card: Integral with tubular EDU assembly.
 - d. Support configuration of upper and lower limits using either a handheld removable program module/configurator or a local switch.
 - e. Support configuration of addresses using a handheld removable program module/configurator.
- F. Alignment Positions:
1. Repeatable and precisely aligned shade positions and limits.
 - a. Support positioning commands from 0 to 100 percent in 1 percent increments.
 - b. Customizable Presets: 32.
 - c. Include three intermediate dry contact presets

2. Shades on same switch circuit or same network group address with same opening height, to align at each intermediate stopping position when traveling from any position, up or down.
 3. Shades of differing heights: Capable of custom, aligned intermediate stop positions when traveling from any position, up or down.
 4. Alignment of shade bands mechanically aligned on same EDU: Plus or minus 0.125 inch (3 mm).
 5. Alignment of standard shades on adjacent EDUs: Plus or minus 0.25 inch (6 mm) when commanded to same alignment position.
- G. Local Switch Presets:
1. Minimum of three customizable preset positions accessible over the local dry contact control inputs and over the network connection.
 2. Preset positions: Customizable to any position between and including defined upper and lower limits (initially defaults to 25, 50, and 75 percent of shade travel).
 3. Configuration of Custom Preset Positions: A handheld removable program module/configurator or a local switch.
- H. Network Presets:
1. Minimum of 32 customizable preset positions (including the three local switch presets) accessible via network commands.
 2. Preset positions: Customizable to any position between and including defined upper and lower limits (initially defaults to defined lower limit).
 3. Configuration of Custom Preset Positions: A handheld removable program module/configurator or a local switch.

2.4 MOTOR CONTROLS, INTERFACES, AND ACCESSORIES

- A. Unless indicated to be excluded, provide required equipment as necessary for a complete operating system providing the control intent specified. Provide components and connections necessary to interface with other systems as indicated.
- B. Digital Network Controls:
1. Basis of Design: MechoShade Systems LLC; MechoNet. Low-voltage network utilizes standard Category 5/6 UTP cable; maximum of 4,000 feet (1,219 m), 250 nodes.
 2. Reprogram control without requiring wiring modifications.
 3. Ten-year non-volatile power failure memory for system configuration settings.
 4. Network Interface Components:
 - a. MechoNet Network Interface; MNI Series: Four configurable motor/EDU ports (models available for RJ45 or terminal block wiring); four configurable switch ports; one infrared (IR) remote control port; one configurable serial port for RS232/RS485 communication.
 - b. IQ2 Dual Splitter: Two motor/EDU ports; two switch ports.
 - c. IQ/MLC2 Motor Group Controller: Four ports for line-voltage standard (non-intelligent) motors (120 or 230 VAC; 600 W, 1/4 HP maximum).
 - d. IQ Gateway; one for each floor where controlling across multiple floors.

OR

- C. Low-Voltage Wall Controls; IQ Switch:
1. Momentary dry contact switch enables manual local control or network control of any individual shade motor or shade group/sub-group on MechoNet network.
 2. Control Functions:

- a. Open: Automatically open controlled shades to fully open position when button is pressed.
- b. Close: Automatically close controlled shades to fully closed position when button is pressed.
- c. Presets: For selection of predetermined shade positions.
- d. Dual Stations: For individual control of two shades/groups.
- 3. Finish: White.
- 4. Single Station: 5-button (open, close, and three intermediate stop positions).

OR

D. Wireless Controls:

- 1. MechoNet Wireless Controllers:
 - a. Serves as gateway, router, and controller between EnOcean wireless devices and MechoNet network.
 - b. Communicates with EnOcean wireless devices via 902 MHz RF. Supports wireless daylight sensors, occupancy/vacancy sensors, and switches.
 - c. Controller to manage up to 16 EnOcean wireless devices.
 - d. Controller to be configurable to one of two modes of operation:
 - 1) SolarTrac Mode: Relays EnOcean wireless sensor and control information to SolarTrac automatic solar-evaluation control system.
 - 2) Solar Activated Control Mode: Utilizes EnOcean wireless sensor and control information for internal automation algorithms to adjust shade positions.
 - a) Adjusts shade positions based daylight sensors input optimizing visual comfort. Enables five shade positions; full-up, full-down, and three configurable intermediate preset stop positions. Default of three positions; full-up, full-down, and preset number two.
 - b) Configurable daylight thresholds for shade positions. Includes configurable hysteresis setting, default of 20 percent, preventing frequent cycling of shades during fluctuating daylight conditions.
 - c) Configurable delay timers inhibit shade position changes due to short duration changes in daylight conditions. Default of 300 seconds delay for up, 60 seconds delay for down.
 - d) Night Mode: Configurable night time shade position to support light pollution, privacy, and/or energy conservation requirements. Configurable daylight threshold. Default of 18.6 footcandles (200 lux), Duration: Default of 60 minutes to enter night mode, 30 minutes to exit night mode.
 - e) Occupancy/Vacancy: Where wireless occupancy/vacancy sensors are specified, enables configurable unoccupied/vacant mode shade position (default of full-down) to optimize energy conservation. Configurable timers for detection of unoccupied and occupied states.
 - f) Manual Override: Where local switches are specified. Enables manual temporary override of shade positions for configurable duration. Default of 60 minutes.
 - g) Retract Mode: Manages changes to light level based on shade position for comfort and increasing exposure of occupant to daylight. Shades move up in stepped one-position increments as daylight levels drop. Each step is maintained for one minute while

controller retests daylight conditions before authorizing the next step until target is reached.

- e. Capable of being powered by a dedicated low-voltage power supply or through certain MechoNet devices without additional power supplies.
 - f. Multiple sensors to be configurable to automate the same shade control zone in order to ensure operation based on worst case comfort conditions across the zone.
 - g. Sensors to be configurable to automate multiple shade control zones.
 - h. Maintain a circular log of previous 48 hours of data received from each of 16 possible wireless devices. Data to be capable of being downloaded and stored for record keeping, performance optimization, or troubleshooting purposes.
2. Wireless Daylight Sensors:
- a. Monitors daylight through curtainwall and communicates with MechoNet Wireless Controller. Adjusts shade position based on user-defined light thresholds.
 - b. Powered by integral photovoltaic cells. No batteries or external power supplies.
 - c. Data Transmission:
 - 1) Provide the following data with each message:
 - a) Charge level.
 - b) Illuminance: 0 to 6,100 footcandles (0 to 65,656 lux). Plus or minus 5 percent accuracy.
 - 2) Transmit message when daylight level changes by three percent.
 - 3) Transmit "heartbeat" message once per minute during daylight and once per hour at night for determining when maintenance/support is required.
 - d. Mountable horizontally, vertically, and upside-down on mullion without screws.
3. Wireless Occupancy Sensors:
- a. Monitor room/area occupancy. Communicate with MechoNet Wireless Controller optimizing shade positions.
 - b. Solar-powered with battery backup.
 - c. Passive infrared (PIR) sensing.
 - d. Ceiling-mounted with 360 degree angle of detection optimized for ceiling height between 8 and 10 feet (2.4 and 3.0 m).
4. Wireless Switches:
- a. Communicates with MechoNet Wireless Controller. Adjusts shade positions based on switch operation.
 - b. Enables manual local control or network control of any individual shade motor or shade group/sub-group on MechoNet network.
 - c. Self-powered via rocker switch operation.
 - d. Finish: White.

2.5 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) [] space between bottom bar and window stool [finished floor] [window stool] [].
 - 2. Horizontal Dimensions: Inside Mounting.
 - a. Fill openings from jamb to jamb.
 - b. Symmetrical Light Gaps on Both Sides of Shade: 3/4 inch (19.05 mm) total.
- C. Openings Requiring Continuous Multiple Shade Units with Separate Rollers: Locate roller joints at window mullion centers; butt rollers end-to-end.

2.6 SHADE FABRIC

- A. Basis of Design: Shade fabric as manufactured by MechoShade Systems LLC.
 - 1. Solar Shadecloths:
 - a. Color: Selected from manufacturer's standard colors.
 - b.
 - 2. Blackout Shadecloths:
 - a. Color: Selected from manufacturer's standard colors.
 - 3. Fabric Properties: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 - a. Shade Type: Light filtering shades.
 - b. Shade Type: Room darkening shades.
 - 4. Material Certificates and Product Disclosures:
 - a. Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).
 - 5. Roll Width (in/mm): field measure
 - 6. Color: As selected by Architect from manufacturer's full range of colors.
 - 7. Welded Zipper Edge: Full height on both sides of fabric ensuring smooth operation within ShadeLoc channels.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- C. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

- A. Install shades level, plumb, square, and true per manufacturer's instructions and approved shop drawings. Locate so shade band is at least 2 inches (51 mm) from interior face of glass. Allow proper clearances for window operation hardware. Use mounting devices as indicated.
- B. Replace shades exceeding specified tolerances at no extra cost to Owner.
- C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric.
- D. Clean roller shade surfaces after installation, per manufacturer's written instructions.

- E. Demonstrate operation and maintenance of window shade system to Owner's personnel.
- F. Manufacturer's authorized personnel are to train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as a reference, supplemented with additional training materials as required.

3.4 SYSTEM STARTUP

- A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.
- B. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: Design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified is to be performed by a single manufacturer and their authorized installer/dealer.
 - 1. The Architect will not provide a set of electrical drawings for installation of control wiring for motors, or motor controllers of motorized roller shades.
 - 2. Power wiring (line voltage), to be provided by roller shade installer/dealer, per requirements provided by manufacturer. Coordinate following with roller shade installer/dealer:
 - 3. Contractor To Provide the Following:
 - a. Power Panels and Circuits: Size to accommodate roller shade manufacturer's requirements, as indicated on mechanical and electrical drawings.
 - b. Coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
 - c. Line voltage as dedicated home runs, of sufficient quantity, and capacity as required. Terminate in junction boxes at locations designated by roller shade installer/dealer.
 - d. Run line voltage from terminating points to motor controllers. Wire roller shade motors to motor controllers. Run low voltage control wiring from motor controllers to switch/control locations designated by Architect.
 - 1) Above-ceiling and concealed wiring to be plenum-rated, or in conduit, as required by the electrical code having jurisdiction.
 - e. Use conduit with pull wire in areas, not accessible to roller shade contractor due to building design, equipment location or schedule.

3.5 PROTECTION AND CLEANING

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.
 - 1. Clean soiled shades and exposed components as recommended by manufacturer.
 - 2. Replace shades that cannot be cleaned to "like new" condition.

3.6 MAINTENANCE

- A. Provide Owner a proposal as an alternate to the base bid and at no extra cost, a separate renewable maintenance contract for service and maintenance of motorized shade system.
 - 1. Include a complete description of preventive maintenance, systematic examination, adjustment, parts and labor, cleaning, and testing, with a detailed schedule.
 - a. Contract Duration: Two year from date of Substantial Completion.

END OF SECTION 12496

CONTENTS**DIVISION 21 - FIRE SUPPRESSION****DIVISION 22 - PLUMBING****DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**

SECTION	TITLE
21 05 00	STANDARD CONDITIONS FOR FIRE SUPPRESSION
21 05 18	ESCUTCHEONS FOR FIRE SUPPRESSION PIPING
21 05 23	GENERAL DUTY VALVES FOR FIRE PROTECTION PIPING
21 05 53	IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT
21 13 13	WET PIPE SPRINKLER SYSTEMS
22 05 00	STANDARD CONDITIONS FOR PLUMBING
22 05 17	SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
22 05 18	ESCUTCHEONS FOR PLUMBING PIPING
22 05 23.12	BALL VALVES FOR PLUMBING PIPING
22 05 23.14	CHECK VALVES FOR PLUMBING PIPING
22 05 29	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
22 05 53	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
22 07 19	PLUMBING PIPING INSULATION
22 11 16	DOMESTIC WATER PIPING
22 11 19	DOMESTIC WATER PIPING SPECIALTIES
22 13 00	DRAINAGE SYSTEMS
22 13 16	SANITARY WASTE AND VENT PIPING
22 13 19	SANITARY WASTE PIPING SPECIALTIES
22 13 19 .13	SANITARY DRAINS
22 40 00	PLUMBING FIXTURES AND EQUIPMENT
23 01 30.52	EXISTING HVAC AIR DISTRIBUTION SYSTEM CLEANING
23 05 00	STANDARD CONDITIONS FOR HVAC WORK
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

23 05 18	ESCUTCHEONS FOR HVAC PIPING
23 05 19	METERS AND GAGES FOR HVAC PIPING
23 05 23.12	BALL VALVES FOR HVAC PIPING
23 05 23.13	BUTTERFLY VALVES FOR HVAC PIPING
23 05 23.14	CHECK VALVES FOR HVAC PIPING
23 05 29	HANGERS AND SUPPORTS HVAC PIPING & EQUIP
23 05 48	VIBRATION ISOLATION
23 05 50	FIRE STOPPING
23 05 53	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93	TESTING, BALANCING, AND ADJUSTING
23 07 00	INSULATION AND COVERING
23 07 13	DUCT INSULATION
23 07 19	HVAC PIPING INSULATION
23 09 23.11	CONTROL VALVES
23 09 33	AUTOMATIC TEMPERATURE CONTROL
23 21 13	HYDRONIC PIPING
23 21 16	HYDRONIC PIPING SPECIALITIES
23 21 23	PUMPS
23 23 00	REFRIGERANT PIPING SYSTEM
23 31 13	DUCTWORK
23 31 21	DUCT CLEANING
23 33 00	AIR DUCT ACCESSORIES
23 33 46	FLEXIBLE DUCTS
23 34 23	HVAC POWER VENTILATIONS
23 37 13 .13	AIR DIFFUSERS
23 37 13. 23	REGISTERS AND GRILLES
23 81 27	SPLIT SYSTEM HEAT PUMP
23 81 27	DUCTLESS SPLIT SYSTEM (SINGLE ZONE R410A)
23 82 19	FAN COIL UNITS (IEC)

23 82 30	CONVECTORS, EXTENDED FIN RADIATION, UNIT HEATERS CONVECTORS
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DIVISION 21 – FIRE SUPPRESSION**SECTION 21 05 00 - STANDARD CONDITIONS FOR FIRE SUPPRESSION****PART 1 - GENERAL****1.01 REFERENCE**

- A. Requirements established within the portions of this project manual titled Division 1, General Requirements are collectively applicable to the work of this section.
- B. Instructions to Bidders, Special Conditions and addenda as issued are part of this specification.
- C. Plumbing/Fire Suppression drawings along with all other project drawings and specifications represent the work of this section.
- D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

1.02 SCOPE

- A. Provide labor, material, equipment and supervision necessary to install complete operating fire suppression systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.
- B. It shall be the contractor's responsibility to coordinate his work and the work of his subcontractors to insure that all the work is covered. He shall designate who is responsible for various portions of work which may overlap so that there is complete coverage of all required work. It is the position of the owner and the A/E that all work is the responsibility of the mechanical contractor within this Division of the work.
- C. Contractor shall provide all demolition necessary to remove and replace, repair, install new or modify existing work whether it be walls, floors, ceilings, structure, mechanical or electrical required to install his work. Contractor shall replace all work to leave in a finished condition.
- D. The fire suppression contractor shall remove the entire existing fire suppression system including valves, heads, piping, hangers, supports and related accessories.
- E. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
- F. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
- G. It shall be the fire suppression contractor's responsibility to develop the design of the system based on current flow test results and to provide all the documentation necessary for final approval.
- H. Fire suppression contractor's scope of work shall include but not be limited to the following:
 - 1. Wet Sprinkler System, Siamese connection.
 - 2. Demolition of existing work to accommodate new work.
 - 3. Modify existing systems affected by the new construction or alteration work. Patch and repair and finish to match existing.

1.03 REGULATIONS, CODES, AND STANDARDS

- A. Work shall be performed in accordance with the latest adopted codes, amendments, regulations and ordinances of the authorities having jurisdiction. Observe all safety regulations including the requirements of OSHA.
- B. Obtain and pay for all permits, connection charges, inspections, and certificates required to complete the work.
- C. Latest editions of any referenced standards shall govern.
- D. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- E. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

1.04 SUBMISSIONS

- A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
- B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the A/E. Submissions will be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.
- C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
- D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
- E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- F. Contractor to forward a copy of submittals which have electrical requirements to the Electrical Contractor (EC) for coordination of voltage, amperage, and phase. Response to be received from EC prior to ordering of equipment by mechanical contractor.
- G. Submissions shall include warranties by the manufacturer for equipment being provided. Submissions for commonly related items and equipment shall be combined in a single brochure with all items being furnished clearly identified.
- H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and coordinated with all other trades.
- I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified so as to be clear on what is being provided.
- J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.
- K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the

requested file format may be necessary at \$150/hr billable to the contractor.

1.05 SITE INSPECTION

- A. Visit site, inspect and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of bid will be deemed evidence of having complied with this request. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.

1.06 SUBSTITUTIONS

- A. Material and equipment specified shall be deemed as that which the bidder's quotation represents.
- B. Once bids are accepted only that material and equipment listed in the specifications or added by addenda shall be acceptable. Substitution information for inclusion in an addenda must be received by the A/E at least 10 days prior to bid opening. If acceptable, an addenda will be issued which will add the additional acceptable manufacturers or materials and be available for all contractors to consider. A contractor cannot be the lowest bidder because he utilized substituted materials or equipment as opposed to specified materials or equipment.
- C. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service by the engineer at the rate of \$150.00/hr. for such services. Also billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval or rejection.
- D. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

1.07 DRAWINGS AND SPECIFICATIONS

- A. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.
- B. When a conflict or contradiction exists either between drawings and specs or between specs or between different drawings or details, the more stringent shall apply.
- C. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
- D. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.
- E. The contractor shall refer to the drawings for details which may influence the design of the fire suppression systems.
- F. The architects or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.

G. If a question arises after bidding the A/E interpretation shall govern.

1.08 MEASUREMENTS

A. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

1.09 PROGRESS SCHEDULE

A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date. Work involving interruption of services shall be clearly designated and approved.

1.10 COST SCHEDULE

A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.
B. AIA forms are required for this submission.

1.11 COMPLETION

A. The contractor shall deliver to the owner, with his request for final payment, copies of all manufacturer's guarantees, equipment instructional manuals, a complete set of all final shop drawings, catalog cuts, service contracts, and other items as may be required elsewhere in the documents.

1.12 OFFICE

A. The contractor shall set up his job office (desk) where directed by the owner.

1.13 STORAGE

A. Material shall be stored only where directed by the owner.

1.14 SANITARY

A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
B. Toilet will be located where directed by the owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material shall be new and of present day manufacture.
B. All material and equipment shall be in conformance with accepted trade standards.
C. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed to apply to as many such items as may be necessary to complete the installation.
D. The word "provide" means "furnish and install complete, tested, and adjusted as necessary with all

accessories, covers, escutcheons". The word "piping" means pipe, fitting, controls, valves and hangers as required for a complete system.

2.02 OPERATING INSTRUCTIONS AND MANUALS

- A. Properly and fully instruct owner's personnel in the operation and maintenance of all systems and equipment.
- B. Insure that the owner's personnel are familiar with all operations to carry on required activities.
- C. Such instruction shall be for each item of equipment and each system as a whole.
- D. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, control sequences, service requirements, piping diagrams, names, and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.
- E. Provide to the owner any special tools necessary to operate any of the equipment.

PART 3 - EXECUTION

3.01 PROTECTION

- A. Plug or cap open ends of piping systems.
- B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
- C. Protect all installed work until accepted in place by the owner.
- D. Do not install sprinklers, polished metal escutcheons, and other finished devices until masonry, tile, and painting operations are complete or protect otherwise.
- E. Protect all existing or new work from operations which may cause damage such as hauling, welding, and painting.

3.02 WORKMANSHIP

- A. Install all work neat, trim, and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

3.03 FASTENERS, HANGERS, AND SUPPORTS

- A. Furnish and install all hangers and supports required to suspend, mount, or hang the work per NFPA requirements.
- B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets, and anchors to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded to more than 1/4 rated capacity with a minimum of 200 lbs.
- E. Power driven fasteners shall not be allowed for piping larger than 2", or for equipment. When used they shall not be loaded more than 1/8 rated capacity with a minimum of 200 lbs.
- F. Provide seismic restraint for piping as required by NFPA.

3.04 OFFSETS, TRANSITIONS, MODIFICATIONS

- A. Furnish and install all offsets necessary to install the work and to provide clearance for the other

trades.

- B. Maintain adequate headroom and clearance as directed by the A/E.
- C. Incidental modifications necessary to the installation of the systems shall be made as necessary and at the direction of the A/E.
- D. Rises and drops of piping systems shall be provided as required and where directed to allow for clearances to other construction. Drains shall be installed at no additional cost to the owner. The contractor shall allow for such occurrences in his bid.
- E. Piping, and equipment shall be so arranged as to not pass in front of windows, doors, access panels, access doors, and service clearance areas. Do not install within 3'-0" clearance of electrical or panel fronts.

3.05 ACCESS

- A. Locate all equipment, valves, devices and controllers which may need service in accessible places.

3.06 WIRING

- A. Power wiring shall be provided by the Division 26 Electrical Contractor. This contractor shall furnish all controllers necessary to operate the equipment. The Electrical Contractor shall store and install the electrical devices and furnish and install the power wiring.
- B. Supervisory and alarm wiring shall be furnished and installed under Division 28 portion of the work.
- C. All wiring shall be in accordance with the NEC.
- D. Pushbuttons shall be maintain-contact type.
- E. Refer to the electrical specifications for wiring methods.
- F. Plenum rated cable is required for control wiring.

3.07 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the owner unless otherwise specified. Material and labor for first year warranty is to be provided.
- B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.

3.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver material and equipment in manufacturer's original cartons or on skids.
- B. Store material in dry enclosures or under protective coverings out of way of work progress.
- C. Handle so as to prevent damage to product or any surrounding material.

3.09 MANUFACTURER'S NAMES

- A. Manufacturers names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. All material and equipment must be U.L. and FM approved. Any deviations from this must be acknowledged at bid time by the supplier and he shall be solely responsible for any and all costs associated with the application of his product in the project.

3.10 AS-BUILT DRAWINGS

- A. At the completion of the work the contractor shall furnish a reproducible as-built drawings to the A/E for approval. The drawings shall indicate all work installed and its actual size and location. If

acceptable, the A/E will submit the as-built drawings to the owner as record drawings. If not acceptable, the A/E will return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.

- B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.
- C. To aid in the preparation of as-built drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150/hr. billable to the contractor.

3.11 PENETRATION SEALING

- A. All penetrations of fire walls, smoke walls, and floors by ducts, pipes, conduit, or wiring shall be sealed to prevent the flow of gasses or smoke.
- B. The sealant shall be foamed in place between the penetrant and the adjacent floor or wall with DOW Corning RTV foam or equivalent by 3M, Hilti, or Chase foam.
- C. The installation shall meet the approval of the authority having jurisdiction.
- D. Penetrations through rated surfaces shall have a UL rating equivalent to the adjacent surfaces.

3.12 CUTTING AND PATCHING INTERIOR SURFACES

- A. Respective contractor shall install all hangers, supports, pipe sleeves in floors, walls, partitions, ceilings and roof slabs as construction progresses to permit their work to be built into place and to eliminate unnecessary cutting of construction work.
- B. All cutting of concrete, or other material for the passage of piping through floors, walls, partitions and ceiling shall be done by the contractor where necessary to install his work. Contractor will close all such openings around piping, and conduit with materials equivalent to that removed. All exposed surfaces shall be left in suitable condition for refinishing without further work.
- C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

3.13 CONNECTIONS TO EXISTING SYSTEMS

- A. The contractor shall be responsible for connecting new systems to existing systems.
- B. Arrange for outages with the owner.
- C. Contractor shall shut down and drain existing systems.
- D. Contractor shall cut in, weld, or thread, and make connections compatible with existing systems.
- E. Provide new valves at connections to existing systems.
- F. Contractor shall refill existing and fill new systems.
- G. Contractor shall purge air from systems, both new and existing.
- H. Contractor shall place existing systems back into operation and perform the necessary tests.

3.14 COORDINATION

- A. The sprinkler shop drawings shall show all ductwork, diffusers, grilles, piping, conduit lighting fixtures coordinated with the sprinkler piping and sprinkler beads.
- B. All architectural features, structural conditions which may impact on the sprinkler layout shall be shown.
- C. The location of equipment, controller, fire pumps, and jockey pumps compression and valve shall be coordinated with the other trades showing all necessary clearances.

3.15 WELDING

- A. All electric power for arc welding shall be supplied by the contractor performing the work.

3.16 VEHICLES

- A. Vehicle access to the site will be as directed by the owner.

3.17 RUBBISH DISPOSAL

- A. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

3.18 PROTECTION

- A. Maintain all public walks and access ways.
- B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.

3.19 SCAFFOLDING

- A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

3.20 CLEANUP

- A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from equipment.
- B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
- C. Remove all trash and debris from the premises.

3.21 WORK COMPLETION

- A. The contractor shall promptly correct work rejected by the engineer failing to conform to the requirements of the contract documents, whether discovered before or after substantial completion and whether or not fabricated, installed or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

3.22 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

- A. All RFI's shall include the following information based on AIA Document G716:
 - 1. To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
 - 2. Provide a description with specification and/or drawing references.
 - 3. Provide the senders recommendation including cost and/or schedule considerations.
 - 4. Provide receiver's reply space.
 - 5. Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

3.23 SHOP DRAWING REQUIREMENTS

- A. The following is a list of required shop drawings for the project. Not all items may be identified, and it is the responsibility of the contractor to submit additional shop drawings where indicated in the specifications.

FIRE PROTECTION	DATE REC'D	ACTION	DATE REC'D	ACTION
COORDINATION DRAWINGS				
SPRINKLER SYSTEM HYDRAULIC CALCULATIONS AND DESIGN DRAWINGS AND DETAILS				
FIRE MARSHAL APPROVAL				
INSURANCE COMPANY APPROVAL				
SPRINKLER HEADS				
PIPING/VALVES/HANGERS				
SPARE SPRINKLER CAP & SIGNS				
AS-BUILTS				
WARRANTIES AND GUARANTEES				
OPERATIONS AND MAINTENANCE MANUALS				
TESTS/CERTIFICATIONS				
EMERGENCY AND MANUFACTURER CONTACTS				
CONTRACTOR'S LETTER OF COMPLETION				

END OF SECTION

SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING**PART 1 - GENERAL**

1.01 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One Piece, Cast-Brass Type: With [polished, chrome-plated] [and] [rough-brass] finish and setscrew fastener.
- B. One Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.

- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
- j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
- k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 21 05 23 - GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Iron butterfly valves with indicators.
 2. Check valves.
 3. Iron OS&Y gate valves.
 4. NRS gate valves.
 5. Indicator posts.
 6. Trim and drain valves.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
1. Main Level: HAMV - Fire Main Equipment.
 - a. Level 1: HCBZ - Indicator Posts, Gate Valve.
 - b. Level 1: HLOT - Valves.
 - 1) Level 3: HLUG - Ball Valves, System Control.
 - 2) Level 3: HLXS - Butterfly Valves.
 - 3) Level 3: HMER - Check Valves.
 - 4) Level 3: HMRZ - Gate Valves.
 2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
 - a. Level 1: VQGU - Valves, Trim and Drain.
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
1. Automated Sprinkler Systems:
 - a. Indicator posts.
 - b. Valves.
 - 1) Gate valves.
 - 2) Check valves.
 - a. Single Check Valves
 - c. Miscellaneous valves.
- C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.
- D. ASME Compliance:
1. ASME B16.1 for flanges on iron valves.
 2. ASME B1.20.1 for threads for threaded-end valves.
 3. ASME B31.9 for building services piping valves.

- E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- F. NFPA Compliance: Comply with NFPA 24 for valves.
- G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.
- H. Valve Sizes: Same as upstream piping unless otherwise indicated.
- I. Valve Actuator Types:
 - 1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
 - 2. Handwheel: For other than quarter-turn trim and drain valves.
 - 3. Handlever: For quarter-turn trim and drain valves NPS 2-inch and smaller.

2.02 IRON BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Globe Fire Sprinkler Corporation.
 - 2. NIBCO INC.
 - 3. Tyco Fire Products LP.
 - 4. Victaulic Company.
- B. Description:
 - 1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
 - 4. Seat Material: EPDM.
 - 5. Stem: Stainless steel.
 - 6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
 - 7. Actuator: Worm gear or traveling nut.
 - 8. Supervisory Switch: Internal or external.
 - 9. Body Design: Grooved-end connections.

2.03 CHECK VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Globe Fire Sprinkler Corporation.
 - 2. Mueller Co.
 - 3. NIBCO INC.
 - 4. Reliable Automatic Sprinkler Co., Inc. (The).
 - 5. Tyco Fire Products LP.
 - 6. Victaulic Company.
 - 7. Viking Corporation.
- B. Description:
 - 1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Type: Single swing check.
 - 4. Body Material: Cast iron, ductile iron, or bronze.
 - 5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
 - 6. Clapper Seat: Brass, bronze, or stainless steel.
 - 7. Hinge Shaft: Bronze or stainless steel.
 - 8. Hinge Spring: Stainless steel.
 - 9. End Connections: Flanged, grooved, or threaded.

2.04 IRON OS&Y GATE VALVES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hammond Valve.
 - 2. Mueller Co.
 - 3. NIBCO INC.
 - 4. Victaulic Company.
- B. Description:
 - 1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Body and Bonnet Material: Cast or ductile iron.
 - 4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
 - 5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
 - 6. Stem: Brass or bronze.
 - 7. Packing: Non-asbestos PTFE.
 - 8. Supervisory Switch: External.
 - 9. End Connections: Grooved.

2.05 NRS GATE VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mueller Co.
 - 2. NIBCO INC.
 - 3. Victaulic Company.
- B. Description:
 - 1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Body and Bonnet Material: Cast or ductile iron.
 - 4. Wedge: Cast or ductile iron with elastomeric coating.
 - 5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
 - 6. Stem: Brass or bronze.
 - 7. Packing: Non-asbestos PTFE.
 - 8. Supervisory Switch: External.
 - 9. End Connections: Grooved.

2.06 INDICATOR POSTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Cast Iron Pipe Company.
 - 2. Clow Valve Company; a subsidiary of McWane, Inc.
 - 3. Kennedy Valve Company; a division of McWane, Inc.
 - 4. Mueller Co.
 - 5. NIBCO INC.
- B. Description:
 - 1. Standard: UL 789 and FM Global standard for indicator posts.
 - 2. Type: Underground or Wall.
 - 3. Base Barrel Material: Cast or ductile iron.
 - 4. Extension Barrel: Cast or ductile iron.
 - 5. Cap: Cast or ductile iron.
 - 6. Operation: Wrench or Handwheel.

2.07 TRIM AND DRAIN VALVES

A. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire Protection Products, Inc.
 - b. NIBCO INC.
 - c. United Brass Works, Inc.
2. Description:
 - a. Pressure Rating: 175 psig.
 - b. Body Material: Brass or bronze.
 - c. Ends: Threaded.
 - d. Stem: Bronze.
 - e. Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

- A. Comply with requirements in the following Sections for specific valve installation requirements and applications:
1. Section 211100 "Facility Fire Suppression Water-Service Piping" for application of valves in fire-suppression water service piping outside the building.
 2. Section 211200 "Fire Suppression Standpipes" for application of valves in fire-suppression standpipes.
 3. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
 4. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.
- H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

END OF SECTION

SECTION 21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Warning signs and labels.
 - 2. Pipe labels.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

PART 2 - PRODUCTS**2.01 WARNING SIGNS AND LABELS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady Corporation.
 - 2. Brimar Industries, Inc.
 - 3. Carlton Industries, LP.
 - 4. Champion America.
 - 5. Craftmark Pipe Markers.
 - 6. emedco.
 - 7. LEM Products Inc.
 - 8. Marking Seives Inc.
 - 9. National Marker Company.
 - 10. Seton Identification Products.
 - 11. Stranco, Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
- C. Letter Color: Red.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by ¾ inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- H. Fasteners: Stainless steel.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.02 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - 2. Brady Corporation.
 - 3. Brimar Industries, Inc.
 - 4. Carlton Industries, LP.
 - 5. Champion America.
 - 6. Craftmark Pipe Markers.
 - 7. emedco.
 - 8. Kolbi Pipe Marker Co.
 - 9. LEM Products Inc.
 - 10. Marking Services Inc.
 - 11. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-adhesive Pipe Labels: Printed plastic with contact type, permanent adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.02 LABEL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Piping: Painting of piping is specified in Architectural Specification Sections or minimally (2) coats of exterior paint and (1) primer coat.
- D. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

END OF SECTION

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Cover system for sprinkler piping.
 - 3. Specialty valves.
 - 4. Sprinklers.
- B. Related Requirements:
 - 1. Section 210523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For wet-pipe sprinkler systems.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.
 - 3. Valving
 - 4. Main riser details
 - 5. Sprinkler locations and types
 - 6. Hydraulic reference points
 - 7. Hanger locations
 - 8. Pipe sizes
 - 9. Most remote hydraulic area
 - 10. Flow switches
 - 11. Tamper switches
 - 12. Pressure switches
- C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which items of other systems and equipment are shown and coordinated with each other, using input from installers of the items involved.
- B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- D. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility.
Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
2. Contractor shall be fully licensed and accredited in the installation of automatic sprinkler and related fire protection equipment for a minimum of 5 years and shall be regularly engaged in this trade.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
1. NFPA 13.
 2. NFPA 13R.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Delegated Design: Engage a qualified professional engineer, with minimum 5 years' experience to design wet-pipe sprinkler systems.
1. Sprinkler system design shall be approved by authorities having jurisdiction.
 - a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - b. Sprinkler Occupancy Hazard Classifications:
 - 1) Automobile Parking Areas: Ordinary Hazard, Group 1.
 - 2) Building Service Areas: Ordinary Hazard, Group 1.
 - 3) Churches: Light Hazard.
 - 4) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - 5) Dry Cleaners: Ordinary Hazard, Group 2.
 - 6) General Storage Areas: Ordinary Hazard, Group 1.
 - 7) Laundries: Ordinary Hazard, Group 1.
 - 8) Libraries except Stack Areas: Light Hazard.
 - 9) Library Stack Areas: Ordinary Hazard, Group 2.
 - 10) Machine Shops: Ordinary Hazard, Group 2.
 - 11) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - 12) Office and Public Areas: Light Hazard.
 - 13) Plastics Processing Areas: Extra Hazard, Group 2.
 - 14) Printing Plants: Extra Hazard, Group 1.
 - 15) Repair Garages: Ordinary Hazard, Group 2.
 - 16) Residential Living Areas: Light Hazard.
 - 17) Restaurant Service Areas: Ordinary Hazard, Group 1.
 - 18) Solvent Cleaning Areas: Extra Hazard, Group 2.
 - 19) Upholstering Plants: Extra Hazard, Group 1.
 2. Minimum Density for Automatic-Sprinkler Piping Design:

- a. Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. area.
 - b. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 - d. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
- 3. Maximum Protection Area per Sprinkler: According to UL listing.
- 4. Maximum Protection Area per Sprinkler:
 - a. Residential Areas: 400 sq. ft.
 - b. Office Spaces: 120 sq. ft. 225 sq. ft.
 - c. Storage Areas: 130 sq. ft.
 - d. Mechanical Equipment Rooms: 130 sq. ft.
 - e. Electrical Equipment Rooms: 130 sq. ft.
 - f. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.
- E. Where glass is incorporated as part of an interior fire rated partition, provide sprinkler coverage on both sides of the glass in the form of a water curtain as described in NFPA 13.
- F. In multi-story buildings, the sprinkler system for each floor shall be provided with sectionalizing valves, flow switches, and combination drain and inspectors test connections.
- G. Concealed spaces in buildings having combustible construction shall be protected with sprinklers.

2.02 STEEL PIPE AND FITTINGS

- A. Standard-Weight Galvanized and Black Steel Pipe: ASTM A 53/A 53M. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized and Black Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Black Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5-inch and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10-inch, plain end.
- E. Galvanized and Black Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- F. Galvanized and Uncoated Steel Couplings: ASTM A 865/A 865M, threaded.
- G. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- H. Malleable- or Ductile-Iron Unions: UL 860.
- I. Cast-Iron Flanges: ASME 16.1, Class 125.
- J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
 - 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
 - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
 - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
- K. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Fittings, Inc.
 - b. Tyco Fire Products LP.
 - c. Victaulic Company.
 - 2. Pressure Rating: 175-psig minimum.
 - 3. Galvanized Painted Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M,

malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.

4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- L. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Victaulic Company.

2.03 CPVC PIPE AND FITTINGS

- A. CPVC Pipe: ASTM F 442/F 442M and UL 1821, SDR 13.5, for 175-psig rated pressure at 150 deg. F, with plain ends. Include "LISTED" and "CPVC SPRINKLER PIPE" markings.
- B. CPVC Fittings: UL listed or FM Global approved 175-psig rated pressure at 150 deg. F, socket type. Include "LISTED" and "CPVC SPRINKLER FITTING" markings.
 1. NPS 3/4-inch to NPS 1-1/2-inch: ASTM F 438 and UL 1821, Schedule 40, socket type.
 2. NPS 2-inch to NPS 3-inch: ASTM F 439 and UL 1821, Schedule 80, socket type.
 3. CPVC-to-Metal Transition Fittings: CPVC, one piece, with dimensions' equivalent to pipe; one end with threaded brass insert, and one socket end.
 4. CPVC-to-Metal Transition Unions: CPVC, with dimensions' equivalent to pipe; one end with threaded brass insert, and one socket end.
 5. Flanges: CPVC, one or two pieces.
- C. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493 solvent cement recommended by pipe and fitting manufacturer and made for joining CPVC sprinkler pipe and fittings. Include cleaner or primer recommended by pipe and fitting manufacturer.
- D. Plastic Pipe-Flange Gasket and Bolts and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.04 COVER SYSTEM FOR SPRINKLER PIPING

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. DecoShield Systems, Inc.
- B. Description: System of support brackets and covers made to protect sprinkler piping.
- C. Brackets: Glass-reinforced nylon.
- D. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

2.05 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Specialty Valves Pressure Rating: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Alarm Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc. (The).
 - c. Tyco Fire Products LP.
 - d. Victaulic Company.

- e. Viking Corporation.
- 2. Standard: UL 193.
- 3. Design: For horizontal or vertical installation.
- 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
- 5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
- 6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
- G. Automatic (Ball Drip) Drain Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc. (The).
 - b. Tyco Fire Products LP.
 - 2. Standard: UL 1726.
 - 3. Pressure Rating: 175-psig minimum.
 - 4. Type: Automatic draining, ball check.
 - 5. Size: NPS 3/4-inch.
 - 6. End Connections: Threaded.

2.06 SPRINKLER PIPING SPECIALTIES

- A. Branch Outlet Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Fittings, Inc.
 - b. Tyco Fire Products LP.
 - c. Victaulic Company.
 - 2. Standard: UL 213.
 - 3. Pressure Rating: 175-psig minimum.
 - 4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 - 5. Type: Mechanical-tee and -cross fittings.
 - 6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 - 7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 - 8. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Flow Detection and Test Assemblies:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGF Manufacturing Inc.
 - b. Reliable Automatic Sprinkler Co., Inc. (The).
 - c. Tyco Fire Products LP.
 - d. Victaulic Company.
 - 2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 - 3. Pressure Rating: 175-psig minimum 300 psig.
 - 4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded or grooved.
- C. Branch Line Testers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Fire-End & Croker Corporation.
 - c. Potter Roemer LLC.

2. Standard: UL 199.
 3. Pressure Rating: 175 psig.
 4. Body Material: Brass.
 5. Size: Same as connected piping.
 6. Inlet: Threaded.
 7. Drain Outlet: Threaded and capped.
 8. Branch Outlet: Threaded, for sprinkler.
- D. Sprinkler Inspector's Test Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGF Manufacturing Inc.
 - b. Triple R Specialty.
 - c. Tyco Fire Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.
 2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 3. Pressure Rating: 175-psig minimum.
 4. Body Material: Cast- or ductile-iron housing with sight glass.
 5. Size: Same as connected piping.
 6. Inlet and Outlet: Threaded.
- E. Adjustable Drop Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aegis Technologies, Inc.
 - b. CECA, LLC.
 - c. Corcoran Piping System Co.
 - d. Merit Manufacturing.
 2. Standard: UL 1474.
 3. Pressure Rating: 250-psig minimum.
 4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
 5. Size: Same as connected piping.
 6. Length: Adjustable.
 7. Inlet and Outlet: Threaded.
- F. Flexible Sprinkler Hose Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic
 - b. Viking Corporation
 2. Standard: UL 1474.
 3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
 4. Pressure Rating: 175-psig minimum.
 5. Size: Same as connected piping, for sprinkler.

2.07 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Globe Fire Sprinkler Corporation.
 2. Reliable Automatic Sprinkler Co., Inc. (The).
 3. Tyco Fire Products LP.
 4. Viking Corporation.
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

- C. Pressure Rating for Residential Sprinklers: 175-psig maximum.
- D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- E. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Early-Suppression, Fast-Response Applications: UL 1767.
 - 2. Nonresidential Applications: UL 199.
 - 3. Residential Applications: UL 1626.
 - 4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- F. Sprinkler Finishes: Chrome plated bronze and painted.
- G. Special Coatings: Wax lead and corrosion-resistant paint
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
 - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc. (The).
 - b. Tyco Fire Products LP.
 - c. Victaulic Company.
 - d. Viking Corporation.
 - 2. Standard: UL 199.
 - 3. Type: Wire cage with fastening device for attaching to sprinkler.
- J. Sprinkler heads at the top of the elevator shaft shall be rated at 200°F. Sprinklers in swimming pools shall be rated for corrosive environments similar to Viking's electroless nickel plated sprinklers.
- K. Sprinkler heads in refrigerated boxes with temperatures below 40°F shall be dry pendants.
- L. Provide an allowance for an additional 12 heads and piping to cover architectural review and adjustment at shop drawing review. Design shall follow building lines, centers, and architectural features for a uniform, coordinated appearance.

2.08 MANUAL CONTROL STATIONS

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2-inch pipe nipple, and bronze ball valve.
- B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.09 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AGF Manufacturing Inc.
 - 2. AMETEK, Inc.
 - 3. Ashcroft Inc.
 - 4. Brecco Corporation.
 - 5. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2-inch to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0- to 250-psig minimum.
- E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.01 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.
- B. Install shutoff valve backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.02 WATER-SUPPLY CONNECTIONS

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 221119 "Domestic Water Piping Specialties."
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.03 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2-inch and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2-inch and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 21 05 48

"Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS ¼-inch and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they are not subject to freezing.
- N. Fill sprinkler system piping with water.

3.04 JOINT CONSTRUCTION

- A. Joining method: Joints NPS 2-inch and smaller shall be threaded; Joints NPS 2 1/2-inch and larger shall be grooved mechanical joints.
- B. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- C. Install unions adjacent to each valve in pipes NPS 2-inch and smaller.
- D. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2-inch and larger end connections.
- E. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- F. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- G. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- I. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- J. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Steel-Piping, Pressure-Sealed Joints: Join steel pressure-seal fittings with tools recommended by fitting manufacturer.
- N. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- O. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- P. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.05 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
 - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
 - 3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.06 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.07 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Electrical Specifications.

3.08 FIELD QUALITY CONTROL

- A. Perform the following tests and inspection with the assistance of a factory-authorized service representative:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
 - 6. Coordinate with fire-pump tests. Operate as required.
 - 7. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.09 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded or grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. CPVC pipe, Schedule 40CPVC fittings, and solvent-cemented joints may be used for light-hazard and residential occupancies.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-inch and smaller, shall be one of the following:
 - 1. Standard weight or Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard weight or Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - 3. Standard weight or Schedule 40, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 - 4. Standard weight or Schedule 40, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
- E. Standard or Schedule 40, black-steel pipe with cut or roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 1. Standard weight or Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for
- F. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2-inch to NPS 4-inch shall be one of following:
 - 1. Standard weight or Schedule 30 black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard weight or Schedule 30 galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - 3. Standard weight or Schedule 30, black-steel pipe with cut or roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 4. Standard weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- G. Standard-pressure, wet-pipe sprinkler system, NPS 5-inch and larger, shall be one of the following:
 - 1. Standard weight or Schedule 10, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard weight or Schedule 10, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - 3. Standard weight or Schedule 10, black-steel pipe with cut or roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 4. Standard weight or Schedule 10, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as

indicated.

5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated Attic sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

DIVISION 22 - PLUMBING**SECTION 22 05 00 - STANDARD CONDITIONS FOR PLUMBING****PART 1 - GENERAL****1.01 REFERENCE**

- A. Requirements established within the portions of this project manual titled Division 1, General Requirements are collectively applicable to the work of this section.
- B. Instructions to Bidders, Special Conditions and addenda as issued are part of this specification.
- C. Plumbing drawings along with all other project drawings and specifications represent the work of this section.
- D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

1.02 SCOPE

- A. Provide labor, material, equipment and supervision necessary to install complete operating plumbing systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.
- B. It shall be the contractor's responsibility to coordinate his work and the work of his subcontractors to insure that all the work is covered. He shall designate who is responsible for various portions of work which may overlap so that there is complete coverage of all required work. It is the position of the owner and the A/E that all work is the responsibility of the mechanical contractor within this division of the work.
- C. Contractor shall provide all demolition necessary to remove and replace, repair, install new or modify existing work whether it be walls, floors, ceilings, structure, mechanical or electrical required to install his work. Contractor shall replace all work to leave in a finished condition.
- D. The plumbing contractor shall remove the entire existing plumbing system including fixtures, domestic water piping, soil, waste and vent piping, gas piping, rainwater conductors, hangers, supports and floor drains. Pipe, conduit, ductwork and wiring shall be cut back behind wall surfaces, above ceilings, and below floor levels so that a patch can be placed over the opening.
- E. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
- F. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
- G. Plumbing contractor's scope of work shall include but not be limited to the following:
 - 1. Domestic water system and insulation (See Section 22 11 16, 22 07 00 and 22 40 00).
 - 2. Sanitary and vent system. (See Section 22 13 00)
 - 3. Storm and overflow systems and any insulation (See Section 22 07 00 and 22 13 00).
 - 4. All other work in Division 22.
 - 5. Roof penetrations for plumbing work.
 - 6. Demolition of existing work to accommodate new work.

7. Repair existing areas affected by new construction. Patch, repair and finish to match existing.
8. Provide third party certification of all packaged systems by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399 as well as Pamphlet #70 and National Electrical Code Article 90-7.
9. Fire stopping of penetrations. (See Section 22 05 50).

1.03 REGULATIONS, CODES, AND STANDARDS

- A. Work shall be performed in accordance with the latest adopted codes, amendments, regulations and ordinances of the authorities having jurisdiction. Observe all safety regulations including the requirements of OSHA.
- B. Obtain and pay for all permits, connection charges, inspections, and certificates required to complete the work.
- C. Latest editions of any referenced standards shall govern.
- D. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- E. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

1.04 SUBMISSIONS

- A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
- B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the A/E. Submissions will be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.
- C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
- D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
- E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- F. Contractor to forward a copy of submittals which have electrical requirements to the Electrical Contractor (EC) for coordination of voltage, amperage, and phase. Response to be received from EC prior to ordering of equipment by mechanical contractor.
- G. Submissions shall include warranties by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, drains shall be combined in a single brochure with all items being furnished clearly identified.
- H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and coordinated with all other trades.
- I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified so as to be clear on what is being provided.
- J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor

and other trades.

- K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150/hr. billable to the contractor.

1.05 SITE INSPECTION

- A. Visit site, inspect and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of bid will be deemed evidence of having complied with this request. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.

1.06 SUBSTITUTIONS

- A. Material and equipment specified shall be deemed as that which the bidder's quotation represents the contractor.
- B. Once bids are accepted only that material and equipment listed in the specifications or added by addenda shall be acceptable. Substitution information for inclusion in an addenda must be received by the A/E at least 10 days prior to bid opening. If acceptable, an addenda will be issued which will add the additional acceptable manufacturers or materials and be available for all contractors to consider. It shall be a basic premise that a contractor is a lowest bidder because he utilized substituted materials or equipment as opposed to specified materials or equipment.
- C. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service by the engineer at the rate of \$150.00/hr. for such services. Also, billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval or rejection.
- D. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

1.07 DRAWINGS AND SPECIFICATIONS

- A. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.
- B. When a conflict or contradiction exists either between drawings and specs or between specs or between different drawings or details, the more stringent shall apply.
- C. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
- D. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be

required for the project.

- E. The architects or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.
- F. If a question arises after bidding the A/E interpretation shall govern.

1.08 MEASUREMENTS

- A. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

1.09 PROGRESS SCHEDULE

- A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

1.10 COST SCHEDULE

- A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.
- B. AIA forms are required for this submission.

1.11 COMPLETION

- A. The contractor shall deliver to the owner, with his request for final payment, copies of all manufacturer's guarantees, equipment instructional manuals, a complete set of all final shop drawings, catalog cuts, service contracts, and other items as may be required elsewhere in the documents.

1.12 OFFICE

- A. The contractor shall set up his job office (desk) where directed by the owner.

1.13 STORAGE

- A. Material shall be stored only where directed by the owner.

1.14 SANITARY

- A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
- B. Toilet will be located where directed by the owner.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material shall be new and of present day manufacture.
- B. All material and equipment shall be in conformance with accepted trade standards.
- C. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed

to apply to as many such items as may be necessary to complete the installation.

- D. The word “provide” means “furnish and install complete, tested, and adjusted as necessary with all accessories, covers, escutcheons”. The word “piping” means pipe, fitting, controls, valves and hangers as required for a complete system.

2.02 OPERATING INSTRUCTIONS AND MANUALS

- A. Properly and fully instruct owner’s personnel in the operation and maintenance of all systems and equipment.
- B. Insure that the owner's personnel are familiar with all operations to carry on required activities.
- C. Such instruction shall be for each item of equipment and each system as a whole.
- D. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, control sequences, service requirements, piping diagrams, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.
- E. Provide to the owner any special tools necessary to operate any of the equipment.

2.03 DRAIN PANS

- A. All water heaters mounted above the floor shall be provided with drain pans. Drain to suitable discharge point acceptable to owner and A/E. To be visible outfall.
- B. Drains shall slope down in direction of flow at 1" per 10 feet.

PART 3 - EXECUTION

3.01 PROTECTION

- A. Plug or cap open ends of piping systems and conduit.
- B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
- C. Protect all installed work until accepted in place by the owner. Cover plumbing fixtures.
- D. Do not install plates, polished metal escutcheons, and other finished devices until masonry, tile, and painting operations are complete or protect otherwise.
- E. Protect all existing or new work from operations which may cause damage such as hauling, welding, soldering, painting, insulating, and covering.

3.02 WORKMANSHIP

- A. Install all work neat, trim, and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

3.03 FASTENERS, HANGERS, AND SUPPORTS

- A. Furnish and install all hangers and supports required to suspend, mount, or hang the work.
- B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets, and anchors to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded to more than 1/4 rated capacity with a minimum of 200 lbs.
- E. Powder driven fasteners shall not be allowed for piping larger than 2", or for equipment. When used

they shall not be loaded more than 1/8 rated capacity with a minimum of 200 lbs.

- F. All hangers, miscellaneous steel, braces, and supports shall be galvanized, cadmium plated, or painted with corrosion resistant primer and finish coat of epoxy enamel.
- G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles at not more than 8 foot centers up to 1 1/4" dia. and 10 foot centers above 1 1/4" dia. Piping shall not support other piping.
- H. Support vertical piping at floor levels. Piping shall have split rings.
- I. Provide and install lintels where required for mechanical work and not indicated on architectural or structural drawings.
- J. Furnish steel framing for roof openings and floor openings. Submit details for review.

3.04 SLEEVES

- A. All piping passing through floors or walls shall have sleeves unless holes are cored. Sleeves shall be 16 gage galvanized steel in non-bearing walls, 10 gage galvanized steel for bearing walls, and schedule 40 galvanized pipe in floors. Sleeves shall accommodate insulation. This shall not apply to sprinkler piping.
- B. Sleeves passing through foundation walls not exposed to interior spaces or sleeves passing through slab on grade may be schedule 40 PVC.
- C. Wall sleeves shall finish flush with wall.
- D. Floor sleeves shall extend 1 inch above floor.
- E. Sleeves in walls between interior spaces and unexcavated, exterior, crawl, or backfilled spaces shall be made watertight with "Link-Seal" modular wall and casing seal. Casing shall be schedule 40 galvanized pipe with anchor flange.

3.05 PLATES

- A. Furnish and install chrome plated plates wherever piping passes into finished areas.
- B. Plates shall be securely fastened to piping or building construction.
- C. Floor plates shall cover one inch floor extension.

3.06 OFFSETS, TRANSITIONS, MODIFICATIONS

- A. Furnish and install all offsets necessary to install the work and to provide clearance for the other trades.
- B. Maintain adequate headroom and clearance as directed by the A/E.
- C. Ductwork transitions necessary to accommodate available space or clearance requirements shall be contract requirements.
- D. Incidental modifications necessary to the installation of the systems shall be made as necessary and at the direction of the A/E.
- E. Rises and drops of piping systems shall be provided as required and where directed to allow for clearances to other construction. Drains shall be installed at no additional cost to the owner. The contractor shall allow for such occurrences in his bid.
- F. Piping and equipment shall be so arranged as to not pass in front of windows, doors, access panels, access doors, coil removal or filter removal space or service clearance areas. Do not install within 3'-0" clearance of electrical panel fronts.

3.07 RECESSES

- A. Furnish information to the general contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment or devices which are to be recessed into walls.
- B. Make offsets or modifications as required to suit final locations.

3.08 LABELING

- A. All equipment shall be provided with permanent black laminated white core labels with 3/8" letters.

3.09 FLASHING AND COUNTER-FLASHING

- A. Roof drains and overflow drains shall have counter-flashing fittings. General contractor shall provide flashing.
- B. Piping and conduit through the roof shall be flashed by the General Contractor. This contractor shall furnish counterflashing.

3.10 ACCESS

- A. Locate all equipment, valves, devices and controllers which may need service in accessible places.
- B. Where access is not available; access panels shall be provided. Furnish prime painted steel access doors to the General Contractor for installation.
- C. Access doors shall be 16 gauge frames and 22 gauge steel door. Access doors in fire rated walls shall have a "B" label for 1 ½ hours.
- D. Maintain clearances for tube removal, coil pulls, and filter removal.

3.11 WIRING

- A. Power wiring shall be provided by the Division 16 Electrical Contractor. This contractor shall furnish all 3 phase starters, pushbuttons, and controllers necessary to operate the equipment. The Electrical Contractor shall store and install the electrical devices and furnish and install the power wiring.
- B. Control wiring shall be furnished and installed under Division 26 portion of the work. Wiring for controls is control wiring whether it is line voltage or low voltage.
- C. All wiring shall be in accordance with the NEC.
- D. Pushbuttons shall be maintain-contact type.
- E. Refer to the electrical specifications for wiring methods.
- F. Plenum rated cable is required for control wiring.

3.12 UTILITIES

- A. Do not interrupt any utility or service without adequate previous notice and scheduling with the owner.
- B. Refer to Division 1 for requirements for providing temporary utilities.

3.13 CUTTING AND PATCHING EXTERIOR SERVICES

- A. This contractor shall be responsible for returning disturbed areas to original condition where excavation for utilities has been required.
- B. Cut and patch paved areas to match original surfaces.
- C. Properly tamp backfill before finishing surfaces.
- D. Concrete pavements and curbs shall be formed and poured to match adjacent areas.
- E. Grass areas shall be sodded and maintained until established growth is achieved.

3.14 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the owner unless otherwise specified. Material and labor for first year warranty is to be provided.

- B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.
- C. Compressor system components shall be provided with a 5 year factory warranty. Material only for years 2 through 5 is required.

3.15 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver material and equipment in manufacturer's original cartons or on skids.
- B. Store material in dry enclosures or under protective coverings out of way of work progress.
- C. Handle so as to prevent damage to product or any surrounding material.

3.16 MANUFACTURERS' NAMES

- A. Manufacturers' names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer's name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being named in the specification. Any deviations from this must be acknowledged at bid time by the supplier and he shall be solely responsible for any and all costs associated with the application of his product in the project.
- B. A design cannot be prepared which accommodates the installation of all suppliers and is not intended to do so. If certain modifications must be made to accommodate one particular supplier's equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

3.17 AS-BUILT DRAWINGS

- A. At the completion of the work the contractor shall furnish a reproducible as-built drawings to the A/E for approval. The drawings shall indicate all work installed and its actual size and location. If acceptable, the A/E will submit the as-built drawings to the owner as record drawings. If not acceptable, the A/E will return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
- B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.
- C. To aid in the preparation of as-built drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150/hr. billable to the contractor.

3.18 PENETRATION SEALING

- A. All penetrations of Natatorium walls, fire walls, smoke walls, and floors by pipes or wiring shall be sealed to prevent the flow of gasses or smoke.
- B. The sealant shall be foamed in place between the penetrant and the adjacent floor or wall with DOW Corning RTV foam or equivalent by 3M, Hilti, or Chase foam.
- C. The installation shall meet the approval of the authority having jurisdiction.
- D. Penetrations through rated surfaces shall have a UL rating equivalent to the adjacent surfaces.

3.19 CUTTING AND PATCHING INTERIOR SURFACES

- A. Respective contractor shall install all hangers, supports, pipe sleeves in floors, walls, partitions,

ceilings and roof slabs as construction progresses to permit their work to be built into place and to eliminate unnecessary cutting of construction work.

- B. All cutting of concrete, or other material for the passage of piping through floors, walls, partitions and ceiling shall be done by the respective contractor where necessary to install his work. Respective contractor will close all such openings around piping with materials equivalent to that removed. All exposed surfaces shall be left in suitable condition for refinishing without further work.
- C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

3.20 INVERTS AND ELEVATIONS

- A. Indicated inverts and elevations of existing utilities are approximate and based on the best information available.
- B. Upon award of contract, contractor shall verify in the field all such information and report any discrepancies before proceeding with work. Contractor shall be responsible for extra work caused by his failure to verify inverts and elevations.

3.21 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

- A. Furnish and install final connections to equipment furnished in other parts of the specification or furnished by the owner. Provide drainage connections, vent connections, water connections, fuel gas connections, gas connections to the fixtures or equipment. Plumbing connections shall include valved supplies and trapped waste connections.

3.22 CONNECTIONS TO EXISTING SYSTEMS

- A. The contractor shall be responsible for connecting new systems to existing systems.
- B. Arrange for outages with the owner.
- C. Contractor shall shut down and drain existing systems.
- D. Contractor shall cut in, weld, solder, or thread, and make connections compatible with existing systems.
- E. Provide new valves at connections to existing systems.
- F. Contractor shall refill existing and fill new systems.
- G. Contractor shall purge air from systems, both new and existing.
- H. Contractor shall place existing systems back into operation.
- I. Contractor shall repair and replace any insulation damaged or removed during connection procedures.

3.23 COORDINATION DRAWINGS

- A. Provide 3/8" = 1'-0" scale drawings showing all coordinated ductwork, piping, conduit, and equipment of all trades.
- B. The sheet metal shop drawings may be used as the basis of these drawings.
- C. Show ductwork, walls, beams, steel, drainage piping, domestic water piping, HVAC piping, sprinkler piping, light fixtures, electrical conduit and equipment.
- D. Contact other disciplines and obtain information to identify fully coordinated systems.
- E. Submit for review and approval to the A/E.
- F. Provide all dimensional data and necessary clearances to other trades for installation of fixtures and equipment within casework and counter tops.
- G. Work shall not proceed until coordination is completed and all conflicts, issues, sequences etc., are resolved.

3.24 WELDING

- A. All electric power for arc welding shall be supplied by the contractor performing the work.

3.25 VEHICLES

- A. Vehicle access to the site will be as directed by the owner.

3.26 RUBBISH DISPOSAL

- A. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

3.27 PROTECTION

- A. Maintain all public walks and access ways.
- B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.

3.28 SCAFFOLDING

- A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

3.29 CLEANUP

- A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from fixtures and equipment.
- B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
- C. Clean and polish all plumbing fixtures.
- D. Remove all trash and debris from the premises.

3.30 MOUNTING HEIGHTS

- A. Contractor to coordinate all mounting heights with all trades and architect prior to rough-in.

3.31 WORK COMPLETION

- A. The contractor shall promptly correct work rejected by the engineer failing to conform to the requirements of the contract documents, whether discovered before or after substantial completion and whether or not fabricated, installed or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

3.32 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

- A. All RFI's shall include the following information based on AIA Document G716:
 - 1 To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
 - 2 Provide a description with specification and/or drawing references.
 - 3 Provide the senders recommendation including cost and/or schedule considerations.
 - 4 Provide receiver's reply space.
 - 5 Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

3.33 SHOP DRAWING REQUIREMENTS

- A. The following is a list of required shop drawings for the project. Not all items may be identified, and it is the responsibility of the contractor to submit additional shop drawings where indicated in the specifications.

PLUMBING	DATE REC'D	ACTION	DATE REC'D	ACTION
COORDINATION DRAWINGS				
VALVES, STRAINERS				
MIXING VALVES				
PIPING/FITTINGS/LABELING				
DRAINS				
FIXTURES/TRIM/CARRIERS				
INSULATION A. HANDICAP COVERS B. DOMESTIC WATER PIPING				
AS-BUILT DRAWINGS				
WARRANTIES AND GUARANTEES				
OPERATIONS AND MAINTENANCE MANUALS				
INSTRUCTIONS				
TESTS/CERTIFICATIONS				
EMERGENCY AND MANUFACTURER CONTACTS				

END OF SECTION

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS**2.01 SLEEVES**

- A. Cast Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. GPT; an EnPro Industries company.
 - 3. Metraflex Company (The).
 - 4. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.03 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves.
 - b. Piping NPS 6-inch and Larger: Cast-iron wall sleeves.
 - 2. Exterior Concrete Walls below Grade:

- a. Piping Smaller Than NPS 6-inch Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- b. Piping NPS 6-inch and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6-inch and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6-inch: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6-inch and Larger: Galvanized-steel-pipe sleeves.
- 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6-inch: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6-inch and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Escutcheons
 - 2. Floor plates

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS**2.01 ESCUTCHEONS**

- A. One Piece, Cast-Brass Type: With polished, chrome-plated, and rough-brass finish and setscrew fastener.
- B. One Piece, Deep-Pattern Type: Deep-drawn, box shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One Piece, Stamped-Steel Type: With chrome plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

- A. One Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, stamped-

- steel type.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast-brass type with polished, chrome-plated finish.
- g. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, stamped-steel type.
- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
- j. Bare Piping in Equipment Rooms: One piece, cast-brass type with polished, chrome-plated finish.
- k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One piece, floor plate type.

3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 3. ASME B16.18 for solder-joint connections.
 - 4. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
 - 2. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.

2.02 BRASS BALL VALVES

- A. Brass Ball Valves, One-Piece:
 - 1. Manufacturers:
 - a. KITZ Corporation
 - b. WATTS
 - c. Apollo
 - d. Grove
 - e. Jamesbury
 - f. NIBCO
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Forged brass or bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass or stainless steel.
 - h. Ball: Chrome-plated brass or stainless steel.
 - i. Port: Reduced.

2.03 BRONZE BALL VALVES

- A. Bronze Ball Valves, One-Piece:
 - 1. Manufacturers:
 - a. NIBCO Inc.
 - b. WATSS
 - c. Apollo
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.

- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.02 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.03 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Brass ball valve, one piece.
 - 3. Bronze ball valve, one piece with bronze trim.

END OF SECTION

SECTION 22 05 23.14 - CHECK VALVES FOR PLUMBING PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Bronze swing check valves.
 - 2. Iron swing check valves.
 - 3. Iron swing check valves with closure control.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE SWING CHECK VALVES

- A. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.

- f. Red-White Valve Corporation.
 - g. Stockham; Crane Energy Flow Solutions.
 - h. Watts; a Watts Water Technologies company.
- 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: PTFE.

2.03 IRON SWING CHECK VALVES

- A. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Stockham; Crane Energy Flow Solutions.
 - 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Composition.
 - g. Seat Ring: Bronze.
 - h. Disc Holder: Bronze.
 - i. Disc: PTFE.
 - j. Gasket: Asbestos free.

2.04 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Stockham; Crane Energy Flow Solutions.
 - g. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
 - h. Closure Control: Factory-installed exterior lever and spring.
- B. Iron Swing Check Valves with Lever and Weight-Closure Control, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Crane; Crane Energy Flow Solutions.
 - c. Hammond Valve.
 - d. Jenkins Valves; Crane Energy Flow Solutions.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Stockham; Crane Energy Flow Solutions.
 - h. Watts; a Watts Water Technologies company.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
 - h. Closure Control: Factory installed exterior lever and weight.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

3.02 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 1. Pump-Discharge Check Valves:
 - a. NPS 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2 ½ - inch and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; metal-seat or resilient-seat check valves.
 - c. NPS 2 ½ - inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- C. End Connections:
 1. For Copper Tubing, NPS 2-inch and Smaller: Threaded or soldered.

2. For Copper Tubing, NPS 2 ½ -inch to NPS 4-inch: threaded.
3. For Copper Tubing, NPS 5-inch and Larger: Flanged.
4. For Steel Piping, NPS 2-inch and Smaller: Threaded.
5. For Steel Piping, NPS 2 ½ -inch to NPS 4-inch: threaded.
6. For Steel Piping, NPS 5-inch and Larger: Flanged.

3.04 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2-inch and Smaller: Bronze swing check valves bronze nonmetallic disc, Class 125, with soldered or threaded end connections.
- B. Pipe NPS 2 ½ - inch and Larger:
 1. Iron swing check valves with metal nonmetallic-to-metal seats, Class 125, with threaded or flanged end connections.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2-inch and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4-inch and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4-inch and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4-inch to NPS 3 1/2 -inch: 12 inches long and 0.048 inch thick.
 - b. NPS 4-inch: 12 inch long and 0.06 inch thick.
 - c. NPS 5-inch and NPS 6-inch: 18 inches long and 0.06 inch thick.
 - d. NPS 8-inch to NPS 14-inch: 24 inches long and 0.075 inch thick.
 - e. NPS 16-inch to NPS 24-inch: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8-inch and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve

indicated slope of pipe.

- B. Trim excess length of continuous-thread hanger and support rods to 1 ½ - inch.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use 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-inch to NPS 30-inch.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg. F, pipes NPS 4-inch to NPS 24-inch, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4-inch to NPS 36-inch, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2-inch to NPS 8-inch.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2-inch to NPS 30-inch.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4-inch to NPS 36-inch, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4-inch to NPS 36-inch, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1-inch to NPS 30-inch, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2-inch to NPS 42-inch if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- 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 ¼ inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Warning signs and labels.
 - 2. Pipe labels.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS**2.01 WARNING SIGNS AND LABELS**

- A. Manufacturers:
 - 1. Brady Corporation
 - 2. Brimar Industries, Inc.
 - 3. Craftmark Pipe Makers
 - 4. Marking Services Inc.
 - 5. National Marker Company
 - 6. Seton Identification Products
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.
- D. Background Color: Yellow.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.02 PIPE LABELS

- A. Manufacturers:
 - 1. Brady Corporation
 - 2. Brimar Industries, Inc.
 - 3. Craftmark Pipe Makers
 - 4. Marking Services Inc.

- 5. Seton Identification Products
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.01 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings unfinished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
 - 1. Domestic Water Piping
 - a. Background: Safety green.
 - b. Letter Colors: White.
 - 2. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Yellow
 - b. Letter Color: Black.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic hot-water piping.
 - 2. Domestic recirculating hot water piping.
 - 3. Sanitary waste piping exposed to freezing conditions.
 - 4. Stormwater piping exposed to freezing conditions.
 - 5. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
 - 1. Section 220716 "Plumbing Equipment Insulation."

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS**2.01 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Pittsburgh Corning Corporation.
 - 2. Special-Shaped Insulation: ASTM C 552, Type III.
 - 3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 4. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
 - 5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge or expanded rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
- H. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armacell LLC.
 - b. Nomaco Insulation.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Ramco Insulation, Inc.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg. F.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated

- according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. K-Flex USA.
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.

2.04 MASTICS

- A. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 - b. Knauf Insulation.
 - c. Vimasco Corporation.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg. F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- B. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Knauf Insulation.
 - e. Mon-Eco Industries, Inc.
 - f. Vimasco Corporation.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg. F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.05 SEALANTS

- A. Joint Sealants for Cellular-Glass Products:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - e. Pittsburgh Corning Corporation.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Permanently flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 100 to plus 300 deg. F.
 5. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg. F.
 5. Color: Aluminum.
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg. F.
 5. Color: White.

2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 - b. Vimasco Corporation.

2.08 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005,

Temper H-14.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. ITW Insulation Systems; Illinois Tool Works, Inc.
 - c. RPR Products, Inc.
 2. Sheet and roll stock ready for shop or field sizing.
 3. Finish and thickness are indicated in field-applied jacket schedules.
 4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 5. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- C. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pittsburgh Corning Corporation.
 - b. Polyguard Products, Inc.

2.09 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces' force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.

- c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces' force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lb./inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces' force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. C & F Wire.

2.11 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Company.
 - b. Insul-Tect Products Co.
 - c. McGuire Manufacturing.
 - d. Plumberex Specialty Products, Inc.
 - e. Truebro.
 - f. Zurn Industries, LLC.
 - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:

- a. Truebro.
 - b. Zurn Industries, LLC.
2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket.

- Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1 ½ - inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.04 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular glass insulation to valve body.
2. 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.

3.06 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.

3.07 INSTALLATION OF POLYOLEFIN INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Seal split-tube 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 polyolefin 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 polyolefin 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 cut sections of polyolefin pipe and sheet insulation to valve body.
 2. 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.

3.08 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1 ½ -inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.09 FINISHES

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

3.10 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.

3.11 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.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

	Temp	Up to 1"	Up to 1.5"	Up to 4"	Up to 8"	8" & Up
1. Hot Water						
a) Domestic HW/HWR	100-130	1"	1"	1.5"	1.5"	1.5"

- B. Domestic Cold Water
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 3. Polyolefin: 1 inch thick.
- C. Stormwater and Overflow: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 3. Polyolefin: 1 inch thick.
- D. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:
 - 1 Flexible Elastomeric: 1 inch thick.
 - 2 Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 3 Polyolefin: 1 inch thick.
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1/2 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - 3. Polyolefin: 1/2 inch thick.
- F. Sanitary Waste Piping Where Heat Tracing Is Installed: Mineral-fiber, preformed pipe insulation, Type I, 1 ½ - inches thick.

3.13 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. Aluminum, Smooth 0.016 inch thick.
- D. Piping, Exposed:
 - 1. Aluminum, Smooth: 0.016 inch thick.

3.15 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Copper tube and fittings.
 - 2. Ductile-iron pipe and fittings.
 - 3. Galvanized steel pipe and fittings.
 - 4. Piping joining materials.
 - 5. Transition fittings.
 - 6. Dielectric fittings.
- B. Related Requirements:
 - 1. Section 221113 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water service piping enters the building.

1.02 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.
- B. Sustainable Design Submittals:

1.03 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS**2.01 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- C. Comply with NSF Standard 372 for low lead.

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:

1. MSS SP-123.
 2. Cast-copper-alloy, hexagonal-stock body.
 3. Ball-and-socket, metal-to-metal seating surfaces.
 4. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
1. Fittings for NPS 2-inch and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
 2. Fittings for NPS 2 ½ to NPS 4-inch: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.03 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe:
1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Standard-Pattern, Mechanical-Joint Fittings:
1. AWWA C110/A21.10, ductile or gray iron.
 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Compact-Pattern, Mechanical-Joint Fittings:
1. AWWA C153/A21.53, ductile iron.
 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.04 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe:
1. ASTM A 53/A 53M, Type E, Grade B, Standard Weight.
 2. Include ends matching joining method.
- B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
- C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Malleable-Iron Unions:
1. ASME B16.39, Class 150.
 2. Hexagonal-stock body.
 3. Ball-and-socket, metal-to-metal, bronze seating surface.
 4. Threaded ends.
- E. Flanges: ASME B16.1, Class 125, cast iron.

2.05 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 2. Full face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
- G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM 656.
- H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.06 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Plastic-to-Metal Transition Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
 - d. Uponor.
 - 2. Description:
 - a. CPVC or PVC one piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
- D. Plastic-to-Metal Transition Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Company.
 - 2. Description:
 - a. CPVC or PVC four-part union.
 - b. Brass or stainless steel threaded end.
 - c. Solvent-cement-joint or threaded plastic end.
 - d. Rubber O-ring.
 - e. Union nut.

2.07 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Central Plastics Company.
 - b. Jomar Valve.
 - c. Matco-Norca.
 - d. Watts; a Watts Water Technologies company.
 - e. Wilkins.
 - f. Zurn Industries, LLC.
 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 125 psig minimum at 180 deg. F.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous.

- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Matco-Norca.
 - d. Watts; a Watts Water Technologies company.
 - e. Wilkins.
 - f. Zurn Industries, LLC.
 - 2. Standard: ASSE 1079.
 - 3. Factory-fabricated, bolted, companion-flange assembly.
 - 4. Pressure Rating: 125 psig minimum at 180 deg. F.
 - 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Nonconducting materials for field assembly of companion flanges.
 - 3. Pressure Rating: 150 psig
 - 4. Gasket: Neoprene or phenolic.
 - 5. Bolt Sleeves: Phenolic or polyethylene.
 - 6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products.
 - c. Matco-Norca.
 - d. Precision Plumbing Products.
 - e. Victaulic Company.
 - 2. Standard: IAPMO PS 66.
 - 3. Electroplated steel nipple complying with ASTM F 1545.
 - 4. Pressure Rating and Temperature: 300 psig at 225 deg. F.
 - 5. End Connections: Male threaded or grooved.
 - 6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- I. Joints for PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.
- J.
- K. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1 ½ -inch and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2-inch and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 inch and Smaller: Plastic-to-metal transition fittings or unions.

3.05 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2-inch and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2 ½ -inch to NPS 4-inch: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5-inch and Larger: Use dielectric flange kits.

3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.

- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 -inch and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1-inch and NPS 1 ¼ -inch: 72 inches with 3/8-inch rod.
 - 3. NPS 1 ½ -inch and NPS 2-inch: 96 inches with 3/8-inch rod.
 - 4. NPS 2 ½ -inch: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5-inch: 10 feet with 1/2-inch rod.
 - 6. NPS 6-inch: 10 feet with 5/8-inch rod.
 - 7. NPS 8-inch: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1 ¼ -inch and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1 1/2 -inch: 108 inches with 3/8-inch rod.
 - 3. NPS 2-inch: 10 feet with 3/8-inch rod.
 - 4. NPS 2 ½ -inch: 11 feet with 1/2-inch rod.
 - 5. NPS 3-inch and NPS 3 ½ inch: 12 feet with 1/2-inch rod.
 - 6. NPS 4-inch and NPS 5-inch: 12 feet with 5/8-inch rod.
 - 7. NPS 6-inch: 12 feet with 3/4-inch rod.
 - 8. NPS 8-inch to NPS 12-inch: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2 ½ -inch and larger.

3.08 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.09 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections, and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired

- before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
 - B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
 - C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3-inch and smaller, shall be one of the following:
 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed copper pressure-seal fittings; and pressure-sealed joints.
 2. PVC, Schedule 80; socket fittings; and solvent-cemented joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4-inch to NPS 8-inch and larger, shall be one of the following:
 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed joints.
 2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
 3. PVC, Schedule 80; socket fittings; and solvent-cemented joints.
- F. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6-inch to NPS 12-inch, shall be one of the following:
 1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
- G. Under-building-slab, domestic water piping, NPS 2-inch and smaller shall be one of the following:
 1. Hard or soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed copper pressure-seal-joint fittings; and pressure-sealed joints.
 2. PVC, Schedule 80 socket fittings; and solvent-cemented joints.
- H. Aboveground domestic water piping, NPS 2-inch and smaller shall be one of the following:
 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast or wrought-copper, solder-joint fittings; and soldered joints.
 2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint

- 3. fittings; and pressure-sealed joints.
- 3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper push-on-joint fittings; and push-on joints.
- I. Aboveground domestic water piping, NPS 2 ½ - to NPS 4-inch shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast or wrought copper, solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); grooved-joint, copper-tube appurtenances; and grooved joints.
 - 4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
- J. Aboveground domestic water piping, NPS 5-inch to NPS 8-inch, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast or wrought-copper, solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B)); grooved-joint, copper-tube appurtenances; and grooved joints.
 - 3. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
- K. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6-inch to NPS 12-inch, shall be one of the following:
 - 1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
 - 2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

END OF SECTION

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIAL

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Vacuum breakers.
 - 2. Balancing valves.
 - 3. Temperature-actuated, water mixing valves.
 - 4. Strainers.
 - 5. Hose bibbs.
 - 6. Wall hydrants.
 - 7. Drain valves.
 - 8. Water-hammer arresters.
 - 9. Trap-seal primer valves.
- B. Related Requirements:
 - 1. Section 221116 "Domestic Water Piping" for water meters.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 Annex G.

2.02 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers
 - 1. Standard: ASSE 1001.

2. Size: NPS 1/4-inch to NPS 3-inch, as required to match connected piping.
 3. Body: Bronze.
 4. Inlet and Outlet Connections: Threaded.
 5. Finish: Rough bronze or Chrome plated.
- B. Hose-Connection Vacuum Breakers
1. Standard: ASSE 1011.
 2. Body: Bronze, nonremovable, with manual drain.
 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 4. Finish: Chrome or nickel plated.

2.04 BALANCING VALVES

- A. Memory-Stop Balancing Valves
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Jenkins Valves; Crane Energy Flow Solutions.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Stockham; Crane Energy Flow Solutions.
 2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
 3. Pressure Rating: 400-psig minimum CWP.
 4. Size: NPS 2-inch or smaller.
 5. Body: Copper alloy.
 6. Port: Standard or full port.
 7. Ball: Chrome-plated brass.
 8. Seats and Seals: Replaceable.
 9. End Connections: Solder joint or threaded.
 10. Handle: Vinyl-covered steel with memory-setting device.

2.05 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Water-Temperature Limiting Devices
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Armstrong International, Inc.
 - c. Honeywell Water Controls.
 - d. Leonard Valve Company.
 - e. Powers.
 - f. Symmons Industries, Inc.
 - g. TACO Incorporated.
 - h. Watts; a Watts Water Technologies company.
 - i. Zurn Industries, LLC.
 2. Standard: ASSE 1017.
 3. Pressure Rating: 125 psig.
 4. Type: Thermostatically controlled, water mixing valve.
 5. Material: Bronze body with corrosion-resistant interior components.
 6. Connections: Threaded inlets and outlet.
 7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
 8. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers.
 - e. Symmons Industries, Inc.
 - f. Zurn Industries, LLC.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot and cold water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Chrome plated.
9. Piping Finish: Chrome plated.
10. Cabinet: Factory fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.

2.06 STRAINERS FOR DOMESTIC WATER PIPING**A. Y-Pattern Strainers**

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 inch and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2 ½ - inch and larger.
3. End Connections: Threaded for NPS 2 inch and smaller; flanged for NPS 2 ½ - inch and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2-inch and Smaller: 0.020 inch.
 - b. Strainers NPS 2 ½ -inch to NPS 4-inch: 0.045 inch.
 - c. Strainers NPS 5-inch and Larger: 0.10 inch.
6. Drain: Pipe plug.

2.07 HOSE BIBBS**A. Hose Bibbs**

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2-inch or NPS 3/4-inch threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.

13. Operation for Finished Rooms: Wheel handle.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome or nickel plated hose bibb.

2.08 WALL HYDRANTS

A. Non freeze Wall Hydrants

1. Standard: ASME A112.21. 3M for concealed or exposed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4-inch or NPS 1-inch.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): One with each wall hydrant.

B. Non freeze, Hot- and Cold-Water Wall Hydrants

1. Standard: ASME A112.21. 3M for concealed or exposed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig
3. Operation: Loose key.
4. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
5. Inlet: NPS 3/4-inch or NPS 1-inch.
6. Outlet: Concealed.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Vacuum Breaker:
 - a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
 - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
10. Operating Keys: One with each wall hydrant.

C. Vacuum Breaker Wall Hydrants

1. Standard: ASSE 1019, Type A or Type B.
2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
3. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
4. Pressure Rating: 125 psig.
5. Operation: Loose key or wheel handle.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 1/2-inch or NPS 3/4-inch.
8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.09 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4-inch.
4. Body: Copper alloy.

5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. Precision Plumbing Products.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. Watts; a Watts Water Technologies company.
 - f. Zurn Industries, LLC.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Precision Plumbing Products.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Watts; a Watts Water Technologies company.
 - e. Zurn Industries, LLC.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1-inch threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2-inch threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Jay R. Smith Mfg. Co.
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8-inch minimum, trap makeup connection.
3. Size: NPS 1 1/4 -inch minimum.
4. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air brakes are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.
- F. Set nonfreezing, nondraining-type post hydrants in concrete or pavement.
- G. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.
- H. Install water-hammer arresters in water piping according to PDI-WH 201.
- I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- J. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.02 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.04 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 13 00 - DRAINAGE SYSTEMS**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 22 05 00 for requirements which are applicable to this section.
- B. Requirements of the International codes and authorities having jurisdiction shall be made a part of these specifications.
- C. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirement shall be followed.

1.02 QUALITY ASSURANCE:

- A. Install piping to meet requirements of International Plumbing Code.
- B. Provide manufacturer's certificate that materials meet or exceed minimum requirements as specified.
- C. All Piping and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

1.03 SUBMITTALS:

- A. Certificates: Submit manufacturer's certificates of conformance to applicable codes.
- B. Test Reports: Submit copies of test reports.
- C. Manufacturer's Recommendations: Submit "PVC" manufacturer's materials, installation support and expansion joint recommendations for review by Architect/Engineer.

PART 2 - PRODUCTS**2.01 PIPE AND FITTINGS**

- A. Cast Iron no-hub ASTM-A88 and CISPI-301 with heavy duty banded stainless steel sleeves and rubber sleeve joints for all above ground sanitary drainage and storm drainage piping 2" and larger. Cast iron soil pipe and fittings shall bear the markings of the Cast Iron Soil Pipe Institute and conform to CISPI Standard 301. Copper type DWV for up to 1 1/2".
- B. Cast iron bell and spigot for all underground soil, waste, and storm piping. Tyton type gaskets are acceptable. Contractor may use PVC underground with solvent welded joints when acceptable to the local authority.
- C. Exposed drainage systems shall be schedule 40 galvanized steel, copper tube type "L", or standard weight cast iron.
- D. Dishwasher drainage piping to be cast iron no-hub.

2.02 CLEANOUTS:

- A. Slab on grade; J. R. Smith 433OV with nickel bronze cover and rim.
- B. Concrete Floors; J. R. Smith 4020 with nickel bronze cover. Provide flashing flange where floor is

waterproofed.

- C. Tile Floors; J. R. Smith 4140 with 1/8" recess. Provide flashing flange where floor is waterproofed.
- D. Carpet Floors; J. R. Smith 4020 with carpet marker.
- E. Walls; J. R. Smith 4510-4725 cover plate chrome finish.
- F. Equivalents by Josam, Zurn, Watts and Wade are acceptable.

2.03 FLOOR DRAINS

- A. Finished spaces unless otherwise noted on plans; J. R. Smith 2010-A with nickel bronze strainer. Provide trap primer connection and heel proof grate. Flashing collar. In traffic areas provide heel proof strainer.
- B. Unfinished spaces; J. R. Smith 2110 with cast iron grate and flashing flange.

2.04 TRAP PRIMERS

- A. Smith No. 2699 cast bronze trap primer with 1/2" connections. Provide primered drains with Smith No. 2695 or 2696 cast iron trap primer adaptors.
- B. Trap primers for multiple floor drains shall consist of the appropriate model with distribution unit as manufactured by Precision Plumbing Products.
- C. All trap primers shall be accessibly located and installed in strict accordance with the manufacturer's recommendations.

2.05 BACKWATER VALVE

- A. The contractor shall provide a backwater valve on any sanitary branch below street level and above the site sanitary main.
- B. The valve shall conform to ASME A112.14.1.
- C. Signage shall be provided and posted at the location of the valve.
- D. Provide a sleeve extension and cover to access the valve below the slab.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine areas to receive piping for:
 - 1. Defects that adversely affect execution and quality of work.
 - 2. Deviations beyond allowable tolerance for piping clearances.
- B. Start work only when conditions are satisfactory.

3.02 INSTALLATION

- A. Piping Layout:
 - 1. Complete installation to present a neat, orderly appearance.
 - 2. Do not block openings or passageways with piping.
 - 3. Run piping parallel to walls of building, unless otherwise indicated.
 - 4. Keep piping free from contact with structure or installed items.
 - 5. All changes in direction to be made with "Y" branches or 1/8 bends.
 - 6. Provide cleanouts at base of all stacks, at changes in direction of piping and at 50 foot

intervals. Cleanouts shall be line size up to 4 inch and 4 inch for piping over 4 inch.

B. Workmanship:

1. Examine pipe and fittings before installation and assure no defective materials are incorporated.
2. Keep inside of pipes and fittings free of dirt and debris.
3. Installation of cast iron soil pipe to conform to Cast Iron Soil Pipe Institute Standards Handbook.

C. Placement:

1. Vertical Piping:
 - a. Secure at sufficiently close intervals to keep pipe in alignment, and to support weight of pipe and contents.
 - b. Install risers, stacks, etc. as directly as possible to roof.
 - c. Install supports at each floor.
2. Horizontal Piping, Suspended;
 - a. Support at sufficiently close intervals to prevent sagging and to maintain alignment. Not to exceed: cast iron piping to be supported at pipe joints not to exceed 10'-0" spacing. Copper and steel piping to be supported on 12' spacing. PVC piping to be supported on 4'-0" spacing. Copper tubing up to 1 1/4" to be supported on 6' spacing, over 1 1/4" to be supported on 10'-0" spacing. Other piping to be supported per manufacturer.
 - b. Install hangers and supports at least 18 inches from each joint regardless of pipe length.
 - c. Install hangers at the ends of all runs or branches and at each change of direction or alignment.
 - d. Gasketed or mechanical joints piping shall be securely braced or clamp and rod restrained to prevent horizontal movement where the transition from the vertical of the horizontal occurs. Branches must be secured to prevent movement in any direction by use of sway bracing.
3. Horizontal Piping, Underground;
 - a. Lay piping on firm bed for entire length of trench except where supports are provided.
 - b. Employ partial backfilling and cradling to hold pipe in secure position during backfilling operations.
 - c. Firmly brace piping laid on grade prior to embedment in concrete.

3.03 TESTING

- A. Disconnect all equipment and devices which may be damaged by test pressures.
- B. Plug or cap lines.
- C. Test each piping system for leaks in accordance with the local inspector's test code.
- D. Repair all leaks noted.
- E. Minimum test shall be to fill system to top vent stack and not show a drop of more than 3 inches for 1 hour. Test shall be performed before piping is concealed.
- F. Secure certificate from municipal inspector of an acceptable test.

END OF SECTION

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:

1.03 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
- B. Field quality-control reports.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.02 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.04 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. 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.
 - 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- D. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.05 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.

2.06 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 2. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers:
 - 1) Fernco Inc
 - 2) Froet Industries LLC
 - 3) Plastic Oddities
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. End Connections: Same size as and compatible with pipes to be joined.
 - e. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC, or other material compatible with pipe materials being joined.
 - 3. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers:
 - 1) Cascade Waterworks Mfg.
 - 2) Mission Rubber Co.
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

- d. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drainpipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- L. 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.
- M. 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.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- P. Install aboveground PVC piping according to ASTM D 2665.
- Q. Install underground PVC piping according to ASTM D 2321.
- R. Plumbing Specialties:
 1. Install backwater valves in sanitary waster gravity-flow piping.
 - a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 3. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- T. 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."
- U. 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."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors.
 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- D. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 1. Install transition couplings at joints of piping with small differences in ODs.
 2. In Waste Drainage Piping: Unshielded nonpressure transition couplings.

3.05 VALVE INSTALLATION

- A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.
- B. Shutoff Valves:
 - 1. Install shutoff valve on each sewage pump discharge.
 - 2. Install gate or full-port ball valve for piping NPS 2 and smaller.
 - 3. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
 - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
 - 2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.
 - 4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment." Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install stainless-steel fiberglass pipe hangers for horizontal piping in corrosive environments.
 - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 5. NPS 3: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
 8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. 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.
- J. Install supports for vertical copper tubing every 10 feet.
- K. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Install horizontal backwater valves with cleanout cover flush with floor.
 6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
 7. Equipment: Connect waste piping as indicated.
 - a. Provide shutoff valve if indicated and union for each connection.
 - b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.08 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.

- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.09 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections, and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M (Type C); copper pressure fittings; and soldered joints.
 - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- E. Aboveground, vent piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION

SECTION 22 13 19.13 - SANITARY DRAINS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Floor drains.
 - 2. Trench drains.

1.02 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. HDPE: High-density polyethylene.
- C. PE: Polyethylene.
- D. PP: Polypropylene.
- E. PVC: Polyvinyl chloride.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS**2.01 DRAIN ASSEMBLIES**

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.02 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 1. Manufacturers:
 - a. Jay R Smith Mfg. Co.
 - b. Josam Co.
 - c. MIFAB, Inc
 - d. Sioux Chief Manufacturing
 - e. Wade
 - f. WATTS
 - g. Zurn Industries, LLC
 - 2. Standard: ASME A112.6.3.
 - 3. Pattern: Area Floor, Funnel floor drain.
 - 4. Body Material: Gray iron.
 - 5. Outlet: Bottom Side.
 - 6. Top or Strainer Material: Bronze.
 - 7. Top of Body and Strainer Finish: Nickel bronze.

8. Top Shape: Round Square.
9. Trap Material: Bronze.
10. Trap Pattern: Standard P-trap.
11. Trap Features: Cleanout.

2.03 TRENCH DRAINS

A. Trench Drains:

1. Manufacturers:
 - a. Jay R Smith Mfg. Co.
 - b. Josam Co.
 - c. MIFAB, Inc
 - d. Sioux Chief Manufacturing
 - e. Wade
 - f. WATTS
 - g. Zurn Industries, LLC
2. Standard: ASME A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Flange: Anchor.
5. Clamping Device: Required.
6. Outlet: Bottom End Side.
7. Grate Material: Ductile iron or gray iron.
8. Trap Material: Cast iron.
9. Trap Pattern: Standard P-trap.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- B. Install trench drains at low points of surface areas to be drained.
 1. Set grates of drains flush with finished surface, unless otherwise indicated.
 2. Install on support devices, so that top will be flush with adjacent surface.
- C. Install open drain fittings with top of hub 1 inch (25 mm) above floor.

3.02 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Install piping adjacent to equipment to allow service and maintenance.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.03 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
 - 1. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.02 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. PVC: Polyvinyl chloride.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS**2.01 ASSEMBLY DESCRIPTIONS**

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.02 BACKWATER VALVES- FOR DRAIN LINES SERVING FIXTURES LOCATED BELOW ELEVATION OF THE EXTERIOR MANHOLE COVER.

- A. Horizontal, Cast-Iron Backwater Valves:
 - 1. Manufacturers:
 - a. Jay R. Smith Mfg.; Co.
 - b. Josam Co.
 - c. MIFAB, Inc.
 - d. WATTS
 - e. Zurn Industries, LLC

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled, or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Horizontal, Plastic Backwater Valves

1. Manufacturers
 - a. Endura
 - b. Oatey
 - c. Plastic Oddities
 - d. Sioux Chief Manufacturing
 - e. Zurn Industries, LLC
2. Size: Same as connected piping.
3. Body: ABS PVC.
4. Cover: Same material as body with threaded access to check valve.
5. Check Valve: Removable swing check.
6. End Connections: Socket type.

2.03 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Manufactures:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Co.
 - c. MIFAB, Inc
 - d. Tyler Pipe
 - e. WATTS
 - f. Zurn Industries, LLC
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk or raised head, brass, or cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers:
 - a. Jay R. Smith Mfg.; Co.
 - b. Josam Co.
 - c. MIFAB, Inc
 - d. Sioux Chief Manufacturing
 - e. Zurn Industries, LLC
2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk.

8. Closure: Brass plug with straight threads and gasket.
 9. Adjustable Housing Material: Cast iron Plastic with threads setscrews or other device.
 10. Frame and Cover Shape: Round.
 11. Top Loading Classification: Extra Heavy Duty.
 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to clean out.
- C. Cast-Iron Wall Cleanouts
1. Manufacturers:
 - a. Jay R. Smith Mfg.; Co.
 - b. Josam Co.
 - c. MIFAB, Inc
 - d. Sioux Chief Manufacturing
 - e. Zurn Industries, LLC
 2. Standard: ASME A112.36.2M. Include wall access.
 3. Size: Same as connected drainage piping.
 4. Body: Hub-and-spigot, cast-iron soil pipe T-branch Hubless, cast-iron soil pipe test tee as required to match connected piping.
 5. Closure Plug:
 - a. Brass or Cast iron.
 - b. Countersunk or raised head.
 - c. Drilled and threaded for cover attachment screw.
 - d. Size: Same as or not more than one size smaller than cleanout size.
 6. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.

2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
 2. Size: Same as connected waste piping.
- B. Deep-Seal Traps:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- D. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 2. Body: Bronze or cast iron.
 3. Inlet: Opening in top of body.
 4. Outlet: Larger than inlet.
 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- E. Sleeve Flashing Device:
1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom

- of fitting that will extend through floor slab.
- 2. Size: As required for close fit to riser or stack piping.
- F. Stack Flashing Fittings:
 - 1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
 - 2. Size: Same as connected stack vent or vent stack.
- G. Vent Caps:
 - 1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
 - 2. Size: Same as connected stack vent or vent stack.
- H. Expansion Joints:
 - 1. Standard: ASME A112.6.4.
 - 2. Body: Cast iron with bronze sleeve, packing, and gland.
 - 3. End Connections: Matching connected piping.
 - 4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install backwater valves in building drain piping. Provide on building drainpipe where plumbing fixtures are installed on a floor with a finished floor elevation below the elevation of the manhole cover of the next upstream manhole in the public sewer.
 - 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. Assemble open drain fittings and install with top of hub 2 inches above floor.
- F. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- J. Install vent caps on each vent pipe passing through roof.
- K. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access

and maintenance.

- L. Install wood-blocking reinforcement for wall-mounting-type specialties.
- M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.03 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
 - 1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.05 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES AND EQUIPMENT

- * Code reference - Applies only to projects in Philadelphia

PART 1 - GENERAL**1.01 REFERENCE**

- A. Refer to Section 22 05 00 for requirements which are applicable to this section.
- B. Reference the requirements of the International Plumbing Code.
- C. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.
- *
- D. City of Philadelphia Plumbing Code.

1.02 WORK INCLUDED

- A. Furnish and install plumbing fixtures, drains, trim, supplies, fastening devices, carriers, valves, and traps for a complete installation.
- B. Provide connection of all services for soil, waste, vent, cold and hot water.

1.03 SUBMITTALS

- A. Submit shop drawings of all materials and products described in this section and indicated on the drawings including that listed in the schedule on the drawings.
- B. Fixture submittals shall include all trim associated with the china. They shall be incorporated in a single brochure with the items being furnished clearly identified.

1.04 QUALITY ASSURANCE

- A. All fixtures shall be unmarked, uncracked, true, and level. All shall be warranted to not craze, color, or scale.
- B. Installations shall conform to the International Plumbing Code.
- C. Install all materials and equipment in accordance with the manufacturer's instructions and within the warranty requirements.
- D. All handicapped fixtures and their installation shall conform to the Americans with Disabilities Act and Fair Housing Amendments Act (Public Law 101-336).

PART 2 - PRODUCTS**2.01 TRAPS**

- A. Fixture traps shall be approved self-cleaning type with clean-outs.
- B. Traps shall be chrome plated cast brass.
- C. Traps for lavatories shall be 1 1/4" x 1 1/2" size.

2.02 TRIM

- A. All trim including faucets, waste fittings, strainers, valves, supplies, nipples, and escutcheons shall be chrome plated cast brass.
- B. Exposed water supply pipes shall be chrome plated brass with loose key angle stops.
- C. Fixtures shall be selected for low water consumption and limited to 1.6 gallons per flush on toilets, 2.2 gpm for faucets, and 2.5 gpm for showers.
- D. Public toilet room faucets shall be self-closing metering type when not indicated for the handicapped. Handicapped faucets shall conform to ADA requirements. Provide an approved temperature limiting device that conforms to ASSE 1070.
- E. All lavatories in public toilet rooms shall have grid type strainers.
- F. Waste connections for handicapped lavatories shall be offset. Contractor is to insulate all exposed domestic water and waste piping with prefab PVC jacketed assemblies.
- G. For fixtures requiring flush valves, they shall be of the low consumption type. Selection shall be for use with the specified fixture.
- H. 'Eco-drive' sensor operated flush valves and faucets shall include regenerating battery system.
- I. Water cooler shall have a bottle filler on the low station.

2.03 CARRIERS

- A. All wall hung fixtures shall be provided with floor mounted carriers.
- B. Floor mounted carriers shall have short pattern foot supports.
- C. Carriers for lavatories shall be concealed arm type.

2.04 MANUFACTURERS

- A. Fixtures; Kohler, American-Standard, Crane.
- B. Seats; Church, Olsonite, Sperzel, Benke, Bemis.
- C. Carriers; Josam, Zurn, Wade, J.R. Smith, Watts.
- D. Faucets; American-Standard, Speakman, Chicago, Kohler, Delta, Moen.
- E. Supplies and Traps; McGuire, Brass Craft, Central Brass, Kohler, American-Standard.
- F. Shower, Mop Receptors and Laundry Trays; Crane/Fiat, Stern/Williams.
- G. Domestic Water Heaters-Gas; Rheem/Rudd, A.O. Smith, Lochinvar, Jackson, State.
- H. Shower Enclosures - Kohler, American Standard, Crane/Fiat.
- I. Flush Valves - Sloan Royal
- J. * Flush Valves - Sloan Regal, Coyne and Delaney, Zurn.
- K. Insulation for handicapped lavatory and sink connections insulations - Truebro McGuire "pro-wrap".
- L. Alternate flush valve selection where budget consideration requires a lower cost valve and competitive pricing.

2.05 VACUUM BREAKERS

- A. Furnish and install vacuum breakers on all fixtures, trim, or faucets arranged for the connection of hoses. Vacuum breaker shall be located on the discharge side of the valve.
- B. Vacuum breakers shall be chrome plated brass where exposed and rough brass where concealed.
- C. Install vacuum breakers on wall hydrants, hose bibbs, janitor sinks and wherever else required by code.

2.06 WATER CLOSET CARRIER SELECTION.

- A. Carrier fitting configuration shall be suitable for the stack location shown on the drawings. Carriers to permit handicapped mounting of fixtures shall be utilized where required.

2.07 WALL HUNG WATER CLOSET SUPPORTS/FITTINGS

- A. Smith No. 0100 series "adjustable" deep rough-in support. Where floor construction is not suitable for deep rough-in, Smith No. 0200 series shallow rough-in type may be used. Where furred wall space is not sufficient for the adjustable series, Smith "compact" No. 0400 series may be used.

2.08 WALL HUNG BLOWOUT WATER CLOSET SUPPORTS/FITTINGS

- A. Smith No. 0300 series "adjustable series fixture supports with type No. 2 closet outlet connection. Where furred wall space is not sufficient for the adjustable series, Smith "compact" No. 0400 series or Smith No. 670 thru 680 waste fitting assemble with type No.2 closet outlet connection may be used.

2.09 FLOOR MOUNTED FLOOR OUTLET WATER CLOSET CONNECTION

- A. Smith No. 9230 cast bronze closet flange assembly complete with 5/16" bronze bolts, chromium plated nuts and washers and approved gasket.

2.10 WALL HUNG BLOWOUT URINALS ON FLOOR MOUNTED SUPPORT

- A. Smith No. 0629, 0630, 0632, or 0633 urinal support with adjustable coupling assembly. Face plate shall be supported by extra heavy cast iron base support which shall be securely bolted to floor construction.

2.11 WALL HUNG BLOWOUT AND WASH-OUT URINALS ON FLOOR MOUNTED SUPPORT

- A. Smith No. 0600 series urinal support. Uprights shall be high-strength steel with block bases securely bolted to floor construction.

2.12 ELECTRIC WATER COOLER WALL SUPPORT

- A. Smith No. 0830 floor mounted support electric water cooler support. Uprights shall be high strength steel with block bases securely bolted to floor construction.

2.13 STEEL BACKING PLATE FOR PLUMBING FIXTURES

- A. Where plumbing fixtures of the arms which support them are specified to be attached to a steel plate in the wall, furnish and install a 1/4" thick by 6" wide steel plate which shall extend at least one stud beyond the first and last fixture mounting points. Fixture or supporting arms shall be securely and firmly attached to the steel plate in accordance with the manufacturer's instructions.

2.14 FLAT-SLAB LAVATORIES-CONCEALED ARMS ON BACKING PLATE

- A. Lavatories shall be punched for Smith No. 0728 concealed arm fixture support with chromium plated threaded escutcheons. The arms shall be securely bolted to steel backing plate in the wall as herein before specified. They shall have positive mechanical locking device and shall be fully adjustable after installation of the finished wall.

2.15 FLAT-SLAB LAVATORIES-CONCEALED ARMS ON FLOOR SUPPORT

- A. Lavatories shall be punched for Smith No. 0700-E fixture support. Fixture support shall have

chromium plated threaded escutcheons and concealed arms with positive mechanical locking device. Arms shall be fully adjustable after installation of finished wall. Uprights shall be high-strength steel with block bases securely bolted to floor construction.

2.16 EMERGENCY FIXTURE TEMPERING VALVE

- A. Furnish and install a single valve emergency fixture tempering valve on all emergency fixtures utilizing domestic water with a 50-50 water mix ratio.
- B. Valve shall have a dual internal bypass that provides thermal and pressure assisted activation with triple duty check stops.
- C. Valve shall maintain cold water flow in event of failure.
- D. Valve sizing shall be in accordance with rated fixture demand at a maximum of 20 psi pressure drop.
- E. Valve conform to ANSI-Z-358-1.
- F. Valve to be manufactured by Powers Series ES or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATIONS

- A. Plumbing fixtures shall be installed in a manner to afford easy access for cleaning. Where practical, all piping from fixtures shall run in the most direct route to the wall.
- B. Furnish and install all waste connections, traps, water supplies, final connections, etc., to equipment furnished under other portions of the specifications.
- C. Make final connections to all soil, waste, vent, and water piping to the fixtures.
- D. Fixtures shall be set level and in proper alignment with adjacent walls and fixtures.
- E. All wall hung fixture carriers to be securely anchored to the slab.
- F. Attach floor mounted water closets to floor with wax seal and lag screws. Do not use lead flashing to hold closet in place.
- G. Securely bolt all fixtures to the building construction and unless special hangers are indicated, provide hangers and/or carriers designed specifically for the fixtures by the fixture manufacture.
- H. Caulk all wall hung fixtures between fixture and wall with sealant specified in Section 07900. Provide sealant at all points where mop receptor meets walls and floor.
- I. Install electric water coolers with "P" trap and water shutoff valve within cabinet.
- J. Contractor shall insulate all exposed domestic water and drainage piping under all handicapped lavatories and sinks with pre-formed insulation kit with PVC jacket similar to, Lav-Guard as manufactured by Truebro. There shall be no sharp or abrasive surfaces under the handicapped lavatories.
- K. Contractor shall provide an offset tailpiece for the handicapped lavatory's drain piping to create space for wheelchair access.
- L. Emergency tempering valves shall be accessibly located above ceilings or provided with a recessed cabinet adjacent to the fixture.

3.02 MOUNTING HEIGHTS

- A. Mount fixtures with the following heights above finished floor, except where noted otherwise.

Water Closet:

Standard	15 inches to top of bowl rim
Handicapped	17 - 19 inches to top of seat

Urinal:

Standard	22 inches to top of bowl rim
Handicapped	17 inches to top of bowl rim

Lavatory:

Standard	31 inches to top of basin rim
Handicapped	34 inches to top of basin rim or 29 inches to underside of basin apron

Drinking Fountain:

Standard	40 inches to top of basin rim
Handicapped	36 inches to bubbler outlet

Water Closet Flush Valves:

Standard	11 inches minimum above bowl rim
Handicapped	Center line of flush valve shall not exceed 44" above fin. fl. Flush valve handle shall extend toward the wide side of stall.

Water Closet Tank Type - Trip Lever

Standard	Per manufacturer
Handicapped	Locate on tank side toward wide side of stall.

END OF SECTION

SECTION 23 01 30.52 - EXISTING HVAC AIR DISTRIBUTION SYSTEM CLEANING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes cleaning existing HVAC air-distribution equipment, ducts, plenums, and system components.

1.02 DEFINITIONS

- A. ACAC: American Council for Accredited Certification.
- B. AIHA-LAP: American Industrial Hygiene Association Lab Accreditation Program
- C. ASCS: Air systems cleaning specialist.
- D. CESB: Council of Engineering and Scientific Specialty Boards.
- E. CMI: Certified Microbial Investigator.
- F. CMC: Certified Microbial Consultant.
- G. CMR: Certified Microbial Remediator.
- H. CMRS: Certified Microbial Remediation Supervisor.
- I. EMLAP: Environmental Microbiology Laboratory Accreditation Program.
- J. IEP: Indoor Environmental Professional.
- K. IICRC: Institute of Inspection, Cleaning, and Restoration Certification.
- L. NADCA: National Air Duct Cleaners Association.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives and sealants, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. ASCS Qualifications: A certified member of NADCA
 - 1. Certification: Employ an ASCS certified by NADCA on a full-time basis
 - 2. Supervisor Qualifications: Certified as an ASCS by NADCA
- B. IEP Qualifications: CMI who is certified by ACAC and accredited by CESB.
- C. IEP Qualifications: CMC who is certified by ACAC and accredited by CESB.
- D. CMR Qualifications: Certified by ACAC and accredited by CESB.
- E. CMRS Qualifications: Certified by ACAC and accredited by CESB.

PART 2 - PRODUCTS**2.01 HVAC CLEANING AGENTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Apex Engineering Products Corporation.
 - 2. BBJ Environmental Solutions.
 - 3. Goodway Technologies Corporation.
 - 4. Nu-Calgon.
 - 5. QuestVapco Corporation.
- B. Description:
 - 1. Formulated for each specific soiled coil condition that needs remedy.

2.02 ANTIMICROBIAL SURFACE TREATMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bio-Cide International, Inc.
 - 2. Contec, Inc.
 - 3. Ecolab, Inc.
- B. Description: Specific product selected shall be as recommended by the IEP based on the specific antimicrobial needs of the specific Project conditions.
 - 1. Formulated to kill and inhibit growth of microorganisms.
 - 2. EPA-registered for use in HVAC systems and for the specific application in which it will be used.
 - 3. Have no residual action after drying, with zero VOC off-gassing.
 - 4. OSHA compliant.
 - 5. Treatment shall dry clear to allow continued visual observation of the treated surface.

PART 3 - PART 3 – EXECUTION**3.01 PREPARATION**

- A. Inspect HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.
- B. Cleaning Plan: Prepare a written plan for air-distribution system cleaning that includes strategies and step-by-step procedures.
- C. Proceed with work only after conditions detrimental to performance of the Work have been corrected and cleaning plan has been approved.
- D. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.
- E. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning.

3.02 CLEANING

- A. Comply with NADCA ACR.
- B. Perform electrical lockout and tagout according to Owner's standards or authorities having jurisdiction.

- C. Remove non-adhered substances and deposits from within the HVAC system.
- D. Systems and Components to Be Cleaned: All air-moving and -distribution equipment.
- E. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.
 - 1. Particulate Collection: For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
 - 2. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building,
- F. Control odors and mist vapors during the cleaning and restoration process.
- G. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.
- H. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.
- I. Clean all air-distribution devices, registers, grilles, and diffusers.
- J. Clean non-adhered substance deposits according to NADCA ACR and the following:
 - 1. Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
 - 2. Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
 - 3. Clean evaporator coils, reheat coils, and other airstream components.
- K. Air-Distribution Systems:
 - 1. Create service openings in the HVAC system as necessary to accommodate cleaning.
 - 2. Mechanically clean air-distribution systems specified to remove all visible contaminants, so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).
- L. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.
- M. Mechanical Cleaning Methodology:
 - 1. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.
 - a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
 - b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials, such as duct and plenum liners.
 - 2. Cleaning Mineral-Fiber Insulation Components:
 - a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR.
 - b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).
 - c. Fibrous materials that become wet shall be discarded and replaced.
- N. Coil Cleaning:

1. See NADCA ACR, "Coil Surface Cleaning" Section. Type 1, or Type 1 and Type 2, cleaning methods shall be used to render the coil visibly clean and capable of passing coil cleaning verification.
 2. Coil drain pans shall be subject to NADCA ACR, "Non-Porous Surfaces Cleaning Verification." Ensure that condensate drain pans are operational.
 3. Electric-resistance coils shall be de-energized, locked out, and tagged before cleaning.
 4. Cleaning methods shall not cause any appreciable damage to, cause displacement of, inhibit heat transfer, or cause erosion of the coil surface or fins, and shall comply with coil manufacturer's written recommendations.
 5. Rinse thoroughly with clean water to remove any latent residues.
- O. Application of Antimicrobial Treatment:
1. Apply antimicrobial agents and coatings if active fungal growth is determined by the IEP to be at Condition 2 or Condition 3 status according to IICRC S520, as analyzed by a laboratory accredited by AIHA-LAP with an EMLAP certificate and with results interpreted by an IEP. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.
 2. Apply antimicrobial treatments and coatings after the system is rendered clean.
 3. Apply antimicrobial agents and coatings directly onto surfaces of interior ductwork.
 4. Microbial remediation shall be performed by a qualified CMR and CMRS.

3.03 CLEANLINESS VERIFICATION

- A. Verify cleanliness according to NADCA ACR, "Verification of HVAC System Cleanliness" Section.
- B. Surface-Cleaning Verification: Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
- C. Verification of Coil Cleaning: Coil will be considered clean if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection.
- D. Prepare a written cleanliness verification report.

3.04 RESTORATION

- A. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR, "Restoration and Repair of Mechanical Systems" Section.
- B. Restore service openings capable of future reopening. Comply with requirements in [Section 233113 "Metal Ducts] [Section 233116 "Nonmetal Ducts]."
- C. Reseal fibrous-glass ducts. Comply with requirements in Section 233116 "Nonmetal Ducts."
- D. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing. Comply with requirements in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts."
- E. Replace damaged insulation according to Section 230713 "Duct Insulation."
- F. Ensure that closures do not hinder or alter airflow.
- G. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.
- H. Restore manual volume dampers and air-directional mechanical devices inside the system to their marked position on completion of cleaning.

END OF SECTION

DIVISION 23 - HVAC**SECTION 23 05 00 - STANDARD CONDITIONS FOR HVAC****PART 1 - GENERAL****1.01 REFERENCE**

- A. Requirements established within the portions of this project manual titled Division 1, General Requirements are collectively applicable to the work of this section.
- B. Instructions to Bidders, Special Conditions and addenda as issued are part of this specification.
- C. Mechanical, Plumbing, and HVAC drawings along with all other project drawings and specifications represent the work of this section.
- D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

1.02 SCOPE

- A. Provide all labor, material, equipment, and supervision necessary to disconnect and remove the existing heating system in its entirety including, but not limited to; radiators, hot water supply, and return piping, boilers, pumps, baseboard radiation, controls, supports, hangers, and all associated insulation, equipment pads, and accessories. Patch and repair openings in walls, floors, and ceilings, for piping and equipment that was removed. Pipe, conduit, ductwork, and wiring shall be cut back behind wall surfaces, above ceilings, and below floor levels so that a patch can be placed over the opening.
- B. Provide labor, material, equipment, and supervision necessary to install complete operating mechanical systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.
- C. It shall be the contractor's responsibility to coordinate his work and the work of his subcontractors to insure that all the work is covered. He shall designate who is responsible for various portions of work which may overlap so that there is complete coverage of all required work. It is the position of the owner and the A/E that all work is the responsibility of the mechanical contractor within this Division of the work.
- D. Contractor shall provide all demolition necessary to remove and replace, repair, install new or modify existing work whether it be walls, floors, ceilings, structure, mechanical or electrical required to install his work. Contractor shall replace all work to leave in a finished condition.
- E. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
- F. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
- G. HVAC contractor's scope of work shall include but not be limited to the following:
 - 1. Air distribution system, associated ductwork, devices, equipment, and insulation.

2. Heating hot water system and insulation. * Dual temperature system and insulation.
3. Chilled water system, equipment, and insulation.
4. Condensate drainage system (air conditioner units). Condensate pumps.
5. Exhaust systems.
6. Humidification systems.
7. Demolition of existing work for new work.
8. Test Balance & Adjust.
9. Generator exhaust, ductwork, and exhaust insulation. Generator Room exhaust system.
10. Repair existing areas affected by the new construction. Patch, repair and finish to match existing.
11. Automatic Temperature Control System.
12. Building automation system (existing) and automatic temperature controls.
13. All other work identified in Division 23 and/or on the mechanical drawings except that identified as plumbing or fire protection work.
14. Contractor shall not utilize new HVAC equipment for temporary heating, cooling, and dehumidification purposes. Temporary HVAC is to be provided as described under the architect's general conditions. Contractor is to protect all HVAC equipment during construction and cover all ductwork openings.
15. Provide third party certification of all packaged systems by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399 as well as Pamphlet #70 and National Electrical Code Article 90-7.
16. Fire stopping of penetrations. (See Section 23 05 50)

1.03 REGULATIONS, CODES, AND STANDARDS

- A. Work shall be performed in accordance with the latest adopted codes, amendments, regulations and ordinances of the authorities having jurisdiction. Observe all safety regulations including the requirements of OSHA.
- B. Obtain and pay for all permits, connection charges, inspections, and certificates required to complete the work.
- C. Latest editions of any referenced standards shall govern.
- D. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- E. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

1.04 SUBMISSIONS

- A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
- B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the A/E. Submissions will be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.
- C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
- D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
- E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.

- F. Contractor to forward a copy of submittals which have electrical requirements to the Electrical Contractor (EC) for coordination of voltage, amperage, and phase. Response to be received from EC prior to ordering of equipment by mechanical contractor.
- G. Submissions shall include warranties by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, drains shall be combined in a single brochure with all items being furnished clearly identified.
- H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and coordinated with all other trades.
- I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified so as to be clear on what is being provided.
- J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

1.05 SITE INSPECTION

- A. Visit site, inspect and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of bid will be deemed evidence of having complied with this request. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.

1.06 SUBSTITUTIONS

- A. Material and equipment specified shall be deemed as that which the bidder's quotation represents.
- B. Once bids are accepted only that material and equipment listed in the specifications or added by addenda shall be acceptable. Substitution information for inclusion in an addenda must be received by the A/E at least 10 days prior to bid opening. If acceptable, an addenda will be issued which will add the additional acceptable manufacturers or materials and be available for all contractors to consider. It shall be a basic premise that a contractor is a lowest bidder because he utilized substituted materials or equipment as opposed to specified materials or equipment.
- C. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service by the engineer at the rate of \$150.00/hr. for such services. Also billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval or rejection.
- D. If the contractor elects to submit alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the drawings and specifications, it is the contractor's responsibility to coordinate the work with other trades and pay for any associated costs with the substitution or change.
- E. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be

fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

1.07 DRAWINGS AND SPECIFICATIONS

- A. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.
- B. When a conflict or contradiction exists either between drawings and specs or between specs or between different drawings or details, the more stringent shall apply.
- C. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
- D. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.
- E. The architects or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.
- F. If a question arises after bidding the A/E interpretation shall govern.

1.08 MEASUREMENTS

- A. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

1.09 PROGRESS SCHEDULE

- A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

1.10 COST SCHEDULE

- A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.
- B. AIA forms are required for this submission.

1.11 COMPLETION

- A. The contractor shall deliver to the owner, with his request for final payment, copies of all manufacturer's guarantees, equipment instructional manuals, a complete set of all final shop drawings, catalog cuts, service contracts, and other items as may be required elsewhere in the documents.

1.12 OFFICE

- A. The contractor shall set up his job office (desk) where directed by the owner.

1.13 STORAGE

- A. Material shall be stored only where directed by the owner.

1.14 SANITARY

- A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
- B. Toilet will be located where directed by the owner.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material shall be new and of present day manufacture.
- B. All material and equipment shall be in conformance with accepted trade standards.
- C. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed to apply to as many such items as may be necessary to complete the installation.
- D. The word "provide" means "furnish and install complete, tested, and adjusted as necessary with all accessories, covers, escutcheons". The word "piping" means pipe, fitting, controls, valves, and hangers as required for a complete system.

2.02 MOTORS

- A. Incorporate latest IEEE and NEMA standards.
- B. All copper windings with ball bearings.
- C. Indoors; drip proof, 40 degree C rise.
- D. Outdoors; totally enclosed 55 degree C rise.
- E. Motors over 10 HP to be high efficiency with PF in excess of 0.9.

2.03 MOTOR STARTERS AND CONTACTORS

- A. Fractional with horsepower up to ½ HP; electrical contract.
- B. Polyphase and single phase above ½ HP: this contract.
- C. Electrical contractor shall install all starters except for those provided as an integral part of equipment.
- D. Polyphase starters shall be magnetic combination type, across-the-line electrically operated, electrically held, three pole assemblies, with arc extinguishing characteristics, silver to silver renewable contacts, 3 pole thermal bi-metallic, red run pilot light, individual phase protection, with overload heaters matched to motors installed and with 4 auxiliary contact, Hand-off-Auto switch, and control transformer.
- E. For single phase motors above ½ HP provide magnetic combination single phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120 volt control transformer with dual primary fusing auxiliary contacts.
- F. Starters shall be as manufactured by G. E., Siemens, Square "D", Cetus or Cutler-Hammer.

2.04 EQUIPMENT START UP

- A. Verify that equipment is operating within warranty requirements.
- B. Advise owner and A/E at least two days prior.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to A/E.

2.05 LUBRICATION

- A. Lubricate all equipment in accordance with manufacturer's instructions.
- B. Lubricate prior to start up.
- C. Provide one year's supply of lubricants to the owner.

2.06 OPERATING INSTRUCTIONS AND MANUALS

- A. Properly and fully instruct owner's personnel in the operation and maintenance of all systems and equipment.
- B. Insure that the owner's personnel are familiar with all operations to carry on required activities.
- C. Such instruction shall be for each item of equipment and each System as a whole.
- D. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, control sequences, service requirements, piping diagrams, names, and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.
- E. Provide to the owner any special tools necessary to operate any of the equipment.

2.07 DRAIN PANS

- A. Provide auxiliary galvanized steel condensate drain pan with 1" MPT drain connection for all interior fan coil units, cooling coils, heat pumps, and any other cooling equipment requiring condensate removal. Drain to suitable discharge point acceptable to owner and A/E. Drain lines shall be separate and independent of A/C unit drain system unless provided with interlocked water sensing switch.
- B. All water heaters mounted above the floor shall be provided with drain pans. Drain to suitable discharge point acceptable to owner and A/E. To be visible outfall.
- C. Drains shall slope down in direction of flow at 1" per 10 feet.

PART 3 - EXECUTION**3.01 PROTECTION**

- A. Cover duct openings during construction.
- B. Plug or cap open ends of piping systems and conduit.
- C. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
- D. Protect all installed work until accepted in place by the owner. Cover plumbing fixtures and lighting fixtures.
- E. Do not install plates, polished metal escutcheons, thermostats, and other finished devices until masonry, tile, and painting operations are complete or protect otherwise.
- F. Protect all existing or new work from operations which may cause damage such as hauling, welding, soldering, painting, insulating, and covering.

3.02 WORKMANSHIP

- A. Install all work neat, trim, and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

3.03 FASTENERS, HANGERS, AND SUPPORTS

- A. Furnish and install all hangers and supports required to suspend, mount, or hang the work.
- B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets, and anchors to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded to more than 1/4 rated capacity with a minimum of 200 lbs.
- E. Powder driven fasteners shall not be allowed for piping larger than 2", or for equipment. When used they shall not be loaded more than 1/8 rated capacity with a minimum of 200 lbs.
- F. All hangers, miscellaneous steel, braces, and supports shall be galvanized, cadmium plated, or painted with corrosion resistant primer and finish coat of epoxy enamel.
- G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles as indicated in the piping system specification sections. Piping shall not support other piping.
- H. Support vertical piping and ductwork at floor levels. Piping shall have split rings. Ductwork shall have 1 1/2" angle iron frames.
- I. Provide and install lintels where required for mechanical work and not indicated on architectural or structural drawings.
- J. Furnish steel framing for roof openings and floor openings. Submit details for review.

3.04 SLEEVES

- A. All piping passing through floors or walls shall have sleeves unless holes are cored. Sleeves shall be 16 gage galvanized steel in non-bearing walls, 10 gage galvanized steel for bearing walls, and schedule 40 galvanized pipe in floors. Sleeves shall accommodate insulation. This shall not apply to sprinkler piping.
- B. Sleeves passing through foundation walls not exposed to interior spaces or sleeves passing through slab on grade may be schedule 40 PVC.
- C. Wall sleeves shall finish flush with wall.
- D. Floor sleeves shall extend 1 inch above floor.
- E. Sleeves in walls between interior spaces and unexcavated, exterior, crawl, or backfilled spaces shall be made watertight with "Link-Seal" modular wall and casing seal. Casing shall be schedule 40 galvanized pipe with anchor flange.

3.05 PLATES

- A. Furnish and install chrome plated plates wherever piping passes into finished areas.
- B. Plates shall be securely fastened to piping or building construction.
- C. Floor plates shall cover one inch floor extension.

3.06 OFFSETS, TRANSITIONS, MODIFICATIONS

- A. Furnish and install all offsets necessary to install the work and to provide clearance for the other trades.
- B. Maintain adequate headroom and clearance as directed by the A/E.
- C. Ductwork transitions necessary to accommodate available space or clearance requirements shall be contract requirements.
- D. Incidental modifications necessary to the installation of the systems shall be made as necessary and at the direction of the A/E.
- E. Rises and drops of piping systems shall be provided as required and where directed to allow for clearances to other construction. Drains shall be installed at no additional cost to the owner. The

contractor shall allow for such occurrences in his bid.

- F. Ductwork, piping, conduit, and equipment shall be so arranged as to not pass in front of windows, doors, access panels, access doors, coil removal or filter removal space or service clearance areas. Do not install within 3'-0" clearance of electrical panel fronts.

3.07 RECESSES

- A. Furnish information to the general contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment or devices which are to be recessed into walls.
- B. Make offsets or modifications as required to suit final locations.

3.08 EQUIPMENT SETTING

- A. Furnish and install as a minimum, a 4" thick concrete pad beneath all floor mounted equipment in mechanical rooms, boiler rooms, or equipment rooms, or outside on grade. This shall not apply to residential installations of water heaters and air handling units or furnaces unless detailed on drawings or specified elsewhere.
- B. Furnish and install as a minimum, spring vibration isolators under any equipment 5 HP and over and rubber-in-shear vibration isolation under all equipment less than 5 HP. This shall apply to residential installations.
- C. Reinforce concrete with No. 4 rods 12" on centers both ways.
- D. Pad to have 3/4" dowels into concrete at 1 per 4 square feet.

3.09 LABELING

- A. All equipment, panels, controls, safety switches, and devices shall be provided with permanent black laminated white core labels with 3/8" letters.
- B. This shall also apply to all controllers, remote start/stop push buttons, equipment cabinets, and where directed by the A/E.
- C. This shall not apply to local room thermostats and light switches.

3.10 FLASHING AND COUNTERFLASHING

- A. Piping and conduit through the roof shall be flashed by the General Contractor. This contractor shall furnish counterflashing.
- B. Ductwork through the roof and roof mounted duct connected equipment shall be provided with prefabricated roof curbs. General contractor shall flash. This contractor shall counterflash.
- C. Structural dunnage for roof mounted equipment shall be flashed and counterflashed. Prefabricated roof curbs may be utilized.

3.11 ACCESS

- A. Locate all equipment, valves, devices, and controllers which may need service in accessible places.
- B. Where access is not available; access panels shall be provided. Furnish prime painted steel access doors to the General Contractor for installation.
- C. Access doors shall be 16 gauge frames and 22 gauge steel door. Access doors in fire rated walls shall have a "B" label for 1 ½ hours.
- D. Maintain clearances for tube removal, coil pulls, and filter removal.

3.12 WIRING

- A. Power wiring shall be provided by the Division 26 Electrical Contractor. This contractor shall furnish

all 3 phase starters, pushbuttons, and controllers necessary to operate the equipment. The Electrical Contractor shall store and install the electrical devices and furnish and install the power wiring.

- B. Control wiring shall be furnished and installed under Division 23 portion of the work. Wiring for controls is control wiring whether it is line voltage or low voltage.
- C. All wiring shall be in accordance with the NEC.
- D. Pushbuttons shall be maintain-contact type.
- E. Refer to the electrical specifications for wiring methods.
- F. Plenum rated cable is required for control wiring.

3.13 UTILITIES

- A. Do not interrupt any utility or service without adequate previous notice and scheduling with the owner.
- B. Refer to Division 1 for requirements for providing temporary utilities.

3.14 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the owner unless otherwise specified. Material and labor for first year warranty is to be provided.
- B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.
- C. Compressors and refrigeration system components shall be provided with a 5 year factory warranty. Material only for years 2 through 5 is required.

3.15 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver material and equipment in manufacturer's original cartons or on skids.
- B. Store material in dry enclosures or under protective coverings out of way of work progress.
- C. Handle so as to prevent damage to product or any surrounding material.

3.16 MANUFACTURERS' NAMES

- A. Manufacturers' names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer's name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being named in the specification. Any deviations from this must be acknowledged at bid time by the supplier and he shall be solely responsible for any and all costs associated with the application of his product in the project.
- B. A design cannot be prepared which accommodates the installation of all suppliers and is not intended to do so. If certain modifications must be made to accommodate one particular supplier's equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

3.17 AS-BUILT DRAWINGS

- A. At the completion of the work the contractor shall furnish a reproducible as-built drawings to the A/E for approval. The drawings shall indicate all work installed and its actual size and location. If acceptable, the A/E will submit the as-built drawings to the owner as record drawings. If not acceptable, the A/E will return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.

- B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.

3.18 PENETRATION SEALING

- A. All penetrations of Natatorium walls, fire walls, smoke walls, and floors by ducts, pipes, conduit, or wiring shall be sealed to prevent the flow of gasses or smoke.
- B. The sealant shall be foamed in place between the penetrant and the adjacent floor or wall with DOW Corning RTV foam or equivalent by 3M, Hilti, or Chase foam.
- C. The installation shall meet the approval of the authority having jurisdiction.
- D. Penetrations through rated surfaces shall have a UL rating equivalent to the adjacent surfaces.
- E. All other penetrations of walls either above ceilings or exposed shall be closely sealed around the penetration with caulking or packing to prevent flow of air or sound through the wall.

3.19 CUTTING AND PATCHING INTERIOR SURFACES

- A. Respective contractor shall install all hangers, supports, pipe sleeves in floors, walls, partitions, ceilings, and roof slabs as construction progresses to permit their work to be built into place and to eliminate unnecessary cutting of construction work.
- B. All cutting of concrete, or other material for the passage of piping and ductwork through floors, walls, partitions, and ceiling shall be done by the respective contractor where necessary to install his work. Respective contractor will close all such openings around piping, ductwork, and conduit with materials equivalent to that removed. All exposed surfaces shall be left in suitable condition for refinishing without further work.
- C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

3.20 INVERTS AND ELEVATIONS

- A. Indicated inverts and elevations of existing utilities are approximate and based on the best information available.
- B. Upon award of contract, contractor shall verify in the field all such information and report any discrepancies before proceeding with work. Contractor shall be responsible for extra work caused by his failure to verify inverts and elevations.

3.21 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

- A. Furnish and install final connections to equipment furnished in other parts of the specification or furnished by the owner. Provide drainage connections, vent connections, water connections, fuel gas connections, duct connections, gas connections to the fixtures or equipment. Plumbing connections shall include valved supplies and trapped waste connections.

3.22 CONNECTIONS TO EXISTING SYSTEMS

- A. The contractor shall be responsible for connecting new systems to existing systems.
- B. Arrange for outages with the owner.
- C. Contractor shall shut down and drain existing systems.
- D. Contractor shall cut in, weld, solder, or thread, and make connections compatible with existing systems.
- E. Provide new valves at connections to existing systems.
- F. Contractor shall refill existing and fill new systems.
- G. Contractor shall purge air from systems, both new and existing.

- H. Contractor shall place existing systems back into operation.
- I. Contractor shall repair and replace any insulation damaged or removed during connection procedures.

3.23 COORDINATION DRAWINGS

- A. Provide 3/8" = 1'-0" scale drawings showing all coordinated ductwork, piping, conduit, and equipment of all trades.
- B. The sheet metal shop drawings may be used as the basis of these drawings.
- C. Show ductwork, walls, beams, steel, drainage piping, domestic water piping, HVAC piping, sprinkler piping, light fixtures, electrical conduit, and equipment.
- D. Contact other disciplines and obtain information to identify fully coordinated systems.
- E. Submit for review and approval to the A/E.
- F. Provide all dimensional data and necessary clearances to other trades for installation of fixtures and equipment within casework and counter tops.
- G. Work shall not proceed until coordination is completed and all conflicts, issues, sequences etc., are resolved.

3.24 WELDING

- A. All electric power for arc welding shall be supplied by the contractor performing the work.

3.25 VEHICLES

- A. Vehicle access to the site will be as directed by the owner.

3.26 RUBBISH DISPOSAL

- A. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

3.27 PROTECTION

- A. Maintain all public walks and access ways.
- B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.

3.28 SCAFFOLDING

- A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

3.29 UTILITIES (Applies only to existing facilities)

- A. The contractor may use the existing water and electric power for temporary construction needs.
- B. The owner will direct where these services may be tapped.
- C. Those services that are used during construction, but are to remain, shall be refurbished to as new condition before turning back to the owner.

3.30 CLEANUP

- A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from

fixtures and equipment.

- B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
- C. Clean and polish all plumbing fixtures.
- D. Remove all trash and debris from the premises.

3.31 MOUNTING HEIGHTS

- A. Contractor to coordinate all mounting heights with all trades and architect prior to rough-in.
- B. Maximum thermostat mounting height (top of thermostat) in accordance with ADA.
 - 1. Side reach: 48" A.F.F.
 - 2. Forward reach: 48" A.F.F.

3.32 WORK COMPLETION

- A. The contractor shall promptly correct work rejected by the engineer failing to conform to the requirements of the contract documents, whether discovered before or after substantial completion and whether or not fabricated, installed or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

3.33 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

- A. All RFI's shall include the following information based on AIA Document G716:
 - 1. To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
 - 2. Provide a description with specification and/or drawing references.
 - 3. Provide the senders recommendation including cost and/or schedule considerations.
 - 4. Provide receiver's reply space.
 - 5. Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

3.34 SHOP DRAWING REQUIREMENTS

- A. The following is a list of required shop drawings for the project. Not all items may be identified, and it is the responsibility of the contractor to submit additional shop drawings where indicated in the specifications.

HVAC	DATE REC'D	ACTION	DATE REC'D	ACTION
COORDINATION DRAWINGS				
PUMPS				
PUMP BASES				
PIPING FLEX CONNECTION				
SUCTION DIFFUSER				
TRIPLE DUTY VALVE				
AIR SEPARATOR				

HVAC	DATE REC'D	ACTION	DATE REC'D	ACTION
EXPANSION TANK				
GAUGES				
THERMOMETERS				
AUTOMATIC CONTROL VALVES				
VALVES - ALL TYPES				
STRAINERS				
CHECK VALVES				
PRESSURE REDUCING VALVE				
PIPING				
VIBRATION ISOLATION				
INSULATION A. Piping B. Ductwork C. Equipment				
SHEET METAL DRAWINGS				
UNIT HEATERS (HW)				
CONVECTORS (HW)				
FAN COIL UNITS				
FANS				
SPLIT SYSTEMS				
FIRE DAMPERS/RADIANT DAMPERS				
VOLUME DAMPERS				
GRILLES, REGISTERS, DIFFUSERS				
LOUVERS				
AUTOMATIC TEMPERATURE CONTROL A. DEVICES B. WIRING DIAGRAMS C. SEQUENCES				
TEST, BALANCE AND ADJUST REPORT				
AS-BUILT DRAWINGS				
WARRANTIES AND GUARANTEES				

HVAC	DATE REC'D	ACTION	DATE REC'D	ACTION
OPERATIONS AND MAINTENANCE MANUALS				
INSTRUCTIONS				

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small, and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.02 COORDINATION

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

1.03 SUBMITTALS

- A. Shop drawing submittals for motorized equipment shall include, but not limited to, the following information on motors provided with equipment.
 - 1. Manufacturer's name and cutsheets.
 - 2. Motor type.
 - 3. Horsepower.
 - 4. Voltage/Phase/Hertz.
 - 5. RPM.
 - 6. Service factor.
 - 7. Insulation class.
 - 8. NEC code number.
 - 9. Motor efficiency and testing method and results.

PART 2 - PRODUCTS**2.01 GENERAL MOTOR REQUIREMENTS**

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. All materials and equipment furnished shall be installed as per manufacturer's requirements and conform to the requirements of Division 26.

2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level.

- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- C. Incorporate latest IEEE and NEMA standards.
- D. All copper windings with ball bearings.
- E. Indoors; drip proof, 40 degree C rise.
- F. Outdoors; totally enclosed 55 degree C rise.
- G. Motors over 10 HP to be high efficiency with PF in excess of 0.9.

2.03 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.05 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp. shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.06 MOTOR STARTERS

- A. Fractional with horsepower up to ½ HP; electrical contract.
- B. Polyphase and single phase above ½ HP: this contract.
- C. Electrical contractor shall install all starters except for those provided as an integral part of equipment.
- D. Polyphase starters shall be magnetic combination type, across-the-line electrically operated, electrically held, three pole assemblies, with arc extinguishing characteristics, silver to silver renewable contacts, 3 pole thermal bi-metallic, red run pilot light, individual phase protection, with overload heaters matched to motors installed and with 4 auxiliary contact, Hand-off-Auto switch, and control transformer.
- E. For single phase motors above ½ HP provide magnetic combination single phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120 volt control transformer with dual primary fusing auxiliary contacts.
- F. Starters shall be as manufactured by G. E., Siemens, Square "D", Cerus or Cutler-Hammer.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Motors shall be leveled, set in true angular and concentric alignment with driven equipment, and bolted firmly to motor base, if not mounted on equipment. Motors's factory-mounted on equipment shall be checked for alignment to driven equipment and mounting bolts shall be checked to ensure bolts are tightly fastened.
- B. Coordination: The Mechanical Contractor shall have the responsibility to provide adequate rough-in information to the Electrical Contractor. Any costs, such as patching and refinishing of walls, resulting from inadequate information shall be the responsibility of the Mechanical Contractor.
- C. For variable frequency drives, refer to Specification 23 09 93.

END OF SECTION

SECTION 23 05 18 - ESCUTCHEONS FOR HVAC PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS**2.01 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With [polished, chrome plated and rough brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring clip fasteners.

2.02 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep-pattern type.
 - b. Chrome-Plated Piping: One piece, cast-brass type with polished, chrome-plated finish.

- c. Insulated Piping: One piece, stamped-steel type.
- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast-brass type with polished, chrome-plated finish.
- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, stamped-steel type.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast-brass type with polished, chrome-plated finish.
- g. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, stamped-steel type.
- h. Bare Piping in Unfinished Service Spaces: One piece, cast-brass type with polished, chrome-plated finish.
- i. Bare Piping in Unfinished Service Spaces: One piece, stamped-steel type.
- j. Bare Piping in Equipment Rooms: One piece, cast-brass type with polished, chrome-plated finish.
- k. Bare Piping in Equipment Rooms: One piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 23 05 19 - METERS AND GAGES FOR HVAC PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Liquid-in-glass thermometers.
 - 3. Duct-thermometer mounting brackets.
 - 4. Thermowells.
 - 5. Dial-type pressure gages.
 - 6. Gage attachments.
- B. Related Requirements:
 - 1. Section 232216 "Steam and Condensate Piping Specialties" for steam and condensate meters.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include diagrams for power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS**2.01 LIQUID-IN-GLASS THERMOMETERS**

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flo Fab Inc.
 - b. Miljoco Corporation.
 - c. Palmer Wahl Instrumentation Group.
 - d. Tel-Tru Manufacturing Company.
 - e. Trerice, H. O. Co.

- f. Weiss Instruments, Inc.
 - g. Weksler Glass Thermometer Corp.
 - h. Winters Instruments - U.S.
- 2. Standard: ASME B40.200.
- 3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
- 4. Case Form: Adjustable angle unless otherwise indicated.
- 5. Tube: Glass with magnifying lens and blue [or red] organic liquid.
- 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
- 7. Window: Glass.
 - a. Stem: Aluminum and of length to suit installation.
 - b. Design for Air-Duct Installation: With ventilated shroud.
 - c. Design for Thermowell Installation: Bare stem.
- 8. Connector: 1 ¼ inches, with ASME B1.1 screw threads.
- 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.02 DUCT-THERMOMETER MOUNTING BRACKETS

- A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.03 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion in piping tee fitting.
 - 3. Material for Use with Copper Tubing: CNR.
 - 4. Material for Use with Steel Piping: CRES.
 - 5. Type: Stepped shank unless straight or tapered shank is indicated.
 - 6. External Threads: NPS ½-inch, NPS ¾-inch, or NPS 1-inch, ASME B1.20.1 pipe threads.
 - 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
 - 8. Bore: Diameter required to match thermometer bulb or stem.
 - 9. Insertion Length: Length required to match thermometer bulb or stem.
 - 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.04 DIAL-TYPE PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ametek U.S. Gauge.
 - b. Ashcroft Inc.
 - c. Ernst Flow Industries.
 - d. Flo Fab Inc.

- e. Marsh Bellofram.
- f. Miljoco Corporation.
- g. Noshok.
- h. Palmer Wahl Instrumentation Group.
- i. REOTEMP Instrument Corporation.
- j. Tel-Tru Manufacturing Company.
- k. Trerice, H. O. Co.
- l. Watts; a Watts Water Technologies company.
- m. Weiss Instruments, Inc.
- n. Weksler Glass Thermometer Corp.
- o. WIKA Instrument Corporation.
- p. Winters Instruments - U.S.
- 2. Standard: ASME B40.100.
- 3. Case: Sealed type(s); cast aluminum or drawn steel; 4 ½- inch nominal diameter.
- 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
- 5. Pressure Connection: Brass, with NPS ¼-inch or NPS ½-inch, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
- 6. Movement: Mechanical, with link to pressure element and connection to pointer.
- 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
- 8. Pointer: Dark-colored metal.
- 9. Window: Glass.
- 10. Ring: Metal.
- 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.05 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS ¼-inch or NPS ½-inch, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of brass pipe with NPS ¼-inch or NPS ½-inch pipe threads.
- C. Valves: Brass ball, with NPS ¼-inch or NPS ½-inch, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

- G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
- H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- I. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- J. Install valve and syphon fitting in piping for each pressure gage for steam.
- K. Install test plugs in piping tees.
- L. Install flow indicators in piping systems in accessible positions for easy viewing.
- M. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
- N. Install flowmeter elements in accessible positions in piping systems.
- O. Install wafer-orifice flowmeter elements between pipe flanges.
- P. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.
- Q. Install permanent indicators on walls or brackets in accessible and readable positions.
- R. Install connection fittings in accessible locations for attachment to portable indicators.
- S. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.
- T. Install thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic zone.
 - 2. Inlet and outlet of each hydronic boiler.
 - 3. Two inlets and two outlets of each chiller.
 - 4. Inlet and outlet of each hydronic coil in air-handling units.
 - 5. Two inlets and two outlets of each hydronic heat exchanger.
 - 6. Inlet and outlet of each thermal-storage tank.
 - 7. Outside, return, supply, and mixed-air ducts.
- U. Install pressure gages in the following locations:
 - 1. Discharge of each pressure-reducing valve.
 - 2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
 - 3. Suction and discharge of each pump.

3.02 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow space for service and maintenance of meters, gages, machines, and equipment.
- B. Connect flowmeter-system elements to meters.
- C. Connect flowmeter transmitters to meters.
- D. Connect thermal-energy meter transmitters to meters.

3.03 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic zone shall be the following:
 - 1. Industrial-style, liquid-in-glass type.
- B. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up

central systems shall be the following:

1. Liquid-filled type.
- C. Thermometer stems shall be of length to match thermowell insertion length.

3.05 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 150 deg. F.
- B. Scale Range for Heating, Hot-Water Piping: 20 to 240 deg. F.

3.06 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be the following:
 1. Liquid-filled Sealed-mounted, metal case.
- B. Pressure gages at suction and discharge of each pump shall be the following:
 1. Liquid-filled Sealed-mounted, metal case.

3.07 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 160 psi.
- B. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi.

END OF SECTION

SECTION 23 05 23.12 - BALL VALVES FOR HVAC PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Bronze ball valves.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded-end valves.
 - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 3. ASME B16.18 for solder-joint connections.
 - 4. ASME B31.1 for power piping valves.
 - 5. ASME B31.9 for building services piping valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Refer to HVAC valve schedule articles for applications of valves.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 4-inch and larger.
 - 2. Handlever: For quarter-turn valves smaller than NPS 4-inch.
- H. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.
- I. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port and Bronze or Brass Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Apollo Valves; Conbraco Industries, Inc.
 - c. Crane; Crane Energy Flow Solutions.
 - d. Hammond Valve.
 - e. Legend Valve & Fitting, Inc.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.02 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2-inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Steel Piping, NPS 2-inch and Smaller: Threaded ends.

3.03 CHILLED-WATER VALVE SCHEDULE

- A. Pipe NPS 2-inch and Smaller: Bronze ball valves, two pieces, with bronze trim, and full port.

1. Valves may be provided with solder-joint ends instead of threaded ends.

3.04 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2-inch and Smaller: Bronze ball valves, two pieces, with bronze trim, and full port.
 1. Valves may be provided with solder-joint ends instead of threaded ends.

END OF SECTION

SECTION 23 05 23.13 - BUTTERFLY VALVES FOR HVAC PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Iron, single-flange butterfly valves.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.1 for flanges on iron valves.
 - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 3. ASME B31.1 for power piping valves.
 - 4. ASME B31.9 for building services piping valves.
- C. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.
- E. Valve Actuator Types:
 - 1. Gear Actuator: For valves NPS 8-inch and larger.
 - 2. Handlever: For valves NPS 6-inch and smaller.
 - 3. Chainwheel: Device for attachment to gear, stem, or other actuator of size and with chain for mounting height, according to "Valve Installation" Article.
- F. Valves in Insulated Piping: With 2-inch stem extensions with extended necks.

2.02 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. Iron, Single-Flange Butterfly Valves with Aluminum-Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Hammond Valve.
 - c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Spence Engineering Company, Inc.
 - g. Stockham; Crane Energy Flow Solutions.

- h. Tyco Valves & Controls.
 - i. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 150 psig 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One or two-piece stainless steel.
 - g. Disc: Aluminum bronze.
 - B. Iron, Single-Flange Butterfly Valves with Ductile-Iron Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Center Line; Crane Energy Flow Solutions.
 - c. Hammond Valve.
 - d. Jomar Valve.
 - e. Milwaukee Valve Company.
 - f. Mueller Steam Specialty.
 - g. NIBCO INC.
 - h. Spence Engineering Company, Inc.
 - i. Stockham; Crane Energy Flow Solutions.
 - j. Tyco Valves & Controls.
 - k. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 150 psig 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Nickel-plated ductile iron.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for butterfly valves NPS 4-inch and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

3.02 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 CHILLED-WATER VALVE SCHEDULE

- A. Pipe NPS 2 ½ -inch and Larger:
 - 1. Iron, Single-Flange Butterfly Valves, NPS 2 ½ - inch to NPS 12-inch: Aluminum-bronze Ductile-iron Stainless-steel disc, 200 CWP, and EPDM seat.

3.04 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 ½ -inch and Larger:
 - 1. Iron, Single-Flange Butterfly Valves, NPS 2 ½ -inch to NPS 12-inch: Aluminum-bronze Ductile-iron Stainless-steel disc, 200 CWP, and EPDM seat.

END OF SECTION

SECTION 23 05 23.14 - CHECK VALVES FOR HVAC PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Bronze lift check valves.
 - 2. Bronze swing check valves.
 - 3. Iron swing check valves.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded-end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.1 for power piping valves.
 - 6. ASME B31.9 for building services piping valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream piping unless otherwise indicated.
- F. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE SWING CHECK VALVES

- A. Bronze Swing Check Valves with Bronze Disc, Class 125:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane; Crane Energy Flow Solutions.
 - c. Hammond Valve.
 - d. Jenkins Valves; Crane Energy Flow Solutions.
 - e. Jomar Valve.
 - f. KITZ Corporation.

- g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Stockham; Crane Energy Flow Solutions.
 - k. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. KITZ Corporation.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Stockham; Crane Energy Flow Solutions.
 - h. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE.
- C. Bronze Swing Check Valves with Bronze Disc, Class 150:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane; Crane Energy Flow Solutions.
 - c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. KITZ Corporation.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Stockham; Crane Energy Flow Solutions.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- D. Bronze Swing Check Valves with Nonmetallic Disc, Class 150:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.

- c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts; a Watts Water Technologies company.
2. Description:
- a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE.

2.03 IRON SWING CHECK VALVES

A. Iron Swing Check Valves with Metal Seats, Class 125:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. KITZ Corporation.
 - e. Legend Valve & Fitting, Inc.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Stockham; Crane Energy Flow Solutions.
 - i. Watts; a Watts Water Technologies company.
- 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2 ½ -inch to NPS 12-inch, CWP Rating: 200 psig.
 - c. NPS 14-inch to NPS 24-inch, CWP Rating: 150 psig.
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.
 - g. Trim: Bronze.
 - h. Gasket: Asbestos free.

B. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Stockham; Crane Energy Flow Solutions.
- 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2 ½ -inch to NPS 12-inch, CWP Rating: 200 psig.
 - c. NPS 14-inch to NPS 24-inch, CWP Rating: 150 psig.
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.
 - g. Trim: Composition.
 - h. Seat Ring: Bronze.
 - i. Disc Holder: Bronze.
 - j. Disc: PTFE.
 - k. Gasket: Asbestos free.

C. Iron Swing Check Valves with Metal Seats, Class 250:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Stockham; Crane Energy Flow Solutions.
 - g. Watts; a Watts Water Technologies company.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2 ½ -inch to NPS 12-inch, CWP Rating: 500 psig.
 - c. NPS 14-inch to NPS 24-inch, CWP Rating: 300 psig.
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.
 - g. Trim: Bronze.
 - h. Gasket: Asbestos free.

2.04 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2 ½ -inch to NPS 12-inch, CWP Rating: 200 psig.
 - c. NPS 14-inch to NPS 24-inch, CWP Rating: 150 psig.
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.
 - g. Trim: Bronze.
 - h. Gasket: Asbestos free.
 - i. Closure Control: Factory installed, exterior lever and spring.

B. Iron Swing Check Valves with Lever and Weight-Closure Control, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Stockham; Crane Energy Flow Solutions.
 - g. Watts; a Watts Water Technologies company.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2 ½ -inch to NPS 12-inch, CWP Rating: 200 psig.
 - c. NPS 14-inch to NPS 24-inch, CWP Rating: 150 psig.
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.

- g. Trim: Bronze.
- h. Gasket: Asbestos free.
- i. Closure Control: Factory-installed, exterior lever and weight.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

3.02 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Pump-Discharge Check Valves:
 - a. NPS 2-inch and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2 ½ -inch and Larger: Iron swing check valves with lever and weight or with spring; metal-seat check valves.
- B. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer.
 - 1. For Copper Tubing, NPS 2-inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules.
 - 2. For Copper Tubing, NPS 2 ½ -inch to NPS 4-inch: Flanged ends except where threaded valve-end option is indicated in valve schedules.
 - 3. For Copper Tubing, NPS 5-inch and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2-inch and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2 ½ to NPS 4-inch: Flanged ends except where threaded valve-end option is indicated in valve schedules.
 - 6. For Steel Piping, NPS 5-inch and Larger: Flanged ends.

3.04 CHILLED-WATER VALVE SCHEDULE

- A. Pipe NPS 2-inch and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Bronze swing check valves with bronze disc, Class 125.
- B. Pipe NPS 2 ½ -inch and Larger:
 - 1. Iron Valves, NPS 2 ½ -inch to NPS 4-inch: May be provided with threaded ends instead of flanged ends.
 - 2. NPS 2 ½ -inch to NPS 12-inch: Iron swing check valves with lever and spring closure control,

- Class 125.
- 3. Iron swing check valves with metal seats, Class 125.

3.05 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2-inch and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Bronze swing check valves with bronze disc, Class 125.
- B. Pipe NPS 2 ½ -inch and Larger:
 - 1. Iron Valves, NPS 2 ½ -inch to NPS 4-inch: May be provided with threaded ends instead of flanged ends.
 - 2. NPS 2 ½ -inch to NPS 12-inch: Iron swing check valves with lever and spring-closure control, Class 125.
 - 3. Iron swing check valves with metal seats, Class 125.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Equipment supports.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment [and obtain approval from authorities having jurisdiction].

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following: include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and

Pressure Vessel Code.

PART 2 - PRODUCTS**2.01 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
- D. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop or field fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert wedge type, stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.06 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2-inch and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4-inch and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4-inch and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS ¼-inch to NPS 2 ½ -inch: 12 inches long and 0.048 inch thick.
 - b. NPS 4-inch: 12 inches long and 0.06 inch thick.
 - c. NPS 5-inch and NPS 6-inch: 18 inches long and 0.06 inch thick.
 - d. NPS 8-inch to NPS 14-inch: 24 inches long and 0.075 inch thick.
 - 5. Pipes NPS 8-inch and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve

indicated slope of pipe.

- B. Trim excess length of continuous thread hanger and support rods to 1 ½ inches.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications. Use aluminum pipe hangers and aluminum attachments for Natatorium 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-inch to NPS 30-inch.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg. F, pipes NPS 4-inch to NPS 24-inch, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4-inch to NPS 36-inch, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2-inch to NPS 8-inch.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2-inch to NPS 30-inch.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4-inch to NPS 36-inch, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4-inch to NPS 36-inch, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1-inch to NPS 30-inch, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2-inch to NPS 42-inch if

longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS ¾-inch to NPS 24-inch.
 2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS ¾-inch to NPS 24-inch if longer ends are required for riser clamps.
- 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 ¼ inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 05 48 - VIBRATION ISOLATION**PART 1 - GENERAL**

NOTE: CONTRACTOR IS TO FURNISH AND INSTALL A VIBRATION ISOLATING DEVICE ON ALL MACHINE, MOTOR, AND CIRCULATING PIECES OF EQUIPMENT.
IF A VIBRATION ISOLATING DEVICE IS OMITTED FROM THE DRAWINGS, THE CONTRACTOR IS TO MAKE AN ALLOWANCE TO INSTALL ONE.

1.01 REFERENCE

- A. Refer to section 23 05 00 for requirements which are applicable to this section.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to select, provide, and install vibration isolation devices as described herein and required for equipment on the project.

1.03 SUBMITTALS

- A. Submit shop drawings of all isolators, rails, hangers, mountings, connectors, hoses, and anchors specified herein.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install equipment in accordance with manufacturer's instructions.

PART 2 - PRODUCTS**2.01 NEOPRENE PADS**

- A. Roof mounted condensing units and floor mounted air handling units or furnaces shall be mounted on neoprene waffle pads. Pads shall be 5/16" thick type "W" as manufactured by Mason Industries Vibration Eliminator Company or Amber Booth.
- B. Application: Floor mounted furnaces and A/C units of 2000 CFM or less.
- C. Roof mounted condensing units up to 5 tons shall be mounted on curbs with neoprene pads. See spring mounts for over 5 tons.

2.02 NEOPRENE MOUNTINGS

- A. Double deflection neoprene mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom so they need not be bolted to the floor. Bolt holes shall be provided for these areas where bolting is required. On equipment such as small vent sets and close coupled pumps, steel rails shall be used

above the mountings to compensate for the overhang.

- B. Mountings shall be type ND or rails type DNR as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
- C. Application: Base mounted pumps up to 5 Hp slab on grade, air handling units' slab on grade, ATC compressors slab on grade.

2.03 SPRING MOUNTINGS

- A. Spring type isolators shall be free standing and laterally stable without any housing and complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflections, compressed spring height and solid spring height.
- B. Mountings shall be type SLF as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
- C. Application: Base mounted pumps not slab on grade and less than 5 Hp, base mounted pumps slab on grade 7 ½ HP and up. Air handling units not slab on grade, ATC compressors not slab on grade and less than 5 Hp. Roof mounted condensing units over 5 tons cooling capacity.

2.04 SPRING AND NEOPRENE HANGERS

- A. Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod insulation bushing that passes through the hanger box lower hole. Hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include a scale drawing of the hanger showing the 30 degree capability.
- B. Hangers shall be type 30N as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
- C. Application: Below 5 ton horizontal suspended heat pumps and fan/coil units, in-line exhaust fans.

2.05 PRE-COMPRESSED SPRING AND NEOPRENE HANGERS

- A. Vibration hangers shall be spring and neoprene as described above, but they shall be pre-compressed to the rated deflection so as to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale.
- B. Hangers shall be type PC3ON as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
- C. Application: Horizontal fan/coil units above 5 ton capacity.

2.06 DUCT HANGERS

- A. Vibration hangers shall contain a steel spring located in a neoprene cup manufactured with a grommet to prevent a short circuiting of the hanger rod. The cup shall contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Hangers shall be provided with an eye bolt on the spring end and provision to attach the housing to the flat iron duct

- straps. Submittals shall include a scale drawing of the hanger showing the 30 degree capability.
- B. Hangers shall be type W30 as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
 - C. Application: Ductwork in mechanical rooms below occupied spaces.

2.07 EQUIPMENT RAIL BASES

- A. Vibration isolator manufacturer shall provide steel members welded to height saving brackets to cradle machines having legs or bases that do not require a complete supplementary rigid to prevent strains in the equipment.
- B. Inverted saddles shall be type ICS as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
- C. Application: Base mounted HVAC units.

2.08 FLOATING CONCRETE BASES

- A. Vibration isolator manufacturer shall furnish rectangular structural beam or channel concrete forms for floating foundations. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. In general, bases shall be a minimum of 1/12th of the longest dimension of the base, but not less than 6". Forms shall include minimum concrete reinforcement consisting of half-inch bars or angles welded in place on 6" centers running both ways in a layer 1 1/2" above the bottom, or additional steel as is required by the structural conditions. Forms shall be furnished with drilled steel members with sleeves welded below the holes to receive equipment anchor bolts where the anchor bolts fall in concrete locations. Height saving brackets shall be employed in all mounting locations. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base.
- B. Bases shall be type K as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
- C. Application: Centrifugal pumps over 5 Hp and not slab on grade.

2.09 PIPE HANGERS

- A. Combination neoprene and spring with 1/2", 1", 2" static deflection.
- B. Application: Pipe hangers in boiler or mechanical room under occupied space.

PART 3 - EXECUTION

3.01 NEOPRENE PADS

- A. Cut pads of size to fit base area of equipment. Install between roof curb or floor and equipment base.

3.02 NEOPRENE MOUNTINGS

- A. Neoprene mountings are for indoor application only. When the equipment has a flush drain pan or tank on the bottom, they may be inverted so that the rectangular rubber covered steel baseplate provides support over a large area.

3.03 SPRING MOUNTINGS

- A. Install units with spring mountings with a minimum of 1/2", 1", 2" static deflection and available 50 per cent travel to solid. Level units and adjust isolators for proper deflection.
- B. Isolators to be selected by vibration isolating company engineers for critical applications.
- C. Roof mounted equipment shall be mounted on roof curbs with galvanized spring mountings between curbs and equipment bases.

3.04 SPRING AND NEOPRENE HANGERS

- A. Hangers shall have a maximum rated deflection of 1.18" for equipment 20 lbs. and under and 1.75" for equipment over 20 lbs.
- B. Average neoprene deflection shall be between 0.35" and 0.4".

3.05 PRECOMPRESSED SPRING AND NEOPRENE HANGERS

- A. Hangers shall have a maximum rated deflection of 1.18" for equipment 20 lbs. and under and 1.75" for equipment over 20 lbs.
- B. Average neoprene deflection shall be between 0.35" and 0.4".

3.06 DUCT HANGERS

- A. Hangers shall have a maximum rated deflection of 1.18" for equipment 95 lbs. and under and 1.35" for equipment over 95 lbs.

3.07 EQUIPMENT RAIL BASE

- A. Select the appropriate base to match equipment being provided. Base shall meet the exact dimensional and weight requirements at all points of the equipment.
- B. Install as recommended by the vibration isolator manufacturer.
- C. Adjust, place in service, and provide instructions.

3.08 FLOATING CONCRETE BASES

- A. Select the appropriate base to match the equipment that is being provided. Base shall meet the exact dimensional and weight requirements at all points of equipment.
- B. Install as recommended by the vibration isolator manufacturer.

END OF SECTION

SECTION 23 05 50 - FIRE STOPPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Refer to Section 23 05 00 for requirements which are applicable to this section.
- B. Refer to International Building Codes.
- C. Section includes.
 - 1. Through penetration firestops and smoke-stops for all fire rated bearing and non-bearing wall and floor assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes, ducts, etc.

1.02 REFERENCES

- A. American Society for Testing and Materials Standards (ASTM):
 - 1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E814: Standard Test method for Fire Tests of Through-Penetration Firestops.
- B. Underwriters Laboratories, Inc.:
 - 1. UL 723 Surface Burning Characteristics of Building Materials
 - 2. UL 1479 Fire Tests of Through-Penetration Firestops.
- C. UL Fire Resistance Directory:
 - 1. Through Penetration Firestop Devices (XHJI)
 - 2. Fire Resistive Ratings (BXUV)
 - 3. Through Penetration Firestop Systems (XHEZ)
 - 4. Fill, Void, or Cavity Material (XHHW)

1.03 DEFINITIONS

- A. FIRESTOPPING: The use of a material or combination of materials in a fire rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on that wall or floor.
- B. SYSTEM: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s), constitutes a "System."
- C. BARRIER: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.
- D. THROUGH-PENETRATION: Any penetration of a fire rated wall or floor that completely breaches the barrier.
- E. MEMBRANE-PENETRATION: Any penetration in a fire rated wall that breaches only one side of the barrier.
- F. CONSTRUCTION GAPS: any gap, joint, or opening, whether static or dynamic, where the top of a wall may meet a floor; wall to wall applications; edge to edge floor configurations; floor to exterior wall; or any linear breach in a rated barrier. Where movement is required, the firestopping system must comply with UL2079 for dynamic joints.

1.04 SUBMITTALS

NOTE: A "Certificate of Conformance," from the manufacturers listed in Section "2.02 Acceptable Manufacturers," is required with the "Submittal Package" to ensure that the material selected meets all of the criteria of this specification as set forth in Section "1.05 Quality Assurance."

- A. Submit manufacturer's product literature for each type of firestop material to be installed. Literature shall indicate product characteristics, typical uses, performance and imitation criteria, and test data. Submittal should be in compliance with Section 23 05 00.
- B. Material Safety Data Sheets (MSDS): Submit MSDS for each firestop product.
- C. UL Tested Systems: Submit drawings showing typical installation details for the methods of installation. Indicate which firestop materials will be used and thickness for different hourly ratings.
- D. Engineering Judgments: Submit manufacturer's drawings for all non-standard applications where no UL rested system exists. All drawings must indicate the "Tested" UL system upon which the judgment is based so as to assess the relevance of the judgment to some known performance.
- E. Submit manufacturer's installation procedures for each type of product.
- F. Approved Applicator: Submit document from manufacturer wherein manufacturer recognizes the installer as qualified or submit a list of past projects to demonstrate capability to perform intended work.
- G. Upon completion, installer shall provide written certification that materials were installed in accordance with the manufacturer's installation instructions and details.

1.05 QUALITY ASSURANCE

- A. Firestopping systems (materials and design):
 - 1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
 - 2. The F rating must be minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column joints, must be tested to UL 2079 with movement capabilities equal to those of the anticipated conditions.
- B. Firestopping materials and systems must be capable of closing or filling through openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).
- C. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
- D. Firestopping sealants must be flexible, allowing for normal pipe movement.
- E. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
- F. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
- G. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).
- H. Installation of firestopping systems shall be performed by a contractor (or contractors) trained or approved by the firestop manufacturer.
- I. Material used shall be in accordance with the manufacturer's written installation instructions.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver material in the manufacturer's original, unopened containers or packages with the manufacturer's name, product identification, lot number, UL label and mixing and installation instructions as applicable.
- B. Store materials in the original, unopened containers or packages and under conditions recommended by the manufacturer.
- C. All firestop materials will be installed prior to expiration of shelf life.

1.07 PROJECT CONDITIONS

- A. Conform to manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.
- B. Verify the condition of the substrates before starting work.
- C. Weather Conditions: Do not proceed with installation of firestop materials when temperatures fall outside the manufacturer's suggested limits.
- D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

1.08 SEQUENCING

- A. Schedule firestopping after installation of penetrants but prior to concealing the openings.
- B. Firestopping shall precede gypsum board finishing.

1.09 PROTECTION

- A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Firestopping materials and systems shall meet the requirements specified herein.
- B. Architect must approve in writing any alternates to the materials and system specified herein.
- C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
- D. For applications where combustible penetrants are involved, i.e., insulated and plastic pipe, a suitable intumescent material must be used.

2.02 ACCEPTABLE MANUFACTURERS

NOTE: Inclusion of materials in this specification does not indicate that the listed products have been evaluated for conformance to this specification. Therefore, the user/contractor must certify in the submittal package, with a "Certificate of Conformance" from the manufacturers listed below, that the material selected meets all of the criteria set forth in Section "1.05 Quality Assurance" of this specification.

- A. Specified Technologies, Inc./GE Pensil® (STI), Somerville, NJ 08876, Phone: (800) 992-1180.
- B. 3M Fire Protection Products, St. Paul, MN

2.03 MATERIALS

- A. Intumescent Firestop Sealants and Caulks:
 - 1. STI SpecSeal SSS100
 - 2. 3M Fire Barrier Caulk CP25WB+

- B. Latex Firestop Sealant
 - 1. STI SpecSeal LC150 Sealant
- C. Elastomeric Water-Based Sealant
 - 1. STI SpecSeal ES100 Elastomeric Sealant
- D. Silicone Firestop Sealants and Caulks:
 - 1. STI SpecSeal Pensil 300\
 - 2. 3M Fire Barrier Silicone Sealants
- E. Firestop Putty:
 - 1. STI SpecSeal Firestop Putty Bars and Pads
 - 2. 3M Fire Barrier Moldable Putty
- F. Firestop Collars:
 - 1. STI Spec Seal Firestop Collars
 - 2. 3M Fire Barrier PPD's.
- G. Wrap Strips:
 - 1. SpecSeal Wrap Strip
 - 2. 3M Fire Barrier FS195 Wrap Strip.
- H. 2-Part Silicone Firestop Foam:
 - 1. STI SpecSeal Pensil 200
 - 2. 3M Fire Barrier 2001 Silicone Foam.
- I. Firestop Mortar:
 - 1. STI SpecSeal Mortar.
- J. Firestop Pillows:
 - 1. STI SpecSeal Pillows
- K. Elastomeric Spray:
 - 1. STI SpecSeal AS Elastomeric Spray
- L. Composite Board:
 - 1. 3M Barrier Sheet Material
- M. Accessories:

2.04 Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer recommendation.

PART 3 - CONDITIONS REQUIRING FIRESTOPPING

- A. General:
- B. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.
- C. Through-Penetrations:
- D. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.
- E. Membrane-Penetrations:
- F. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.
- G. Construction Joints/Gaps:
- H. Fire Stopping shall be provided:
 - 1. Between the edges of floor slabs and exterior walls.
 - 2. Between the tops of walls and the underside of floors
 - 3. In the control joint in masonry walls and floors
 - 4. In expansion joints.
- I. Smoke-Stopping:

3.02 As required by the other Sections, Smoke-Stops shall be provided for Through-Penetrations, Membrane-) Penetrations, and Construction Gaps with a material approved and tested for such application.

3.03 EXAMINATION

- A. Examine the areas and conditions where firestops are to be installed and notify the architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the architect and in accordance with Section 01039.
- B. Verify that environmental conditions are safe and suitable for installation of firestop products.
- C. Verify that all pipe, conduit, cable and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.04 INSTALLATION

- A. General:
 - 1. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
 - 2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
 - 3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
 - 4. Seal holes and penetrations to ensure an effective smoke seal.
 - 5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
 - 6. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
 - 7. All combustible penetrants (e.g., Non-metallic pipes or insulated metallic pipes) shall be fire stopped using products and systems tested in a configuration representative of the field condition.
- B. Dam Construction: When required to properly contain firestopping materials within openings damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Non-combustible damming materials may be left as a permanent component of the firestop system.

3.05 FIELD QUALITY CONTROL

- A. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
- B. Follow safety procedures recommended in the Material Safety Data Sheets.
- C. Finish surfaces of firestopping which are to remain exposed in the completed work to a uniform and level condition.
- D. All areas of work must be accessible until inspection by the applicable Code Authorities.
- E. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification.

3.06 CLEANING

- A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.

- B. Leave finished work in neat, clean condition with no evidence of spill overs or damage to adjacent surfaces.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.
 4. Duct labels.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS**2.01 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Brimar Industries, Inc.
 - c. Carlton Industries, LP.
 - d. Champion America.
 - e. Craftmark Pipe Markers.
 - f. emedco.
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services, Inc.
 - j. Seton Identification Products.
 2. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 3. Letter Color: Black.
 4. Background Color: White.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by ¾ inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-

- quarters the size of principal lettering.
 - 7. Fasteners: Stainless-steel self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Brimar Industries, Inc.
 - c. Carlton Industries, LP.
 - d. Champion America.
 - e. Craftmark Pipe Markers.
 - f. emedco.
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services, Inc.
 - j. Seton Identification Products.
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 3. Letter Color: Black.
 - 4. Background Color: White.
 - 5. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
 - 6. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
 - 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 8. Fasteners: Stainless-steel self-tapping screws.
 - 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8 ½ by 11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady Corporation.
 - 2. Brimar Industries, Inc.
 - 3. Carlton Industries, LP.
 - 4. Champion America.

5. Craftmark Pipe Markers.
 6. emedco.
 7. LEM Products Inc.
 8. Marking Seivics Inc.
 9. National Marker Company.
 10. Seton Identification Products.
 11. Stranco, Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.
- D. Background Color: White
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 2. Brady Corporation.
 3. Brimar Industries, Inc.
 4. Carlton Industries, LP.
 5. Champion America.
 6. Craftmark Pipe Markers.
 7. emedco.
 8. Kolbi Pipe Marker Co.
 9. LEM Products Inc.
 10. Marking Seivics Inc.
 11. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: Size letters according to ASME A13.1 for piping. At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.04 DUCT LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Brady Corporation.
 2. Brimar Industries, Inc.
 3. Carlton Industries, LP.
 4. Champion America.
 5. Craftmark Pipe Markers.
 6. emedco.
 7. Kolbi Pipe Marker Co.
 8. LEM Products Inc.
 9. Marking Seivics Inc.
 10. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.
- D. Background Color: White.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet areas of congested piping and equipment.
- C. Pipe Label Color Schedule:
 - 1. Chilled-Water Piping: White letters on a safety-green background.
 - 2. Heating Water Piping: White letters on a safety-green background.
 - 3. Refrigerant Piping: Black letters on a safety-orange background.

3.04 DUCT LABEL INSTALLATION

- A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green: For exhaust, outside, relief, return, and mixed-air ducts.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.

1.02 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

1.03 ACTION SUBMITTALS

- A. LEED Submittals:
 - 1. Air-Balance Report for Prerequisite IEQ 1: Documentation indicating that work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
 - 2. TAB Report for Prerequisite EA 2: Documentation indicating that work complies with ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.04 INFORMATIONAL SUBMITTALS

- A. Certified TAB reports.

1.05 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC or NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)**PART 3 - EXECUTION****3.01 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for

TAB work. Include, at a minimum, the following:

1. Airside:
 - a. Duct systems are complete with terminals installed.
 - b. Volume, smoke, and fire dampers are open and functional.
 - c. Clean filters are installed.
 - d. Fans are operating, free of vibration, and rotating in correct direction.
 - e. 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.
2. Hydronics:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
 - b. Piping is complete with terminals installed.
 - c. Water treatment is complete.
 - d. Systems are flushed, filled, and air purged.
 - e. Strainers are pulled and cleaned.
 - f. Control valves are functioning per the sequence of operation.
 - g. Shutoff and balance valves have been verified to be 100 percent open.
 - h. Pumps are started, and proper rotation is verified.
 - i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
 - j. Variable-frequency controllers' startup is complete and safeties are verified.
 - k. Suitable access to balancing devices and equipment is provided.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233700 "Air Duct Accessories."
 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230700 "Duct Insulation," Section 230700 "HVAC Equipment Insulation," and Section 230700 "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.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.

- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. 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.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."
- M. The contractor shall allow for (2) passes for each heating and cooling season.
- N. Allow for one sheave change for 50% of the HVAC systems to be tested and adjusted. Replacement sheave shall be furnished and installed by the mechanical contractor. Sheave shall be adjusted by the TBA contractor.

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 4. Obtain approval from [Architect] [Owner] [Construction Manager] [commissioning authority] for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

3.06 DUCTWORK LEAKAGE TESTING

- A. Installed ductwork shall be tested prior to installation of access doors, take-offs, etc.
- B. All leak testing shall be witnessed by the engineer or representative of the engineer. The contractor shall give the engineer 72 hours' notice prior to testing. Any testing not witnessed by the engineer or his/her representative shall be considered invalid and will be redone.
- C. The testing shall be performed as follows:
 1. Perform testing in accordance with HVAC Air Duct Leakage Test Manual.
 2. Use a certified orifice tube for measuring the leakage.
 3. Determine section of system to be tested and blank off.
 4. Determine the percentage of the system being tested.
 5. Using that percentage, determine the allowable leakage (cfm) for that section being tested.
 6. Pressurize to operating pressure and repair any significant or audible leaks.
 7. Repressurize the measure leakage.
 8. Repeat steps 6 and 7 until the leakage measured is less than the allowable defined in step 5.

NOTE: It is recommended that the first 100'-300' of ductwork installed be tested to insure the quality of the workmanship at an early stage.

3.07 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
 1. Check liquid level in expansion tank.
 2. Check highest vent for adequate pressure.
 3. Check flow-control valves for proper position.
 4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 5. Verify that motor starters are equipped with properly sized thermal protection.
 6. Check that air has been purged from the system.
- D. The contractor shall allow for (2) passes for each system and each terminal unit.

3.08 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
 1. Verify that the differential-pressure sensor is located as indicated.
 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:
 1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 2. Position valves for full flow through coils.
 3. Measure flow by main flow meter, if installed.

4. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - a. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - b. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 5. Adjust flow measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
 6. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
 7. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
 8. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 9. Prior to verifying final system conditions, determine the system differential-pressure set point.
 10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 11. Mark final settings and verify that all memory stops have been set.
 12. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 13. Verify that memory stops have been set.
- D. For systems with diversity:
1. Determine diversity factor.
 2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
 3. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.

- 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
4. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
6. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
7. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
13. Verify that memory stops have been set.

3.09 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.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.

2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.
- F. Air-Terminal-Device Reports:
1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft.
 2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg. F.
- G. 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-water temperature in deg. F.
 - c. Leaving-water temperature in deg. F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg. F.
 - f. Leaving-air temperature in deg. F.
- H. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
- 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
 - 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.

- I. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
- B. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 - 3. If the second verification also fails, Owner may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION AND COVERING**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 23 05 00 for requirements which are applicable to this section.
- B. Insulation to be in accordance with ASHRAE 90.1-2010.

1.02 SCOPE

- A. The work included in this specification consists of furnishing all labor, materials, accessories, and equipment necessary for the insulation of all heating and air conditioning systems. Said work shall be completed in strict accordance with the insulation section of the specifications and applicable drawings.
- B. All work is subject to the terms and conditions of the contract.

1.03 SUBMITTALS

- A. Submit shop drawings which indicate complete material data, a list of materials proposed, and indicate thickness and density of material for individual services.
- B. Submit fabrication instructions for pipe fitting and valve insulation.
- C. Submit manufacturers joining recommendations for butt joints and longitudinal seams.

1.04 QUALITY ASSURANCE

- A. Install insulation in accordance with the manufacturer's instructions.
- B. Insulation shall be installed by skilled workmen regularly engaged in insulation work.
- C. Protect insulation and covering until accepted in place by the owner.

PART 2 - PRODUCTS**2.01 HOT WATER PIPING**

- A. Includes;
 - 1. Domestic Hot Water Supply
 - 2. Domestic Hot Water Return
 - 3. Heating Hot Water Supply
 - 4. Heating Hot Water Return
- B. Material; Fiberglass bonded with resins to form circular pipe sleeves and pipe covering segments with factory applied all service jacket.
- C. Fire Safety; U.L. listing flame spread rating of 25 and smoke developed rating of 50.
- D. Thermal conductivity of 0.276 at 90 degrees F.
- E. Thickness per ASHRAE STD. 90.1-2010:
Piping System Types: PIPE SIZES / INSULATION THICKNESS

	Temp	Up to 1"	Up to 1.5"	Up to 4"	Up to 8"	8" & Up
2. Hot Water						
a) Heating HW	140-200	1.5"	1.5"	2"	2"	2"
b) Domestic HW/HWR	100-130	1"	1"	1.5"	1.5"	1.5"

- F. Joints; Pressure sealing lap strips for longitudinal joints and minimum 3" pressure sealing butt strips for circumferential joints.
- G. Valves and Fittings; Fiberglass insulation of same thickness as pipe with pre-molded fitting covers.
- H. Contractor shall insulate all exposed domestic water and drainage piping under all handicapped lavatories and sinks with pre-formed insulation kit with PVC jacket similar to Lav,Guard as manufactured by Truebro. There shall be no sharp or abrasive surfaces under the handicapped lavatories.
- I. Manufacturer: Johns-Manville Micro-Lok, Knauf Lo Smoke PVC.

2.02 COLD WATER PIPING

- A. Includes;
 - 1. Domestic Cold Water: 1/2" insulation
 - 2. Horizontal Storm Water, both normal and overflow, and underside of Roof Drains: 1" insulation.
 - 3. Fan/coil condensate drains: 1/2" insulation
 - 4. Dual Temperature water supply and return: 1½ " insulation
 - 5. Chilled water supply and return: 1½" insulation
 - 6. Geothermal HPS & R piping: 1 ½" insulation
- B. Material; Fiberglass bonded with resins to form circular pipe sleeves with factory applied jacket of Kraft paper bonded to aluminum foil, reinforced with fiberglass yarn. Vapor barrier.
- C. Fire safety; Flame spread rating of 25 or less and a smoke density rating of 50 or less and a fuel contributed rating of 50 as tested by ASTM E 84-75.
- D. Thermal Conductivity; 0.25 at 100 degrees.
- E. Joints; Pressure sealing lap strips for longitudinal joints and 3 inch wide wrapping strips for butt joints. Strips shall be sealed with an adhesive meeting NFPA 90 25-50 code such as:
 - 1. CMC17-465
 - 2. H. B. Fuller Co., Foster Products Division 85-20
 As an option the contractor may utilize pressure sensitive butt strips.
- F. Valves and Fittings; Fiberglass insulation of same thickness as pipe with pre-molded fitting covers. Seal edges of fitting cover with vapor barrier mastic adhesive or vapor barrier strip tape which shall overlap the insulation and fitting cover by 2 inches.
- G. Manufacturer: Johns-Manville Micro-Lok HP, Knauf Proto Lo Smoke PVC.

2.03 DUCT INSULATION - INTERIOR – CONCEALED

- A. Includes: All supply, return, and outside air ductwork.
 - 1. All supply air ductwork.
 - 2. All outside air ductwork.
 - 3. All return air ductwork.
 - 4. All dryer exhaust ductwork extending thru unconditioned spaces and/or attics.
 - 5. All exhaust ductwork extending thru unconditioned spaces.
 - 6. Kitchen supply and return ductwork.

7. Supply ductwork in unconditioned spaces.
8. Return ductwork in unconditioned spaces.
9. Soundtraps if adjacent ductwork is lined or insulated.
10. Duct heating coils if adjacent ductwork is lined or insulated.

* NOTE: Refer to Section 23 31 13 which defines Lining Requirements. Insulation indicated is in addition to internal lining.

- B. Material; Flexible vapor seal duct insulation with foil scrim kraft facing consisting of aluminum foil reinforced with fiberglass scrim to a U.L. rated kraft, 0.75 lb. density, .02 perms.
- C. Fire safety; Flame spread rating of 25 or less and a smoke density rating of 50 or less as tested by ASTM E 84-75.
- D. In conditioned space thickness is 2" inches, equaling an installed "R" value of 4.2. In unconditioned space/outdoors, thickness is 3", equaling an installed "R" value of 8.3.
- E. Application; All joints shall be sealed with a 3 inch wide strip of same material applied with H. B. Fuller Co., Foster Products Division 85-75. For ducts over 18" wide insulation shall be secured on bottom at 18" centers to reduce sagging.
- F. Manufacturer: Johns-Manville 800 Series Flexible Spin-Glass.

2.04 DUCT INSULATION - INTERIOR – EXPOSED

- A. Same as above except 6 PCF density with FSK facing, 0.02 perms.
- B. Secured with fasteners, 2 rows per side at 12" centers.

2.05 EQUIPMENT INSULATION

- A. Includes;
 1. Pumps
- B. Material; Spun glass inorganic glass fiber insulation bonded by a thermosetting resin with aluminum foil reinforced with fiber glass yarn and laminated to a fire-resistant kraft. 6 lb. density. Provide vapor barrier on all equipment that will have cold surfaces.
- C. Fire safety; Flame spread rating of 25 or less and a smoke density rating of 50 or less as tested by ASTM E 84-75.
- D. Thermal conductivity; 0.24 at 100 degrees F.
- E. Application; All joints shall be sealed with a 3 inch wide strip of same material applied with H. B. Fuller Co., Foster Products Division 85-75.
- F. Manufacturer: Johns-Manville 800 Series Non-Flexible Spin-Glass or approved equal.
- G. Thickness: 1 1/2" on equipment in mechanical rooms and in ceiling spaces, 3" on equipment in unconditioned attic spaces.

2.06 REFRIGERANT PIPING

- A. Includes;
 1. Refrigerant lines - interior
 2. Refrigerant lines - exterior
- B. Material; Elastomeric thermal insulation with exposed closed cell structure, pipe size 1 1/2" or less = 1", pipe size larger than 1 1/2" = 1 1/2" (interior and exterior).
- C. Residential Only - 1/2" interior, 1" exterior - minimum of R-2).
- D. Fire safety; Flame spread rating of 25 or less and a smoke density rating of 50 or less as tested by ASTM E 84-75.
- E. Thermal conductivity not to exceed .25 BTU per inch/h-Ft2 -°F.
- F. Joints; Butt joints and seams are to be sealed with contact adhesive as per manufacturer's specifications. Seams are to be sealed with an adhesive meeting NFPA 90 25-50 such as CMC 17-465, H. B. Fuller Co., Foster Products Division 85-20 or approved equal. As an option the contractor

may utilize pressure sensitive butt strips. Seal all edges.

G. Manufacturer: Armacell AP Armaflex or approved equal.

H. PHFA Requirement: All exposed refrigerant piping, power, and control wiring extending from the building to the remote condensing unit shall be protected and insulated with split type insulation with PVC jacket and cemented joints.

2.07 MANUFACTURERS

A. Johns-Manville, Certain Teed, Owens/Corning, Knauf, Armstrong.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Do not install until all piping systems and ductwork are tested.

B. Do not install until the building is closed in.

C. Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer.

D. Work in the area which may damage the insulation shall have been completed prior to the start of insulating. The owner shall not be responsible for subsequent charges arising out of damage to insulation caused by work progressing in the area after insulation has been installed.

E. All insulation shall be continuous through wall, ceilings, and floor openings except where fire safe materials are required.

F. Insulation on all cold surfaces must be applied with a continuous unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces shall be adequately insulated and vapor sealed to prevent condensation.

G. Finish insulation neatly at hangers, supports, and other protrusions.

H. Secure with tacks or tape as required.

I. Install inserts on all hangers. Inserts between the pipe and pipe hanger shall consist of rigid pipe insulation of thickness equal to the adjoining insulation and shall be provided with vapor barrier where required. Insert length shall be 10" long for pipes up to and including 2-1/2" and 12" for pipes over 2-1/2".

J. Pipe insulation shall have metal shields. The shields shall be installed between hanger support and the pipe insulation. Shield shall be formed to fit the insulation and shall extend up to the center line of the pipe. Shield shall be 10" long for pipes up to and including 2-1/2" and 12" for pipes over 2-1/2".

K. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

L. All insulation shall be secured at sufficient intervals to prevent sagging, gaps, or spaces from occurring. Any repairs necessary for 1 year due to improper installation shall be provided by Contractor at no cost to Owner.

3.02 SURFACE PREPARATION

A. Pipe, duct, and equipment shall be clean, oil free, and dry prior to the application of insulation.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Related Sections:
 - 1. Section 230716 "HVAC Equipment Insulation."
 - 2. Section 230719 "HVAC Piping Insulation."
 - 3. Section 233113 "Metal Ducts" for duct liners.
- C. Insulation to be in accordance with ASHRAE 90.1-2016.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:
 - 1. For each type of insulation product indicated, include thermal conductivity, water-vapor permeability for closed cell insulations, thickness, applicable ASTM standard specification, and jackets (both factory- and field-applied, if any). For each type of vapor retarder or jacket specified, include water vapor permeability, required thickness, and applicable ASTM standard specification.
 - 2. Product Data: For adhesives, indicating VOC content.
 - 3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 4. Product Data: For coatings, indicating VOC content.
 - 5. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
 - 6. Product Data: For sealants, indicating VOC content.
 - 7. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
 - 8. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components. Laboratory Test Reports for Credit EQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties, and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.

4. Detail application at linkages of control devices.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Install insulation in accordance with the manufacturer's instructions.

Material Certifications: Manufacturers can provide information regarding material and testing certifications from a qualified testing agency acceptable to authorities having jurisdiction (AHJ). The AHJ can use this information for indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. (Many companies published compliance data on public data sheets while also offering technical resources for additional information. The wording was adjusted to reflect this.)

- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency. Suggestion: or proper documentation indicating compliance. (Some fabricated materials used by the industry do not come directly from the manufacturer, so this documentation can be provided in those cases).
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Products that come in contact with austenitic stainless steel operating at temperatures between 140°F and 250°F shall have a leachable chloride content in accordance with the limits set by ASTM C795 (Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel).
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795. See above.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, [Type I] Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.

- c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - 2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - 2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. VOC Content: 420 g/L or less.
 - 2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the

Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 - b. Knauf Insulation.
 - c. Vimasco Corporation.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg. F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.

2.04 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250° F.
 - 5. Color: Aluminum.
 - 6. Sealant shall have a VOC content of 420 g/L or less.
 - 7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250° F.
 - 5. Color: White.
 - 6. Sealant shall have a VOC content of 420 g/L or less.
 - 7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.05 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying

- with ASTM C 1136, Type II.
- 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
- B. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.06 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
 - d. Speedline Corporation.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: [White] [Color-code jackets based on system. Color as selected by Architect].
- D. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. ITW Insulation Systems; Illinois Tool Works, Inc. Johns Manville
 - c. RPR Products, Inc.
 - 2. [Sheet and roll stock ready for shop or field sizing] [Factory cut and rolled to size].
 - 3. Finish and thickness are indicated in field-applied jacket schedules.
 - 4. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - 5. Moisture Barrier for Outdoor Applications: [3-mil-thick, heat-bonded polyethylene and kraft paper] [2.5-mil- thick polysurlyn].
- E. Self-Adhesive Outdoor Jacket: 6014-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross laminated polyethylene film covered with [white] [stucco-embossed] aluminum-foil facing.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Polyguard Products, Inc.
 - b. VentureClad by 3M

2.07 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.

- e. Venture Tape.
 - 2. Width: 3 inches
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces' force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces' force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces' force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.

2.08 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
- B. Insulation Pins and Hangers:
- 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.

- 2) Gemco.
 - 3) Hardcast, Inc.
 - 4) Midwest Fasteners, Inc.
 - 5) Nelson Stud Welding.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Aluminum, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Gemco.
 - 2) Midwest Fasteners, Inc.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1 ½ inches in diameter.
 - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2 ½ inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Hardcast, Inc.
 - 4) Midwest Fasteners, Inc.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Aluminum, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1 ½ inches in diameter.
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Hardcast, Inc.
 - 4) Midwest Fasteners, Inc.
 - 5) Nelson Stud Welding.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 - c. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation

- securely in place but not less than 1 ½ inches in diameter.
 - d. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Gemco.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, galvanized steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. C & F Wire.

2.09 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during storage, application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and

dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1 ½ inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

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

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct

- insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.04 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches' maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches' maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg. F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins. Follow manufacturer's installation instructions.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-

discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

- a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory or field applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.05 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1 ½ -inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.06 FINISHES

- A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified

below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.
- D. Local building code and fire marshal shall approve before painting.

3.07 FIELD QUALITY CONTROL

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

3.08 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 1. Indoor, concealed supply and outdoor air.
 2. Indoor, exposed supply and outdoor air.
 3. Indoor, concealed return located in unconditioned space.
 4. Indoor, exposed return located in unconditioned space.
 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. 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.

3.09 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft. nominal density. "R" value of 4.2.
- B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft. nominal density. "R" value of 4.2.
- C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft. nominal density. "R" value of 4.2.
- D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft. nominal density. "R" value of 4.2.
- E. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.
- F. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft.

- nominal density. "R" value of 4.2.
- G. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. "R" value of 4.2.
- H. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. "R" value of 4.2.
- I. Exposed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. "R" value of 4.2.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 - 1. None.
- D. Ducts and Plenums, Exposed:
 - 1. Aluminum, Smooth: 0.020 inch thick.

END OF SECTION

SECTION 23 07 19 - HVAC PIPING INSULATION**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes insulating the following HVAC piping systems:
 - 1. Chilled-water and brine piping, [indoors] [and] [outdoors].
 - 2. Heating hot-water piping, [indoors] [and] [outdoors].
 - 3. Refrigerant suction and hot-gas piping, [indoors] [and] [outdoors].
 - 4. Dual-service heating and cooling piping, [indoors] [and] [outdoors].
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."
 - 2. Section 230716 "HVAC Equipment Insulation."

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of insulation product indicated, include thermal conductivity, water-vapor permeability for closed cell insulations, thickness, applicable ASTM standard specification, and jackets (both factory- and field-applied, if any). For each type of vapor retarder or jacket specified, include water vapor permeability, required thickness, and applicable ASTM standard specification.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For coatings, indicating VOC content.
 - 4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
 - 5. Product Data: For sealants, indicating VOC content.
 - 6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at pipe expansion joints for each type of insulation.
 - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 4. Detail removable insulation at piping specialties.
 - 5. Detail application of field-applied jackets.
 - 6. Detail application at linkages of control devices.

1.03 INFORMATIONAL SUBMITTALS (Only as necessary)

- A. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Material Certifications: Manufacturers can provide information regarding material and testing

certifications from a qualified testing agency acceptable to authorities having jurisdiction (AHJ). The AHJ can use this information for indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated.

- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Products that come in contact with austenitic stainless steel operating at temperatures between 140°F and 250°F shall have a leachable chloride content in accordance with the limits set by ASTM C795 (Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel).
- C. Insulation materials for use on austenitic stainless steel operating at temperatures between 140°F and 250°F shall be qualified as acceptable according to ASTM C 795. (same reasoning as above)
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Pittsburgh Corning Corporation.
 2. Block Insulation: ASTM C 552, Type I.
 3. Special-Shaped Insulation: ASTM C 552, Type III.
 4. Board Insulation: ASTM C 552, Type IV.
 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 6. Preformed Pipe Insulation with Factory-Applied [ASJ] [ASJ-SSL]: Comply with ASTM C 552, Type II, Class 2.
 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
- H. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply

with ASTM C 1290, Type I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.
- J. Mineral-Fiber, Preformed Pipe Insulation:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Manson Insulation Inc.
 - d. Owens Corning.
 2. Type I, 850 deg. F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, [without factory-applied jacket] [with factory-applied ASJ] [with factory-applied ASJ-SSL]. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 3. Type II, 1200 deg. F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, [without factory-applied jacket] [with factory-applied ASJ] [with factory-applied ASJ-SSL]. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- K. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Owens Corning.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Ramco Insulation, Inc.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg. F.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 2. Adhesives shall have a VOC content of [50] <Insert value> g/L or less.
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:

- a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. K-Flex USA.
2. Adhesives shall have a VOC content of [50] <Insert value> g/L or less.
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. VOC Content: 420 g/L or less.
 2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 - b. Knauf Insulation.
 - c. Vimasco Corporation.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg. F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

2.05 SEALANTS

A. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - e. Pittsburgh Corning Corporation.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg. F.
5. Color: White or gray.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg. F.
5. Color: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg. F.
5. Color: White.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-

applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A.

2.07 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
 - d. Speedline Corporation.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45 and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 1. [Sheet and roll stock ready for shop or field sizing] [Factory cut and rolled to size].
 2. Finish and thickness are indicated in field-applied jacket schedules.
 3. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 4. Moisture Barrier for Outdoor Applications: [3-mil-thick, heat-bonded polyethylene and kraft paper] [2.5-mil-thick polysurlyn].
 5. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45 and 90-degree, short and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union cover.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - a. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.08 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces' force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces' force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces' force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

2.09 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, [1/2 inch] [3/4 inch] wide with [wing seal] [or] [closed seal].
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville
 - b. RPR Products, Inc.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel, or Monel.
- C. Wire: [0.080-inch nickel-copper alloy] [0.062-inch soft-annealed, stainless steel] [0.062-inch soft-

annealed, galvanized steel].

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. C & F Wire.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Install outermost layer of insulation with longitudinal seams at the 3:00 and 9:00 positions of horizontal runs. (Longitudinal seams should be at the sides of horizontal pipe to avoid being stressed from pipe supports, being walked on, having things hung from the insulated pipe, etc. If there will be stresses applied to insulated pipe, it is most likely to be at the top or bottom of the pipe so you do not want to have the joints in the outermost layer at these locations). Check with manufacturer depending upon application.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and

dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Jackets without a self-sealing lap are typically stapled or taped. Jackets like an ASJ jacket that have a self-sealing Lap adhesive system are not usually stapled for indoor applications. For below ambient air systems, any penetrations made in the vapor-retarder jacket needs to be sealed with appropriate vapor-retarder tape or mastic.
4. Overlap jacket longitudinal seams at least 1 ½ inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint

- sealant.
- 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
- 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test

connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:

1. Use the ASL-SSL pressure sensitive adhesive lap seal, and butt (circumferential) strips to seal the seams and joints respectively. Penetrations can be sealed with pressure-sensitive adhesive tape or vapor-retarder mastic. Follow manufacturer's instructions, which include sealing lap seal and butt strips having pressure-sensitive adhesive surfaces. When adhered, the lap and butt strips must be pressurized by rubbing firmly with a plastic squeegee or the back of a knife blade to ensure positive closure. For specific installations, secure each layer of Unfaced preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials. Check with manufacturer for instructions.
 2. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 3. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 4. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
 5. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1 ½ -inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. On horizontal pipe, overlap longitudinal seams arranged to shed water and locate longitudinal seams at 3:00 or 9:00 position on pipe. Seal end joints with weatherproof sealant recommended by insulation manufacturer. On vertical pipe, overlap end joint seams arranged to shed water and locate longitudinal joints to face away from prevailing wind. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints. Where PVDC jackets are indicated, install as follows: Apply wraps of filament tape at ends of each insulation section and on 12 inch centers to secure pipe insulation to pipe prior to installation of PVDC jacket.
 Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.
- D. Where PVDC jackets are indicated, install as follows:
 1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 2. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33 1/2 - inches or less. The 33 1/2 -inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.08 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] <Insert number> finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation

manufacturer's recommended protective coating.

- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.09 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

Testing Agency: [Owner will engage] [Engage] a qualified testing agency to perform 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] <Insert number> locations of straight pipe, [three] <Insert number> locations of threaded fittings, [three] <Insert number> locations of welded fittings, [two] <Insert number> locations of threaded strainers, [two] <Insert number> locations of welded strainers, [three] <Insert number> locations of threaded valves, and [three] <Insert number> 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.

3.10 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.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Chilled Water and Brine, above 40 Deg. F: Insulation shall be one of the following:
 1. Cellular Glass: 1 ½" thick.
 2. Flexible Elastomeric: 1 ½ inches thick.
 3. Mineral-Fiber, 1 ½ inches thick.
 4. Polyolefin: 1 ½ inches thick.
- B. Heating-Hot-Water Supply and Return, 200 Deg. F and Below: Insulation shall be [one of] the following:

	Temp	Up to 1"	Up to 1.5"	Up to 4"	Up to 8"	8" & Up
1. Hot Water						
a) Heating HW	140-200	1.5"	1.5"	2"	2"	2"

1. Cellular Glass: 1 ½" (up to 1.5" dia. Pipe). 2" (2" dia. Pipe and above).
2. Mineral-Fiber, Preformed Pipe, Type I: 1-1" (up to 1.5" dia. Pipe). 2" (2" dia. Pipe and

above).

- C. Refrigerant Suction and Hot-Gas Piping: [Flexible elastomeric] [Mineral-fiber, preformed pipe insulation] [Polyolefin], [1 inch] <Insert dimension> thick.
- D. Refrigerant Suction and Hot-Gas Flexible Tubing: [Flexible elastomeric] [Polyolefin], [1 inch] thick.
- E. Dual-Service Heating and Cooling, 40 to 200 Deg. F: Insulation shall be [one of] the following:
 - 1. Cellular Glass: 1 ½ inches thick.
 - 2. Mineral-Fiber, Preformed Pipe, Type I: 1 ½ inches thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.
- D. Piping, Exposed:
 - 1. Aluminum, Smooth 0.020 inch thick.

END OF SECTION

SECTION 23 09 23.11 - CONTROL VALVES**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes control valves and actuators for DDC systems.
- B. Related Requirements:
 - 1. Section 230923 "Direct-Digital Control System for HVAC" control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.
 - 2. Section 230933 "Electric and Electronic Control System for HVAC" for electric/electronic control valves and actuators in electric and electronic control systems.
 - 3. Section 230993 "Sequence of Operations for HVAC Controls" for requirements that relate to Section 230923.11.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include diagrams for power, signal, and control wiring.
 - 2. Include diagrams for pneumatic signal and main air tubing.
- C. Delegated-Design Submittal:
 - 1. Schedule and design calculations for control valves and actuators, including the following:
 - a. Flow at project design and minimum flow conditions.
 - b. Pressure differentials drop across valve at project design flow condition.
 - c. Maximum system pressure differential drop (pump close-off pressure) across valve at project minimum flow condition.
 - d. Design and minimum control valve coefficient with corresponding valve position.
 - e. Maximum close-off pressure.
 - f. Leakage flow at maximum system pressure differential.
 - g. Torque required at worst case condition for sizing actuator.
 - h. Actuator selection indicating torque provided.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS**2.01 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. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.
- C. Delegated Design: Engage a qualified manufacturer to size products where indicated as delegated

design.

- D. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.
- E. Determine control valve sizes and flow coefficients by ISA 75.01.01.
- F. Control valve characteristics and rangeability shall comply with ISA 75.11.01.
- G. Selection Criteria:
 - 1. Control valves shall be suitable for operation at following conditions:
 - a. Chilled Water: <Insert pressure and coincident temperature requirements>.
 - b. Heating Hot Water: <Insert pressure and coincident temperature requirements>.
 - 2. Fail positions unless otherwise indicated:
 - a. Chilled Water: Open.
 - b. Heating Hot Water: Open.
 - 3. Minimum Cv shall be calculated at 10 percent of design flow, with a coincident pressure differential equal to the system design pump head.
 - 4. In water systems, select modulating control valves at terminal equipment for a design Cv based on a pressure drop of 12' head at design flow unless otherwise indicated.
 - 5. Modulating valve sizes for steam service shall provide a pressure drop at design flow equal to lesser of the following:
 - a. 50 percent of the valve inlet pressure.
 - b. 50 percent of the absolute steam pressure at the valve inlet.

2.02 BALL-STYLE CONTROL VALVES

- A. Ball Valves with Single Port and Characterized Disk:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Belimo Aircontrols (USA), Inc.
 - 2. Pressure Rating for NPS 1-inch and Smaller: Nominal 600 WOG.
 - 3. Pressure Rating for NPS 1 ½ -inch through NPS 2-inch: Nominal 400 WOG.
 - 4. Close-off Pressure: 200 psig.
 - 5. Process Temperature Range: Zero to 212 deg. F.
 - 6. Body and Tail Piece: Cast bronze ASTM B 61, ASTM B 62, ASTM B 584, or forged brass with nickel plating.
 - 7. End Connections: Threaded (NPT) ends.
 - 8. Ball: Bronze or 300 series stainless steel.
 - 9. Stem and Stem Extension:
 - a. Material to match ball.
 - b. Blowout-proof design.
 - c. Sleeve or other approved means to allow valve to be opened and closed without damaging the insulation or the vapor barrier seal.
 - 10. Ball Seats: Reinforced PTFE.
 - 11. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.
 - 12. Flow Characteristic: Equal percentage.
- B. Ball Valves with Two Ports and Characterized Disk:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Belimo Aircontrols (USA), Inc.
 - 2. Pressure Rating for NPS 1-inch and Smaller: Nominal 600 WOG.
 - 3. Pressure Rating for NPS 1 ½ -inch through NPS 2-inch: Nominal 400 WOG.
 - 4. Close-off Pressure: 200 psig.
 - 5. Process Temperature Range: Zero to 212 deg. F.
 - 6. Body and Tail Piece: Cast bronze ASTM B 61, ASTM B 62, ASTM B 584, or forged brass

- with nickel plating.
- 7. End Connections: Threaded (NPT) ends.
- 8. Ball: [Chrome-plated brass or bronze] [or] [300 series stainless steel].
- 9. Stem and Stem Extension:
 - a. Material to match ball.
 - b. Blowout-proof design.
 - c. Sleeve or other approved means to allow valve to be opened and closed without damaging the insulation or the vapor barrier seal.
- 10. Ball Seats: Reinforced PTFE.
- 11. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.
- 12. Flow Characteristics for A-Port: Equal percentage.
- 13. Flow Characteristics for B-Port: Modified for constant common port flow.
- C. Pressure-Independent Ball Valves NPS 2-inch and Smaller:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Belimo Aircontrols (USA), Inc.
 - b. HCI; Hydronics Components Inc.
 - 2. Performance:
 - a. Pressure Rating: 600 psig for NPS 1-inch and 400 psig for NPS 1 ½ -inch and NPS 2-inch.
 - b. Close-off pressure of 200 psig.
 - c. Process Temperature Range: Between Zero to 212 deg. F.
 - d. Rangeability: 100 to 1.
 - 3. Integral Pressure Regulator: Located upstream of ball to regulate pressure, to maintain a constant pressure differential while operating within a pressure differential range of 5 to 50 psig.
 - 4. Body: Forged brass, nickel plated, and with threaded ends.
 - 5. Ball: Chrome-plated brass.
 - 6. Stem and Stem Extension: Chrome-plated brass, blowout-proof design.
 - 7. Stem sleeve or other approved means to allow valve to be opened and closed without damaging field-applied insulation and insulation vapor barrier seal.
 - 8. Ball Seats: Reinforced PTFE.
 - 9. Stem Seal: Reinforced PTFE packing ring stem seal with threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if equivalent cycle endurance can be achieved.
 - 10. Flow Characteristic: Equal percentage.

2.03 BUTTERFLY-STYLE CONTROL VALVES

- A. Commercial-Grade, Two-Way Butterfly Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Keystone; Tyco Flow Control.
 - 2. Performance:
 - a. Bi-directional bubble tight shutoff at 250 psig.
 - b. Comply with MSS SP-67 or MSS SP-68.
 - c. Rotation: Zero to 90 degrees.
 - d. Linear or modified equal percentage flow characteristic.
 - 3. Body: Cast iron ASTM A 126, Class B, ductile iron ASTM A 536 or cast steel ASTM A 216/A 216M WCB fully lugged, suitable for mating to ASME B16.5 flanges.

4. Disc: 316 stainless steel.
 5. Shaft: 316 or 17-4 PH stainless steel.
 6. Seat: Reinforced EPDM or reinforced PTFE with retaining ring.
 7. Shaft Bushings: Reinforced PTFE or stainless steel.
 8. Replaceable seat, disc, and shaft bushings.
 9. Corrosion-resistant nameplate indicating:
 - a. Manufacturer's name, model number, and serial number.
 - b. Body size.
 - c. Body and trim materials.
 - d. Flow arrow.
- B. Commercial-Grade, Three-Way Butterfly Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Keystone; Tyco Flow Control.
 2. Arrangement: Two valves mated to a fabricated tee with interconnecting mechanical linkage.
 3. Performance:
 - a. Bi-directional bubble tight shutoff at 250 psig.
 - b. Comply with MSS SP-67 or MSS SP-68.
 - c. Rotation: Zero to 90 degrees.
 - d. Linear or modified equal percentage flow characteristic.
 4. Body: Cast iron ASTM A 126, Class B, ductile iron ASTM A 536 or cast steel ASTM A 216/A 216M WCB fully lugged, suitable for mating to ASME B16.5 flanges.
 5. Disc: 316 stainless steel.
 6. Shaft: 316 or 17-4 PH stainless steel.
 7. Seat: Reinforced EPDM or reinforced PTFE seat with retaining ring.
 8. Shaft Bushings: Reinforced PTFE or stainless steel.
 9. Replaceable seat, disc, and shaft bushings.
 10. Corrosion-resistant nameplate indicating:
 - a. Manufacturer's name, model number, and serial number.
 - b. Body size.
 - c. Body and trim materials.
 - d. Flow arrow.

2.04 SOLENOID VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. ASCO Valve, Inc.
- B. Description:
1. Action: Either normally open or normally closed in the event of electrical power failure as required by the application.
 2. Size to close against the system pressure.
 3. Manual override capable.
 4. Heavy-duty assembly.
 5. Body: Brass.
 6. Seats and Discs: NBR or PTFE.
 7. Solenoid Enclosure: NEMA 250, Type 4.

2.05 ELECTRIC AND ELECTRONIC CONTROL VALVE ACTUATORS

- A. Actuators for Hydronic Control Valves: Capable of closing valve against system pump shutoff head.
- B. Actuators for Steam Control Valves: Shutoff against 1.5 times steam design pressure.
- C. Position indicator and graduated scale on each actuator.
- D. Type: Motor operated, with or without gears, electric and electronic.

- E. Voltage: Voltage selection delegated to the controls contractor and to be coordinated with the electrical contractor.
- F. Deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.
- G. Function properly within a range of 85 to 120 percent of nameplate voltage.
- H. Construction:
 - 1. For Actuators Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.
 - 2. For Actuators from 100 to 400 W: Gears ground steel, oil immersed, shaft hardened steel running in bronze, copper alloy or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel or cast-aluminum housing.
 - 3. For Actuators Larger Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.
- I. Field Adjustment:
 - 1. Spring Return Actuators: Easily switchable from fail open to fail closed in the field without replacement.
 - 2. Gear Type Actuators: External manual adjustment mechanism to allow manual positioning when the actuator is not powered.
- J. Two-Position Actuators: Single direction, spring return or reversing type.
- K. Modulating Actuators:
 - 1. Operation: 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 counterclockwise 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 [zero 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 pulse duration (length) of signal from a dry contact closure, triac sink, or source controller.
 - d. Programmable Multi-Function:
 - 1) Control Input, Position Feedback, and Running Time: Factory or field programmable.
 - 2) Diagnostic: Feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.
 - 3) Service Data: Include, at a minimum, number of hours powered and number of hours in motion.
- L. Position Feedback:
 - 1. Equip two-position actuators with limits 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.
- M. 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 non-mechanical forms of fail-safe operation are acceptable only where uniquely indicated.

- N. 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.
- O. Valve Attachment:
 - 1. Unless otherwise required for valve interface, provide an actuator designed to be directly coupled to valve shaft without the need for connecting linkages.
 - 2. Attach actuator to valve drive shaft in a way that ensures maximum transfer of power and torque without slippage.
 - 3. Bolt and set screw method of attachment is acceptable only if provided with at least two points of attachment.
- P. 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 shall be from 5 to 95 percent relative humidity, non-condensing.
- Q. Enclosure:
 - 1. Suitable for ambient conditions encountered by application.
 - 2. NEMA 250, Type 2 for indoor and protected applications.
 - 3. NEMA 250, Type 4 or Type 4X for outdoor and unprotected applications.
 - 4. Provide actuator enclosure with heater and control where required by application.
- R. Stroke Time:
 - 1. Operate valve from fully closed to fully open within 15 seconds.
 - 2. Operate valve from fully open to fully closed within 15 seconds.
 - 3. Move valve to failed position within 30 seconds.
 - 4. Select operating speed to be compatible with equipment and system operation.
- S. Sound:
 - 1. Spring Return: 62 dBA.
 - 2. Non-Spring Return: 45 dBA.

PART 3 - EXECUTION

3.01 CONTROL VALVE APPLICATIONS

- A. Control Valves:
 - 1. Select from valves specified in "Control Valves" Article to achieve performance requirements and characteristics indicated while subjected to full range of system operation encountered.
 - 2. Hydronic System, Two-Way Applications Controlled by Temperature: Ball valves with single port and characterized disk or Butterfly-style valves, commercial-grade, two-way valves.
 - 3. Hydronic System, Three Way, Controlled by Temperature: Ball valves with two ports and characterized disk or Butterfly-style valves, commercial-grade, three-way valves.

3.02 INSTALLATION, GENERAL

- A. Furnish and install products required to satisfy most stringent requirements indicated.
- B. Install products level, plumb, parallel, and perpendicular with building construction.
- C. Properly support instruments, tubing, piping, wiring, and conduits to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a 250lb force.

- D. 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.
- E. Firestop penetrations made in fire-rated assemblies and seal penetrations made in acoustically rated assemblies.
- F. Fastening Hardware:
 - 1. Stillson wrenches, pliers, and 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.
- G. 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.
- H. Corrosive Environments:
 - 1. Use products that are suitable for environment to which they will be subjected.
 - 2. If possible, avoid or limit use of materials in corrosive environments, including, but not limited to, the following:
 - a. Laboratory exhaust airstreams.
 - b. Process exhaust airstreams.
 - 3. Use Type 316 stainless steel tubing and fittings when in contact with a corrosive environment.
 - 4. When conduit is in contact with a corrosive environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment.
 - 5. Where control devices are located in a corrosive environment and are not corrosive resistant from manufacturer, field install products in a NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

3.03 ELECTRIC POWER

- A. All electrical wiring for the control system shall be as specified in the Electrical Section of the Specifications and as required by local codes. The wiring shall be by this contractor. This contractor shall coordinate all power and voltage requirements.
- B. Furnish and install electrical power to products requiring electrical connections.
- C. Furnish and install circuit breakers. Comply with requirements in the electrical specifications.
- D. Furnish and install power wiring. Comply with requirements in the electrical specifications.
- E. Furnish and install raceways. Comply with requirements in the electrical specifications.

3.04 CONTROL VALVES

- A. Install pipe reducers for valves smaller than line size. Position reducers as close to valve as possible but at distance to avoid interference and impact to performance. Install with manufacturer recommended clearance.
- B. Install flanges or unions to allow drop-in and -out valve installation.
- C. Where indicated, install control valve with three-valve bypass manifold to allow for control valve isolation and removal without interrupting system flow by providing manual throttling valve in bypass pipe.
- D. Install drain valves in piping upstream and downstream of each control valve installed in a three-valve manifold and for each control valve larger than NPS 2-inch.
- E. Install pressure temperature taps in piping upstream and downstream of each control valve larger than NPS 1-inch.

- F. Valve Orientation:
 - 1. Where possible, install globe and ball valves installed in horizontal piping with stems upright and not more than 15 degrees off of vertical, not inverted.
 - 2. Install valves in a position to allow full stem movement.
 - 3. Where possible, install butterfly valves that are installed in horizontal piping with stems in horizontal position and with low point of disc opening with direction of flow.
- G. Clearance:
 - 1. Locate valves for easy access and provide separate support of valves that cannot be handled by service personnel without hoisting mechanism.
 - 2. Install valves with at least 12 inches of clear space around valve and between valves and adjacent surfaces.
- H. Threaded Valves:
 - 1. Note internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
 - 2. Align threads at point of assembly.
 - 3. Apply thread compound to external pipe threads, except where dry seal threading is specified.
 - 4. Assemble joint, wrench tight. Apply wrench on valve end as pipe is being threaded.
- I. Flanged Valves:
 - 1. Align flange surfaces parallel.
 - 2. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- J. Connect electrical devices and components to electrical grounding system. Comply with requirements in the electrical specifications.
- K. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in the electrical specifications.
- L. Install engraved phenolic nameplate with valve identification on valve.

3.05 CHECKOUT PROCEDURES

- A. Control Valve Checkout:
 - 1. Check installed products before continuity tests, leak tests, and calibration.
 - 2. Check valves for proper location and accessibility.
 - 3. Check valves for proper installation for direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
 - 4. Verify that control valves are installed correctly for flow direction.
 - 5. Verify that valve body attachment is properly secured and sealed.
 - 6. Verify that valve actuator and linkage attachment are secure.
 - 7. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
 - 8. Verify that valve ball, disc, and plug travel are unobstructed.
 - 9. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

3.06 ADJUSTMENT, CALIBRATION, AND TESTING

- A. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.
- B. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed, and 100 percent open

- at proper air pressures.
- C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.
- D. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

END OF SECTION

SECTION 23 09 33 - AUTOMATIC TEMPERATURE CONTROL**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 23 05 00 for requirements which are applicable to this section.
- B. Refer to International Mechanical Code.
- C. Refer to National Electrical Code.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to install a complete, functioning, Automatic Temperature Control (ATC) system.
- B. Power wiring will be provided under the Electrical portion of the work.
- C. Control wiring shall be furnished under this portion of the work. Control wiring is line voltage or low voltage if it performs as control wiring. Power for operation of valves and dampers is considered control wiring.
- D. ATC contractor to arrange for power for control equipment with electrical contractor. Allow for compensation to the electrical contractor to install a power source which may be required.
- E. The mechanical contractor shall be responsible for the complete coordination of all parts of the ATC system whether they be part of packaged control systems within units or built up systems by ATC providers. It is the intent that all systems and subsystems to be coordinated and to be provided to produce the following sequences described in this specification.
- F. All control wiring shall be CAT 6 plenum rated. All control wiring shall run concealed in finished spaces. Control wiring to be in conduit in exposed interior unfinished areas and where subject to damage. All exterior exposed control wiring to be in conduit and weather protected. Conduit to be (EMT, galvanized steel). No pvc piping is permitted in plenums.
- G. Exposed control wiring in interior finished spaces;
 - 1. Control wiring to run in Wiremold V500 series. (steel raceway, 3/4") and associated fittings.
 - 2. Finish to be selected by architect.
 - 3. Contractor to coordinate all final Wiremold run locations and layout with architect/engineer for approval prior to ordering and rough-in.
- H. ATC contractor to be present at equipment/system start-up and verify that all wiring and components are installed correctly and the equipment/system sequence of operation is operating as designed. ATC contractor to perform final calibrations of all devices and equipment. ATC contractor to make all the required corrections if the equipment/system does not operate correctly.
- I. ATC contractor to coordinate with the test, balancing, and adjusting (TBA) contractor prior to performing equipment/systems tests that all air and hydronic systems have been tested and balanced.

1.03 SUBMITTALS

- A. Submit shop drawings of all components.
- B. Submit manufacturers' data sheets of valve Cv performance.
- C. Submit design data and sequence of operations descriptions for all systems.
- D. Submit wiring diagrams of electrical or electronic control systems.
- E. At the completion of the project, submit final "as-built" drawings/CAD disk, all associated

component/equipment cut-sheets/submittals, wiring diagrams, and final/actual sequence of operations descriptions of each system. Include ATC emergency contact information.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Work shall be performed by skilled tradesmen normally engaged in the control systems trade.

PART 2 - PRODUCTS

2.01 CONTROL DEVICES - GENERAL

- A. All control devices and products used in the control system shall be first-line products, manufactured for the application as used.
- B. All thermostats shall have guards. Thermostat guards shall be plastic or metal covers to prevent tampering with the instrument. Provide substantial, locked, opaque cover, hinged to a base which is secured to the wall, not to the thermostat base.
- C. Control valves for fluids shall be two-position (On-Off), modulating two-position, three-way, or modulating three-way (mixing or diverter), as required for the application. Modulating valves shall be selected with the proper flow characteristics to allow control of the flow over as wide a range as is possible with a reasonable maximum pressure drop (7 ft.) of water unless noted otherwise.

2.02 ECONOMIZER

- A. HVAC units shall be provided with economizer controls where indicated on the drawings or elsewhere in these specifications or on any system 4 tons or over. Enthalpy selection system shall consist of one enthalpy transmitter in the outside air, one enthalpy transmitter in the return air, and a relay to select the lower of the two enthalpies. In operation, the signal from the two enthalpy transmitters shall be compared by the differential switching relay so that when the outside air enthalpy is lower than the return air enthalpy, the temperature control system shall modulate the outside, return, and relief dampers to supply up to 100% outside air for "free cooling". When the outside air enthalpy is higher than the return air, the system shall position to minimum outside air. The use of separate temperature and humidity transmitters to arrive at enthalpy is not acceptable. Outside air transmitter shall not be damaged by operation during fog conditions.
- B. The economizer module shall be ASHRAE 90.1 compliant (latest version).
- C. The module shall have a local display screen for diagnostics at the unit.
- D. On projects with building automation systems the economizer shall have a BACNET output and shall be interconnected to the building automation system.
- E. The module shall have fault detection diagnostics.
- F. Manufacturer: Belimo Zip Economizer series. Equal by Honeywell.

2.03 CONTROL DEVICES - ELECTRICAL

- A. All electrical wiring for the control system shall be as specified in this section and the Electrical Section of the Specifications and as required by local codes. The wiring shall be by this contractor.
- B. Electric thermostats shall be low-voltage, modulating type to control modulating devices, or low- or line-voltage type with heat anticipator for two-position controls. Provide locking covers (clear plastic, hinged type).
- C. Where noted on the equipment schedules, thermostats to be 24hr./7 day programmable type, auto

changeover type, +/-3 degree adjustment capability (when integrated with building automation system), WIFI capability. Manufacturer: Honeywell. Provide locking cover (clear plastic, hinged type).

2.04 ACCEPTABLE MANUFACTURERS

- A. Control equipment shall be manufactured by a company regularly engaged in production of this type of equipment, as shown on the drawings, or equivalent equipment by Honeywell, Johnson Controls, Alerton, Schneider Electric, Delta, or prior approved equals.

2.05 DAMPER AND VALVE ACTUATORS

- A. All damper actuators (motors) installed in conjunction with an Air Handler/HVAC unit must be of the spring return, 2 position, occupied/unoccupied type, or modulating where an economizer cycle is required.
- B. Combustion air damper actuators shall be of the 2 position, spring return type.

2.06 RELAYS AND SIGNAL TRANSMITTERS

- A. All necessary relays, contacts, and interface devices shall be furnished to make the system a full and operable system.

2.07 CONTROL VALVES

- A. Hot water control valves shall be of the two-way or three-way, type as indicated with modulating plug, and spring return. Three-point floating type modulation, 0-10vdc or 4-20madc are acceptable. All heating valves shall fail to the open position upon a loss of power.
- B. Modulating valves shall be selected with the proper flow characteristics to allow control of the flow over as wide a range as is possible with a reasonable maximum pressure drop (7 ft) of water unless noted otherwise.
- C. Valves are to be manufactured by Honeywell, Johnson Controls, Powers, Barber Colman or approved equal.

2.08 DUCT SMOKE DETECTORS

- A. Duct smoke detectors shall be of the photo-electronic type with sampling tube of ample length to traverse the entire width of the duct. Duct smoke detectors shall be manufactured by the control companies, the fire alarm companies, B.R.K. Electronics or approved equal. All HVAC units of 2000 CFM or more shall have duct smoke detectors in both the supply and return air streams. A single duct smoke detection in the return air stream shall be provided only when acceptable to the local authority having jurisdiction.
- B. Duct smoke detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
- C. Units of 15,000 CFM or more shall have two detectors. (supply and return air)
- D. Furnish and install where indicated on the drawings or required elsewhere in the specifications air duct smoke detectors. They shall integrate photoelectric, ionization and heat sensing technologies for optimum detection accuracy and to prevent unwanted alarms. Auxiliary contacts shall be provided to shut down the air handling unit fan. The detector shall output to a remote alarm indicator.
- E. Duct smoke detectors to be furnished by the electrical contractor.
- F. Duct smoke detectors shall be installed by the mechanical contractor.
- G. Interconnection between the duct smoke detectors and fire alarm system shall be performed by the electrical contractor/fire alarm contractor.

- H. Control's integration to shut down the HVAC equipment in alarm shall be performed by the mechanical contractor/ATC contractor.

2.09 FREEZESTATS

- A. The freezestat shall be of the vapor pressure type with a 20 foot minimum element. Element shall respond to the lowest temperature sensed by any one foot section.
- B. The freezestat shall be manual reset. Provide reset button and red indicator light. Location to be coordinated with architect.
- C. All coils (heating hot water, chilled water, condenser water/water source) with outside air and hot water in ducts or units shall have freezestats.

2.10 MOTOR OPERATED DAMPERS

- A. The motor operated dampers shall be of the parallel blade type for all 2-position applications such as the combustion air dampers and of the opposed blade type for all modulating applications including the outside air dampers for the heating, air conditioning, and ventilating units.
- B. The damper frames shall be extruded aluminum not less than, 08" thick, thermally broken, roll-formed channel with prepunched slotted mounting holes. The damper blades shall be extruded aluminum insulated R-2.29.
- C. Bearings shall be composed of a Celcon inner bearing with aluminum hexagon blade pivot pin, rotating within a poly carbonate outer bearing inserted in the frame. The dampers shall be equal to Tamco series 9000 ECT for parallel blade dampers and for opposed blade dampers.
- D. Dampers shall have a closed leakage rate of not more than 1.4 CFM per sq. ft. for 3'x3' damper at 1" S.P leakage class 1A.

2.11 DIFFERENTIAL PRESSURE SWITCH

- A. Differential pressure switches shall have adjustable set point and differential and be of the automatic reset, snap acting type as manufactured by Honeywell or approved equal.
- B. +/- 5% accuracy, -1 to +1" P.G.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All control equipment shall be installed as recommended by the manufacturer and as required for service in the field. No equipment shall be concealed or covered by other equipment unless adequate provisions are made for service and replacement.
- B. All wiring shall be run in neat, straight lines to present a finished appearance. Multiple runs shall be supported on brackets and spaced to give access to each line. Any work not neatly installed shall be removed and replaced.
- C. All wires shall be color-coded and numbered on both ends of each conductor for easy identification. Colors and numbers shall not change in the middle of a run, unless an accessible junction box is provided. Provide numbered terminal strips in all control panels.
- D. Wiring diagrams shall be prepared for all electrical connections, showing the actual wire number and terminal identification as installed. No less than three copies of such diagrams shall be delivered to the engineer as-built drawings.
- E. Installation of all equipment shall be made by qualified mechanics familiar with control systems,

forces involved, and their operation.

- F. All connections shall be made by technicians who are familiar with the operation of the equipment and the intent of the control designer.
- G. After all equipment is mounted and connected, the control engineer shall inspect the system and verify the correct operation and connection of all equipment. Any equipment found to be installed improperly or connected incorrectly shall be changed as required. After the system is installed correctly, all instruments shall be calibrated and set points fixed at the correct setting.

3.02 TESTING/TRAINING

- A. At the time of final review, the control contractor shall instruct the owner in the proper operation and maintenance of the system as installed and demonstrate how the system is designed to perform.
- B. At completion of the training, the contractor shall submit a letter stating the owner has received proper training, date, time, and location of training and name of the trainee.
- C. Any system found to be out of calibration or functioning improperly at this time shall be corrected immediately and the correct functions of the entire system demonstrated to the satisfaction of the engineer.
- D. The ATC contractor shall provide two (2 hour) training sessions for systems orientation, product maintenance, trouble shooting, and emergency contacts. ATC contractor to coordinate with owner/architect/engineer to determine representatives/designated staff to be present for the training. ATC contractor to provide one training session during the heating (winter) season and one during the cooling (summer) season.

3.03 WARRANTY PERIOD SERVICES

- A. Equipment, materials, and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance by owner.
- B. Within this period, upon notice by the Owner, any defects in the BAS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the ATC Contractor at no expense to the Owner.
- C. The ATC Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The ATC Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work and description of the corrective actions taken. The report shall clearly certify that all systems/equipment are functioning correctly.
- D. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.
- E. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

PART 4 - SEQUENCE OF OPERATIONS

4.01 GENERAL NOTES

- A. The mechanical contractor shall retain the existing ATC sub-contractor (insert ATC contractor name here) to furnish all labor, materials, equipment, and service necessary for a complete and operating BAS, utilizing direct digital controls as shown on the drawings and described herein. The existing building BAS shall be connected to this building and provide standalone access using a standard web browser; HVAC system control, energy management, alarming, monitoring, trending and reporting functions with operator interface. The BAS shall include a web-based operator interface

depict each mechanical system and building floor plan by a point-and-click graphic. The web server shall reside on the building owner's network and shall be provided with an IP address by the owner. The web server shall gather data from the mechanical systems and generate web pages accessible through a conventional web browser on each pc connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

B. The BAS system shall provide:

1. Stand-alone independent control for all mechanical systems as described in the sections that follow.
2. Complete energy management software and firmware that resides and executes in networked field controllers. Operator workstation software shall not be utilized for energy management execution.
3. Alarm management capability for all mechanical equipment described in the sections that follow – including alarm occurrence, annunciation, remote dial-out to remote sites or pagers, acknowledgement, problem diagnostics, and reporting functions.
4. Complete password protected system monitoring through a local networked operator workstation, or through remote operator workstations. Remote workstations shall utilize telephone or internet or ethernet communications links, as required.
5. Standard and customized manual or automatic reports of trends, runtimes, consumables, alarms, and system operator activities.
6. The Mechanical Contractor shall submit equipment submittals of all mechanical equipment to the ATC Contractor for review prior to ordering the equipment.
7. BAS web controller and main control panel shall be connected to 120v emergency power provided by the electrical contractor.
8. All ATC wiring, components and installation shall comply with the national electric code.
9. ATC contractor shall utilize low voltage conductors (solid or stranded) of the appropriate gauge and approved by the thermostat manufacturer.

4.02 INDOOR VAV AIR HANDLING UNITS WITH CHILLED WATER COOLING AND HOT WATER PRE-HEAT

A. General

1. Air handling unit shall be provided with an open protocol BACNET controller.
2. ATC contractor shall provide, install and wire the duct mounted pressure sensors for VFD operation.
3. A duct mounted temperature sensor shall be shipped loose and field mounted in the supply ductwork to control the heating and cooling cycles of the unit.
4. The unit shall be provided with outside air temperature, outside air dew point, "proof of flow" air flow and dirty filter sensors.
5. ATC contractor shall provide, install and wire the chilled water and hot water pre-heat motorized two-way valves.
6. Occupied/unoccupied shall be determined by the BAS time clock.
7. The ATC contractor shall furnish and install a freezestat.

B. Operation

1. The supply fan shall operate continuously in occupied hours and cycle in unoccupied hours/evening hours. The supply fan shall operate continuously and the supply fan VFD shall vary the fan speed in response to a signal from the supply duct mounted pressure sensor.
2. Ventilation air - during occupied hours, the outside air damper shall be open. During the evening hours and unoccupied hours, the outside air damper shall be closed unless unoccupied cooling can be achieved via economizer.
3. Air-side economizer - when the outside air temperature is lower than the space air temperature and the outside air dewpoint temperature is below 55°F, the unit shall operate in 100% outside air mode with no mechanical cooling. ATC contractor to integrate remote relief

- air controls.
4. Cooling - on a call for cooling, the chilled water coil shall maintain a minimum 55°F (adj.) Leaving air temperature with the outside air damper in the minimum position to satisfy the space cooling requirements. The supply air temperature can be reset to 65°F max if all cooling loads are satisfied.
 5. Heating - on a call for heating, the control valves on the hot water pre-heat coil shall modulate to maintain 55°F (adj.) Leaving air temperature with the outside air damper in the minimum position to satisfy the space heating requirements. If all spaces are satisfied for cooling, the heating supply air temperature shall be reset to 65°F max.
 6. "morning warm-up" mode
 - a. The supply fan shall operate continuously and the outside air damper shall be closed.
 - b. The BAS shall command all of the VAV boxes to fully open their inlet damper and the control valves on the hot water pre-heat coil shall modulate to raise the building space temperature to 70°F (adj.).
 - c. The outdoor air temperature sensor shall anticipate the warm-up start time to achieve occupied temperatures at opening.
 7. Provide a duct smoke detector in each unit 2,000 CFM or over in the return air connection and in the supply air ductwork.
 8. Fire alarm shutdown – If the duct smoke detectors sense smoke, then any combination fire/smoke dampers shall close and the associated unit shall be de-energized. The unit shall not be permitted to operate until all trouble signals are cleared on the fire alarm system.
 9. The freezestat shall be wired with the fan starter. Whenever the air temperature upstream of the coils is 36°F, the fan shall stop, the outside air damper shall close and the chilled water and heating water valves shall open. A manual reset shall return the unit to normal operation.
 10. Integrate with the BAS.

4.03 EXISTING HEATING HOT WATER CHILLED WATER SYSTEM PLANT

- A. The existing heating hot water system plant shall continue to operate under its current sequence.

4.04 DUAL TEMPERATURE SYSTEM CHANGE - OVER

- A. Furnish and install three-way control valves in the dual temperature supply and return piping which shall switch over dual temp water to circulate through the chiller or the convertor. Valves shall be two position.
- B. Change-over from heating to cooling: Switchover shall occur from a manual (automatic) summer-winter switch at the Boiler Room ATC panel.
- C. Change-over from heating to cooling: Provide a water temperature aquastat to monitor water temperature and to prevent flow to the chiller at temperatures above 85°F.
- D. Integrate with the BAS.

4.05 FAN/COIL UNITS - HEATING AND COOLING

- A. General:
 1. Fan coils shall be provided with an open protocol BACNET controller, 24V temperature controller, circuit setter and motorized control valves on the return piping.
 2. Each unit shall be provided with a wall mounted temperature sensor with slide adjustment and local override.
 3. Each unit shall be provided with a wire condensate overflow switch.
 4. Each unit shall be provided with motorized control valves. ATC contractor shall wire valves to the fan coil controller.

5. If the unit receives untempered outside air, it shall be provided with a freezestat.
6. Provide duct mounted smoke detector on the return, for units over 2,000 CFM.

B. Operation

1. The supply fan shall cycle.
2. Cooling: The fan coil controller shall modulate the chilled water 3-way (2-way) valve to maintain 72°F. (adj.)
3. Heating - on a call for heating, the unit shall modulate the heating hot water two or three-way valve to maintain 70°F. (adj.) In the apartment.
4. The condensate overflow switch mounted in the coil drain pan shall disable the unit whenever moisture is sensed. Fan coil unit must be manually restarted.
5. Fire alarm shutdown – If the duct smoke detectors sense smoke, then any combination fire/smoke dampers shall close and the associated unit shall be de-energized. The unit shall not be permitted to operate until all trouble signals are cleared on the fire alarm system.
6. The freezestat shall be wired with the fan starter. Whenever the air temperature upstream of the coils is 36°F, the fan shall stop, the outside air damper shall close and the chilled water valve shall open. A manual reset shall return the unit to normal operation.
7. Integrate with the BAS.

4.06 DUCTLESS SPLIT SYSTEM

A. General

1. The indoor unit shall be furnished with a wireless, wall mounted programmable 24 hr./7-day thermostat. ATC contractor shall install and wire thermostat.
2. ATC contractor shall wire outdoor unit to the indoor unit.
3. The unit shall include a low ambient kit. ATC contractor shall wire the outside air temperature sensor.
4. The units shall be circuited to standby power.
5. Ductless split system to be furnished with a BACNET network card.
6. Integrate with the BAS.

B. Operation

1. Cooling - on a call for cooling, the indoor unit shall operate to maintain 72°F (adj.) In the space.
2. Heating - on a call for heating, the indoor unit shall operate to maintain 60°F (adj.) In the space.

C. Integrate with the BAS.

4.07 EXHAUST FANS

A. General:

1. Fan status (on/off) and start/stop points shall be shown on the BAS workstation.
2. 0-10V speed controllers shall be furnished with each exhaust fan listed in the equipment schedule for balancing purposes.

B. Operation:

1. EF-X (bathroom) - the fan shall operate continuously during occupied hours at the low speed setting. When activated by the wall switch, the fan shall index to the higher speed to achieve the maximum airflow rate.
2. TF-1 (AV Booth Transfer Fan) - the fan shall operate when the space temperature rises above 85°F (adj.). An alarm signal shall be sent to the BAS if the room temperature exceeds 95°F.

C. Refer to exhaust fan schedule for specific controls descriptions.

D. Integrate with the BAS.

4.08 SMOKE DAMPERS (SD) AND COMBINATION FIRE/SMOKE DAMPERS (FSD)

- A. Smoke dampers (SD) and combination fire/smoke dampers (FSD) shall be furnished by the mechanical contractor and installed by the mechanical contractor (or sheet metal sub-contractor). The electrical contractor shall provide 120V power to all smoke dampers and combination fire/smoke dampers (refer to electrical drawings). The fire alarm sub-contractor shall wire the smoke damper or combination fire/ smoke damper to the digital addressable fire alarm system.
- B. Refer to cover sheet or equipment schedules for smoke damper and combination fire/smoke damper specification. Smoke dampers and combination fire/smoke dampers shall be power open, spring closed type (fail closed).
- C. Smoke dampers and combination fire/smoke dampers shall be furnished with open / closed blade indication module (OCI). The fire alarm sub-contractor shall wire the OCI module to the addressable fire alarm system.
- D. Addressable duct mounted smoke detectors or full area smoke detection shall be provided for each smoke damper and combination fire/smoke damper in accordance with international mechanical code section 607.3.3.
- E. The addressable duct mounted smoke detectors shall be furnished by the fire alarm sub-contractor, mounted by the mechanical contractor (or sheet metal sub-contractor) and wired to the addressable fire alarm system by the fire alarm sub-contractor.
- F. Do not integrate with the BAS.

4.09 UNIT HEATERS - HOT WATER

- A. General - Refer to equipment schedule additional information.
- B. Provide a wall mounted (or integral) thermostat which shall start and stop the unit heater to maintain space temperatures. Fan shall start and stop and control valve 2-way shall modulate open/closed to maintain space temperature.
- C. Unit heaters in public areas such as stair towers, lobbies and vestibules shall be furnished with integral tamperproof unit mounted thermostats.
- D. Unit heaters in mechanical rooms, electrical rooms and other back-of-house areas shall be furnished with wall mounted thermostats unless noted otherwise.
- E. Do not integrate with the BAS.

4.10 CONVECTORS, CABINET UNIT HEATERS, EXTENDED FIN RADIATION - HOT WATER

- A. General - Refer to equipment schedule for additional information.
- B. Furnish and install a wall mounted thermostat which shall gradually modulate a two-way or three-way control valve to pass more or less hot water through the heating element to maintain space temperatures.
- C. Baseboard/extended fan radiation heaters, wall convectors and cabinet unit heaters in stair towers, lobbies and vestibules shall be furnished with integral tamperproof unit mounted thermostats.
- D. Do not integrate with the BAS.

4.11 FREEZESTATS

- A. All units with chilled water or heating hot water coils within the units or duct mounted heating hot water coils shall have averaging freezestats on the leaving side of the water coil.
- B. Whenever the air temperature upstream of the water coil is 36°F, the fan shall stop, the outside air damper shall close, the return air damper (if required) shall fully open, and the water valves shall open. A manual reset shall return the unit to normal operation.
- C. The unit shall be de-energized, the outside air damper shall close, the return air damper (if required) shall fully open, and the hot water control valve shall fully open, if the freezestat falls below 36°F

(adj) degrees.

- D. Integrate with the BAS.

4.12 DUCT MOUNTED SMOKE DETECTORS

- A. In air systems with a capacity greater than 2,000 CFM, furnish and install duct mounted smoke detectors in the supply air (downstream the air filters and upstream of any branch duct) and return air ductwork.
- B. The fire alarm sub-contractor shall furnish a fire alarm monitoring module for each required air handling system. The ATC Contractor shall wire the fire alarm monitoring module to the emergency shutdown contacts or combination motor starter/disconnect on each air handling system.
- C. Detectors shall de-energize the unit and signal the addressable fire alarm system if smoke is detected.
- D. Detectors shall be accessible. Mechanical contractor shall be responsible for providing all necessary access panels and doors.
- E. Duct smoke detectors to be furnished by the Electrical/ Mechanical Contractor.
- F. Integrate with the BAS.

4.13 SPACE HIGH TEMPERATURE AND HIGH HUMIDITY SENSORS/ALARMS

- A. Furnish and install wall mounted high temperature and high humidity sensors in the spaces where indicated on the drawings. An alarm shall be sent to the BAS when limits exceed setpoint settings.
- B. Integrate the sensors and alarms with the Building BAS.
- C. Integrate with the BAS.

4.14 VARIABLE FREQUENCY DRIVES

- A. Application: Heating hot water pump (s), chilled water pump (s) and dual temperature pump (s).
- B. Refer to the variable frequency drive specifications for additional information and points.
- C. Control points as a minimum.
 - 1. VFD Speed (H2)
 - 2. VFD Amps
 - 3. VFD RPM
 - 4. Run time (hrs.)
 - 5. Drive Temperature.
 - 6. Drive Command
 - 7. Current Amps.
 - 8. KW
 - 9. Alarms/faults
 - 10. Emergency override stats.
 - 11. Hand/Off/Auto Status.
- D. Integrate with the BAS.
- E. ATC Contractor to provide Modbus interface.

END OF SECTION

SECTION 23 21 13 - HYDRONIC PIPING**PART 1 - GENERAL****1.01 SUMMARY****A. Section includes pipe and fitting materials and joining methods for the following:**

1. Steel pipe and fittings.
2. Joining materials.
3. Transition fittings.
4. Dielectric fittings.

1.02 ACTION SUBMITTALS**A. Product Data: For each type of the following:**

1. Pipe.
2. Fittings.
3. Joining materials.
4. Bypass chemical feeder.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Environmental Product Declaration: For each product.

C. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
4. Locations of and details for penetration and firestopping for fire and smoke rated wall and floor and ceiling assemblies.

1.03 INFORMATIONAL SUBMITTALS**A. Field quality-control reports.****1.04 QUALITY ASSURANCE****A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.****PART 2 - PRODUCTS****2.01 PERFORMANCE REQUIREMENTS**

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Hot-Water Heating Piping: 100 psig at 200 deg. F.
 - 2. Chilled-Water Piping: 150 psig 73 deg. F.
 - 3. Makeup-Water Piping: 150 psig at 73 deg. F.
 - 4. Air-Vent Piping: 200 deg. F.
 - 5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.02 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Victaulic Company.
 - 2. Grooved-End Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze casting.
 - 3. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg. F for use with housing, and steel bolts and nuts.
- E. Wrought-Copper Unions: ASME B16.22.

2.03 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- G. Grooved Mechanical-Joint Fittings and Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Victaulic Company.
 - 2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-

- end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and EPDM gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2.04 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
- a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
- b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.05 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Charlotte Pipe and Foundry Company.
- b. IPEX USA LLC.
- c. KBI (King Bros. Industries).
- d. Viega LLC.
2. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.
- B. Plastic-to-Metal Transition Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Charlotte Pipe and Foundry Company.
- b. IPEX USA LLC.
- c. KBI (King Bros. Industries).
- d. NIBCO INC.
2. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.06 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. A.Y. McDonald Mfg. Co.
- b. Capitol Manufacturing Company.
- c. Central Plastics Company.
- d. HART Industrial Unions, LLC.
- e. Jomar Valve.
- f. Matco-Norca.
- g. Watts; a Watts Water Technologies company.
- h. Wilkins.
- i. Zurn Industries, LLC.
- 2. 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

3.01 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2-inch and smaller, shall be one of the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 - 2. Schedule 40 steel pipe, Grade B, ASTM 53, Seamless; Class 125, cast-iron fittings; screwed fittings.
- B. Hot-water heating piping, aboveground, NPS 2 ½ -inch and larger, shall be the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 - 2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- C. Hot-Water Heating Piping Installed Belowground and within Slabs: Type K, annealed-temper copper tubing, wrought-copper fittings, and brazed joints. Use the fewest possible joints.
- D. Chilled-water piping, aboveground, NPS 2-inch and smaller, shall be one of the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and [soldered] [brazed] [pressure-seal] joints.
 - 2. Schedule 40 steel pipe, Grade B, ASTM 53, Seamless; Class 125, cast-iron fittings; screwed fittings.
- E. Chilled-water piping, aboveground, NPS 2 ½ -inch and larger, shall be one of the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and [soldered] [brazed] joints.
 - 2. Schedule 40 steel pipe, Grade B, ASTM 53, Seamless; Class 125, cast-iron fittings; cast-iron flanges and flange fittings.
- F. Chilled-Water Piping Installed Belowground and within Slabs: Type K, annealed-temper copper tubing, wrought-copper fittings, and brazed joints. Use the fewest possible joints.
- G. AC Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- H. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- I. Air-Vent Piping:
 - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
 - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- J. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition

fittings for plastic piping systems according to piping manufacturer's written instructions.

3.02 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4-inch ball valve, and short NPS 3/4-inch threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to the following:
 - 1. Section 230523.12 "Ball Valves for HVAC Piping."
 - 2. Section 230523.13 "Butterfly Valves for HVAC Piping."
 - 3. Section 230523.14 "Check Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2-inch and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2 ½ -inch and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.
- T. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- U. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- V. 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."
- W. 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."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."
- Y. Piping shall not be installed over electrical panels, equipment, transformers, motor control centers, switch, gear, or substations. If absolutely necessary piping may be sleeved to prevent water from falling on electrical gear provided the installation is acceptable to the electrical inspectors and shall be approved by the engineer prior to installation.
- Z. Allow clearances for expansion and contraction. Provide swing ells at connection points so as not to strain piping systems.

- AA. Exposed insulated risers shall be covered with 22 gauge galvanized steel sleeves from floor to ceiling.
- BB. All piping shall be installed on the interior conditioned side of the building insulation.
- CC. Piping shall not be insulated until it is pressure and leak tested and until the building is closed in.

3.03 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2-inch and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2 ½ -inch to NPS 4-inch: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5-inch and Larger: Use dielectric flange kits.

3.04 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS ¾-inch: Maximum span, 7 feet.
 - 2. NPS 1-inch: Maximum span, 7 feet.
 - 3. NPS 1 ½ -inch: Maximum span, 9 feet.
 - 4. NPS 2-inch: Maximum span, 10 feet.
 - 5. NPS 2 ½ -inch: Maximum span, 11 feet.
 - 6. NPS 3-inch and Larger: Maximum span, 12 feet.
- E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS ¾ -inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. NPS 1-inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. NPS 1 ¼ -inch: Maximum span, 6 feet; minimum rod size, 3/8 inch.
 - 4. NPS 1 ½ -inch: Maximum span, 6 feet; minimum rod size, 3/8 inch.
 - 5. NPS 2 -inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 6. NPS 2 ½ -inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 7. NPS 3-inch and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.05 PIPE 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 pipe and fittings before assembly.

- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- I. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.06 WELDING

- A. All concealed black steel piping shall be fusion welded.
- B. Welding shall be performed in conformance with the ASME Boiler and Pressure Vessel Code Section IX.
- C. Elbows, tees, and branch connections shall be made with welding fittings ANSI B16.9.
- D. Furnish welder test certificates for review. Certificates of successful welder qualification by the following organizations shall be acceptable;
 - ASME Boiler and Pressure Vessel Code
 - ANSI Code for Pressure Piping
 - National Certified Pipe Welding Bureau
 - Military Specification MIL-STD-248.
- E. Weld-o-lets and Thread-o-lets are allowed but shall be a maximum of one size smaller than line size, i.e., a maximum of a 3 inch weld-o-let on a 4 inch pipe.

3.07 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

3.08 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Isolate expansion tanks and determine that hydronic system is full of water.
 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Set makeup pressure-reducing valves for required system pressure.
 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
 7. Verify lubrication of motors and bearings.

END OF SECTION

SECTION 23 21 16 - HYDRONIC PIPING SPECIALTIES**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes special-duty valves and specialties for the following:
 - 1. Hydronic specialty valves.
 - 2. Air-control devices.
 - 3. Strainers.
 - 4. Connectors.
- B. Related Requirements:
 - 1. Section 230523.12 "Ball Valves for HVAC Piping" for specification and installation requirements for ball valves common to most piping systems.
 - 2. Section 230523.13 "Butterfly Valves for HVAC Piping" for specification and installation requirements for butterfly valves common to most piping systems.
 - 3. Section 230523.14 "Check Valves for HVAC Piping" for specification and installation requirements for check valves common to most piping systems.
 - 4. Section 230923.11 "Control Valves" for automatic control valve and sensor specifications, installation requirements, and locations.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Hydronic Specialty Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow control valves.
 - 2. Air-control devices.
 - 3. Strainers
 - 4. Connectors.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division.

PART 2 - PRODUCTS**2.01 HYDRONIC SPECIALTY VALVES**

- A. Plastic Ball Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.

- b. Asahi/America.
 - c. Charlotte Pipe and Foundry Company.
 - d. Colonial Engineering, Inc.
 - e. Georg Fischer Inc.
 - f. Hayward Flow Control.
 - g. IPEX USA LLC.
 - h. Jomar Valve.
 - i. KBI (King Bros. Industries).
 - j. Legend Valve & Fitting, Inc.
 - k. NIBCO INC.
 - l. Plast-O-Matic Valves, Inc.
 - m. SMC The Specialty Mfg. Co.
 - n. Thermoplastic Valves, Inc.
 - o. Watts; a Watts Water Technologies company.
 - 2. Body: Two-, or three-piece CPVC or PVC to match piping.
 - 3. Ball: Full-port CPVC or PVC to match piping.
 - 4. Seats: PTFE.
 - 5. Seals: EPDM.
 - 6. End Connections: Socket, union, or flanged.
 - 7. Handle Style: Tee shape.
 - 8. CWP Rating: Equal to piping service.
 - 9. Maximum Operating Temperature: Equal to piping service.
 - 10. Comply with MSS SP-122.
- B. Plastic Butterfly Valves:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Asahi/America.
 - c. Colonial Engineering, Inc.
 - d. Georg Fischer Inc.
 - e. Hayward Flow Control.
 - f. IPEX USA LLC.
 - g. Legend Valve & Fitting, Inc.
 - h. NIBCO INC.
 - i. Plast-O-Matic Valves, Inc.
 - j. SMC The Specialty Mfg. Co.
 - k. Thermoplastic Valves, Inc.
 - l. Watts; a Watts Water Technologies company.
 - 2. Body: PVC or CPVC to match piping wafer type for installation between flanges.
 - 3. Disc: EPDM-coated steel.
 - 4. Seats: PTFE.
 - 5. Handle Style: Locking lever.
 - 6. CWP Rating: Equal to piping service.
 - 7. Maximum Operating Temperature: Equal to piping service.
- C. Plastic Check Valves:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Asahi/America.
 - c. Colonial Engineering, Inc.
 - d. Georg Fischer Inc.
 - e. Hayward Flow Control.

- f. IPEX USA LLC.
 - g. KBI (King Bros. Industries).
 - h. Legend Valve & Fitting, Inc.
 - i. NIBCO INC.
 - j. Plast-O-Matic Valves, Inc.
 - k. SMC The Specialty Mfg. Co.
 - l. Thermoplastic Valves, Inc.
 - m. Watts; a Watts Water Technologies company.
- 2. Body: Two, or three piece PVC or CPVC to match piping.
- 3. Ends: Socket or flanged.
- 4. Seats: PTFE.
- 5. Check Style: Swing or ball type.
- 6. CWP Rating: Equal to piping service.
- 7. Maximum Operating Temperature: Equal to piping service.
- D. Bronze, Calibrated-Orifice, Balancing Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong Pumps, Inc.
 - b. Bell & Gossett; a Xylem brand.
 - c. Flow Design, Inc.
 - d. Grinnell Mechanical Products.
 - e. Griswold Controls.
 - f. Nexus Valve, Inc.
 - g. NuTech Hydronic Specialty Products.
 - h. Taco.
 - i. Tour & Andersson; available through Victaulic Company.
 - j. Victaulic Company.
 - 2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 - 3. Ball: Brass or stainless steel.
 - 4. Plug: Resin.
 - 5. Seat: PTFE.
 - 6. End Connections: Threaded or socket.
 - 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 - 8. Handle Style: Lever, with memory stop to retain set position.
 - 9. CWP Rating: Minimum 125 psig.
 - 10. Maximum Operating Temperature: 250 deg. F.
- E. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Apollo Valves; Conbraco Industries, Inc.
 - c. Armstrong Pumps, Inc.
 - d. Bell & Gossett; a Xylem brand.
 - e. Spence Engineering Company, Inc.
 - f. Watts; a Watts Water Technologies company.
 - 2. Body: Bronze or brass.
 - 3. Disc: Glass and carbon-filled PTFE.
 - 4. Seat: Brass.
 - 5. Stem Seals: EPDM O-rings.
 - 6. Diaphragm: EPT.
 - 7. Low inlet-pressure check valve.
 - 8. Inlet Strainer: Stainless steel removable without system shutdown.

9. Valve Seat and Stem: Noncorrosive.
 10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- F. Diaphragm-Operated Safety Valves: ASME labeled.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Apollo Valves; Conbraco Industries, Inc.
 - c. Armstrong Pumps, Inc.
 - d. Bell & Gossett; a Xylem brand.
 - e. Spence Engineering Company, Inc.
 - f. Watts; a Watts Water Technologies company.
 2. Body: Bronze or brass.
 3. Disc: Glass and carbon-filled PTFE.
 4. Seat: Brass.
 5. Stem Seals: EPDM O-rings.
 6. Diaphragm: EPT.
 7. Wetted, Internal Work Parts: Brass and rubber.
 8. Inlet Strainer: Stainless steel, removable without system shutdown.
 9. Valve Seat and Stem: Noncorrosive.
 10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- G. Automatic Flow-Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Caleffi.
 - b. Flow Design, Inc.
 - c. Griswold Controls.
 - d. Hays Fluid Controls.
 2. Body: Brass or ferrous metal.
 3. Piston and Spring Assembly: Stainless steel tamper proof, self-cleaning, and removable.
 4. Combination Assemblies: Include bronze or brass-alloy ball valve.
 5. Identification Tag: Marked with zone identification, valve number, and flow rate.
 6. Size: Same as pipe in which installed.
 7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
 8. Minimum CWP Rating: 175 psig 300 psig.
 9. Maximum Operating Temperature: 200 deg. F 250 deg. F.

2.02 AIR-CONTROL DEVICES

- A. Manual Air Vents:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett; a Xylem brand.
 - d. Taco, Inc.
 2. Body: Bronze.
 3. Internal Parts: Nonferrous.
 4. Operator: Screwdriver or thumbscrew.

5. Inlet Connection: NPS 1/2-inch.
 6. Discharge Connection: NPS 1/8-inch.
 7. CWP Rating: 150 psig.
 8. Maximum Operating Temperature: 225 deg. F.
 9. Commercial buildings shall have high capacity vents.
- B. Expansion Tanks:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett; a Xylem brand.
 - d. Flo Fab Inc.
 - e. Taco, Inc.
 2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg. F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 3. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg. F maximum operating temperature.
 4. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg. F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
 5. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.
- C. In-Line Air Separators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Armstrong Products, Inc.
 - c. Bell & Gossett; a Xylem brand.
 - d. Spirotherm, Inc.
 - e. Taco, Inc.
 2. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
 3. Maximum Working Pressure: Up to 175 psig.
 4. Maximum Operating Temperature: Up to 300 deg. F.

2.03 STRAINERS

- A. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for NPS 2-inch and smaller; flanged ends for NPS 2 ½ - inch and larger.
 3. Strainer Screen: Stainless-steel, 40 mesh strainer, or perforated stainless-steel basket.
 4. CWP Rating: 125 psig.

2.04 CONNECTORS

- A. Stainless-Steel Bellow, Flexible Connectors:
1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
 2. End Connections: Threaded or flanged to match equipment connected.

3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg. F.

PART 3 - EXECUTION

3.01 VALVE APPLICATIONS

- A. Install shut off-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.02 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
- C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2-inch and larger.
- D. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
 1. Install tank fittings that are shipped loose.
 2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.
- E. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION

SECTION 23 21 23 - PUMPS**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 23 05 00 for requirements which are applicable to this section.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to install and place into operation pumps and piping systems as specified herein and indicated on the drawings.

1.03 SUBMITTALS

- A. Submit shop drawings of pumps.
- B. Submit manufacturers' data sheets for capacities.
- C. Impeller diameter not more than 85% of the casing cutwater diameter.
- D. Factory run and tested with written test report supplied for pumps over 500 GPM.
- E. Submit only specified manufacturers or those added by addenda.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.

PART 2 - PRODUCTS**2.01 BASE MOUNTED HORIZONTAL END SUCTION FLEX CONNECTED PUMPS**

- A. Cast iron, 175 PSI case, bronze fitted, single stage, size and capacity indicated on the drawings, end suction, back pull-out, centrifugal.
- B. Pump internals serviceable without disturbing piping or motor connections.
- C. Enclosed bronze impeller, statically and dynamically balanced, keyed to shaft, locknut secured.
- D. Mechanical stainless steel seal, carbon seal ring, ceramic or ni-resist seat, replaceable bronze shaft sleeve, regreaseable ball bearings, bronze replaceable case wearing rings.
- E. Motor and pump on common baseplate, flexible drive coupling, coupling guard and non-overloading motor.
- F. Pump factory tested, cleaned, enamel coated.
- G. Manufacturers; Aurora, Model 344A or equal by Bell and Gossett, Peerless, Armstrong, provided specs are matched.
- H. Factory startup.

2.02 Split-Coupled Vertical Inline Pumps with Integrated Controls

- A. Furnish and install Armstrong Series 4300 Design Envelope IVS pumps. The pumps shall be single stage, single or double suction type, vertical inline design with integrated controls. The seal shall be

serviceable without disturbing the motor or the piping connections. The capacities and characteristics shall be as outlined in the plans and specifications. The complete pump unit shall be labeled with ETL listing certification that the product conforms to UL Std 778 and is certified to CSA Std C22.2 No.108. Refer to drawings for additional information.

- B. Pump casing shall be constructed of ASTM A48 class 30 cast iron with ANSI 125 / PN16 flanges for working pressure below 175 psig (12 bar) at 150°F (66°C) and ASTM A536 ductile iron with ANSI 250 / PN25 flanges for working pressures to 375 psig (25 bar) at 150°F (66°C). The casing shall be hydrostatically tested to 150% maximum working pressure. The casing shall be radially split to allow removal of the rotating element without disturbing the pipe connections. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line.
- C. The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.
- D. The impeller shall be bronze, fully enclosed type. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. Two-plane balancing is required where installed impeller diameter is less than 6 times the impeller width.
- E. The pump shaft shall be stainless steel.
- F. The coupling is to be rigid spacer type constructed of high tensile aluminum alloy. The coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.
- G. The pump shall be fitted with an outside balanced type mechanical seal, with Viton elastomers and antimony carbon (or resin bonded carbon for potable water applications) vs. silicon carbide faces rated up to 250°F (121°C). A 316 stainless steel gland plate shall be provided with a factory installed flush line with manual vent.
- H. All split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positively cooling and lubrication.
- I. To improve seal chamber cleanliness, supply in the flush line to the mechanical seal a 50 micron cartridge filter and sight flow indicator, to suit the working pressure encountered.
- J. Alternately, supply in the flush line to the mechanical seal a maintenance-free sediment separator, with sight flow indicator for pump differential pressures exceeding 30 psig (or 200 kPa).
- K. The motor frame shall be NEMA TC type. Motor enclosure is to be ODP or TEFC with NEMA Premium Efficiency rating. Acceptable motor insulation for variable speed operation is NEMA MG-1 Part 31.
- L. The variable frequency drive & controls shall be rated UL Type 12 or UL Type 4X and be an integral component of the pumping unit.
- M. The integrated VFD shall be of the VVC-PWM type providing near unity displacement power factor ($\cos \phi$) without the need for external power factor correction capacitors at all loads and speeds. The VFD shall incorporate DC link chokes for the reduction of mains borne harmonic currents and to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime. RFI filters will be fitted as standard to ensure the VFD meets low emission and immunity requirements.
- N. VFD and motor protection shall include: motor phase to phase fault, motor phase to ground fault, loss of supply phase, over voltage, under-voltage, motor over-temperature, inverter overload, and over-current.
- O. Where selected, VFD shall have Sensorless control software to provide automatic speed control in variable volume systems without the need for pump mounted (internal/external) or remotely mounted differential pressure sensor. The default operating mode under Sensorless control shall be Quadratic Pressure Control (QPC) whereby head reduction with reducing flow will be according to a quadratic control curve, the head at minimum flow being 40% of the design duty head. Control mode setting and minimum/maximum head setpoints shall be user adjustable via a built-in programming interface.

- P. If the quantity of pumps in a system is 2 to 4-maximum, including any standby, a Sensorless controller shall be added to a pumping unit and set up at the factory to operate in parallel Sensorless mode. The pump controls, which will be linked on site by the control contractor, will automatically stage the units, as appropriate, to maintain the best efficiency pumping and minimum operating cost. The standby unit will be brought into the rotation to exercise and equalize wear. The sequence of controls and staging points will be submitted to the engineer for approval at the time of order.
- Q. The VFD shall have the following additional features:
1. Sensorless override for BAS/BMS control signal.
 2. Manual pump control or closed loop PID control
 3. Programmable skip frequencies and adjustable switching frequency for noise and vibration control
 4. Auto alarm reset.
 5. Four programmable digital inputs, two analog inputs, one programmable analog / digital output
 6. One volt-free contact
 7. One RS485 port for serial communications to building management systems.
 8. Standard serial communication protocols Modbus RTU (default), Johnson Controls Metasys N2, or Siemens FLN Environmental

2.03 IN-LINE PUMPS

- A. Furnish and install in-line circulating pumps of the size and capacity indicated on the drawings.
- B. Pumps shall be cast iron with stainless shaft and iron impellers.
- C. Motors shall be 1750 RPM with internal overload protection.
- D. Manufacturers; B&G, Aurora, Armstrong, Peerless.

2.04 FLEXIBLE CONNECTORS

- A. Neoprene flanged connectors for 150 lb. ASA drilling, galvanized flanges, neoprene and nylon bellows.
- B. Type MFNC or MFNEC as manufactured by Mason Industries Inc, or equal by Amber/Booth.

2.05 VIBRATION ISOLATING BASES

- A. Steel frame, reinforced for concrete fill, spring mounted.
- B. 6" deep for 1 inch static deflection.
- C. Springs recessed into frame corners.
- D. Manufacturers; Mason Industries Inc, Amber/Booth.

2.06 HORIZONTAL SPLIT-CASE DOUBLE-SUCTION PUMPS

- A. Aurora Model 411 bronze-fitted, horizontal, split-case, double-suction, centrifugal pumps to operate with the capacities, pressures, and RPM as indicated on pump schedule.
- B. Each pump shall be equipped with a heavy cast iron casing having a 250 lb. case working pressure, bronze double-suction impeller, statically and dynamically balanced, bronze case wear rings, (bronze shaft sleeves with mechanical seals) (hardened stainless steel shaft sleeves with packed boxes), grease-lubricated ball bearings with double row thrust bearing housed in integrally-cast bearing support arms, field interchangeability between packing and mechanical seals, and mounted on heavy steel baseplates.
- C. Pumps with packing shall have drilled and tapped connection for piping gland leakage to floor drains. If not available as part of pump design, drain connections must be from drip-rim feature of baseplate.
- D. Pumps shall be driven through flexible coupling with guard by open drip-proof motors having

electrical characteristics as indicated on pump schedule.

- E. The pump manufacturer or his representative shall provide start-up service and maintenance manuals for the building operating maintenance personnel.

2.07 END-SUCTION PUMPS - CLOSE COUPLED

- A. Aurora Model 341A bronze-fitted, end-suction, centrifugal pumps.
- B. Pumps shall be designed for back pull-out for ease of field servicing.
- C. Unit shall be equipped with heavy cast iron casing having a 175 lb. case working pressure, bronze statically and dynamically balanced impeller, bronze case wear ring, mechanical seal with carbon against Ni-resist stationary seat, and 303 stainless steel metallic parts.
- D. Hot water pumps shall be equipped with mechanical seal flush line.
- E. Pumps shall be equipped with bronze shaft sleeves and be driven by open drip-proof motors having horsepower and electrical characteristics as indicated on pump schedule.
- F. The pump manufacturer or his representative shall provide start-up service and maintenance manuals for the building operating maintenance personnel.

PART 3 - EXECUTION

3.01 PUMPS - GENERAL.

- A. Install pump in accordance with pump manufacturer's instructions and the Hydraulic Institute.
- B. Piping shall not generate any load on pump casing.
- C. Pumps shall be mounted on a 6 inch high housekeeping pad and vibration isolation as specified or indicated elsewhere.
- D. Install flexible connectors on suction and discharge.
- E. Provide pressure gauges on suction and discharge.
- F. Provide a strainer at pump suction and check valve at pump discharge.
- G. Suction reducers shall be eccentric, discharge increases concentric.
- H. Long radius elbows installed only in vertical position and adequately supported to prevent load on pump casing.
- I. Verify alignment prior to grouting.
- J. Provide factory authorized startup of pumps over 200 GPM.
- K. Provide balancing valve on pump discharge.

END OF SECTION

SECTION 23 23 00 - REFRIGERANT PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves and specialties.
 - 3. Refrigerants.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.
- B. Sustainable Design Submittals:
 - 1. Product Data for EA Prerequisite 3, "Fundamental Refrigerant Management": For refrigerants, indicating compliance with refrigerant management practices.
- C. Shop Drawings:
 - 1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 2. Show interface and spatial relationships between piping and equipment.
 - 3. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.

3. Hot-Gas and Liquid Lines: 535 psig.

2.02 COPPER TUBE AND FITTINGS

- A. Copper Tube: [ASTM B 88, Type K or L (ASTM B 88M, Type A or B)] [ASTM B 280, Type ACR].
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8/A5.8M.
- F. Flexible Connectors:
 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 2. End Connections: Socket ends.
 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 4. Working Pressure Rating: Factory test at minimum 500 psig.
 5. Maximum Operating Temperature: 250 deg. F.

2.03 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Heldon Products; Henry Technologies.
 - c. Parker - Sporlan Hannifin Corp.
 - d. Paul Mueller Company.
 2. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 3. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 4. Operator: Rising stem and hand wheel.
 5. Seat: Nylon.
 6. End Connections: Socket, union, or flanged.
 7. Working Pressure Rating: 500 psig.
 8. Maximum Operating Temperature: 275 deg. F.
- B. Packed-Angle Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Heldon Products; Henry Technologies.
 - c. Parker - Sporlan Hannifin Corp.
 - d. Paul Mueller Company.
 2. Body and Bonnet: Forged brass or cast bronze.
 3. Packing: Molded stem, back seating, and replaceable under pressure.
 4. Operator: Rising stem.
 5. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
 6. Seal Cap: Forged-brass or valox hex cap.
 7. End Connections: Socket, union, threaded, or flanged.
 8. Working Pressure Rating: 500 psig.
 9. Maximum Operating Temperature: 275 deg. F.
- C. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Emerson Climate Technologies.
 - c. Heldon Products; Henry Technologies.
 - d. Parker Hannifin Corp.
 - e. Paul Mueller Company.
 2. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
 3. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
 4. Piston: Removable polytetrafluoroethylene seat.
 5. Closing Spring: Stainless steel.
 6. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
 7. End Connections: Socket, union, threaded, or flanged.
 8. Maximum Opening Pressure: 0.50 psig.
 9. Working Pressure Rating: 500 psig.
 10. Maximum Operating Temperature: 275 deg. F.
- D. Service Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Emerson Climate Technologies.
 - c. Heldon Products; Henry Technologies.
 - d. Parker Hannifin Corp.
 - e. Paul Mueller Company.
 - f. Refrigeration Sales, Inc.
 2. Body: Forged brass with brass cap including key end to remove core.
 3. Core: Removable ball-type check valve with stainless-steel spring.
 4. Seat: Polytetrafluoroethylene.
 5. End Connections: Copper spring.
 6. Working Pressure Rating: 500 psig.
- E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Emerson Climate Technologies.
 - c. Heldon Products; Henry Technologies.
 - d. Parker Hannifin Corp.
 - e. Paul Mueller Company.
 2. Body and Bonnet: Plated steel.
 3. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 4. Seat: Polytetrafluoroethylene.
 5. End Connections: Threaded.
 6. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and [24] [115] [208]-V ac coil.
 7. Working Pressure Rating: 400 psig.
 8. Maximum Operating Temperature: 240 deg. F.
- F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.

- b. Heldon Products; Henry Technologies.
 - c. Parker - Sporlan Hannifin Corp.
 - d. Paul Mueller Company.
 - 2. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 - 3. Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 4. Seat: Polytetrafluoroethylene.
 - 5. End Connections: Threaded.
 - 6. Working Pressure Rating: 400 psig.
 - 7. Maximum Operating Temperature: 240 deg. F.
- G. Thermostatic Expansion Valves: Comply with AHRI 750.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Emerson Climate Technologies.
 - c. Parker - Sporlan Hannifin Corp.
 - 2. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 3. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 4. Packing and Gaskets: Non-asbestos.
 - 5. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 6. Suction Temperature: 40 deg. F
 - 7. Superheat: Adjustable
 - 8. Reverse-flow option (for heat-pump applications).
 - 9. End Connections: ODF female, sweat connection, flare.
 - 10. Working Pressure Rating: 700 psig for 410A, 450 psig for non-410A
 - 11. Equalizer: External
- H. Straight-Type Strainers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Heldon Products; Henry Technologies.
 - c. Parker Hannifin Corp.
 - 2. Body: Welded steel with corrosion-resistant coating.
 - 3. Screen: 100-mesh stainless steel.
 - 4. End Connections: Socket or flare.
 - 5. Working Pressure Rating: 500 psig.
 - 6. Maximum Operating Temperature: 275 deg. F.
- I. Angle-Type Strainers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Heldon Products; Henry Technologies.
 - c. Parker Hannifin Corp.
 - 2. Body: Forged brass or cast bronze.
 - 3. Drain Plug: Brass hex plug.
 - 4. Screen: 100-mesh monel.
 - 5. End Connections: Socket or flare.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 275 deg. F.
- J. Moisture/Liquid Indicators:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.

- b. Emerson Climate Technologies.
 - c. Heldon Products; Henry Technologies.
 - d. Parker – Sporlan Hannifin Corp.
 - 2. Body: Forged brass.
 - 3. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - 4. Indicator: Color coded to show moisture content in parts per million (ppm).
 - 5. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 - 6. End Connections: Socket or flare.
 - 7. Working Pressure Rating: 650 psig
 - 8. Maximum Operating Temperature: 240 deg. F.
- K. Replaceable-Core Filter Dryers: Comply with AHRI 730.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Emerson Climate Technologies.
 - c. Heldon Products; Henry Technologies.
 - d. Parker – Sporlan Hannifin Corp.
 - 2. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 - 3. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 4. Desiccant Media: Molecular sieve, Activated alumina.
 - 5. End Connections: Socket.
 - 6. Access Ports: NPS 1/4-inch connections at entering and leaving sides for pressure differential measurement.
 - 7. Maximum Pressure Loss: 2 psig
 - 8. Working Pressure Rating: 650psig
 - 9. Maximum Operating Temperature: 240 deg. F.
- L. Permanent Filter Dryers: Comply with AHRI 730.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Danfoss Inc.
 - b. Emerson Climate Technologies.
 - c. Heldon Products; Henry Technologies.
 - d. Parker – Sporlan Hannifin Corp.
 - 2. Body and Cover: Painted-steel shell.
 - 3. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 4. Desiccant Media: Molecular sieve, Activated alumina.
 - 5. End Connections: Socket
 - 6. Maximum Pressure Loss: 2 psig
 - 7. Working Pressure Rating: 650 psig
 - 8. Maximum Operating Temperature: 240 deg. F.

2.04 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arkema Inc.
 - b. DuPont Fluorochemicals Div.
 - c. Genetron Refrigerants; Honeywell International Inc.
 - d. Mexichem Fluor Inc.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR or Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, Type K (A) or Type L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
- E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, Type K (A), or Type L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- F. Safety-Relief-Valve Discharge Piping: Copper, Type ACR or Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- G. Safety-Relief-Valve Discharge Piping: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- H. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, Type K (A), Type L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
- I. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, Type K (A) or Type L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

3.02 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless or packed-angle valves on inlet and outlet side of filter dryers.
- E. Install a full-size, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection downstream of the bulb location where it will reflect suction-line pressure at bulb location.
- H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
 2. Thermostatic expansion valves.
 3. Hot-gas bypass valves.
 4. Compressor.
- K. Install filter dryers in liquid line between condenser and thermostatic expansion valve [, and in the suction line at the compressor].
- L. Install receivers sized to accommodate pump-down charge.
- M. Install flexible connectors (Vibration absorbers) at compressors.

3.03 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 2. Install horizontal suction lines with a uniform slope downward to compressor.
 3. Install traps and double risers to entrain oil in vertical runs.
 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- R. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for

sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.04 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.05 HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
 - 1. NPS 1/2-inch: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 2. NPS 5/8-inch: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 3. NPS 1-inch: Maximum span, 72 inches; minimum rod, 1/4 inch.
 - 4. NPS 1 1/4 -inch: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 5. NPS 1 1/2 -inch: Maximum span, 96 inches; minimum rod, 3/8 inch.
- D. Support multifloor vertical runs at least at each floor.

3.06 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.
- B. Prepare test and inspection reports.

3.07 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line.

3.08 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.
 - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 31 13 - DUCTWORK**PART 1 - GENERAL****1.01 GENERAL REQUIREMENTS**

- A. Construct rectangular ductwork to meet all functional criteria defined in Section VII, of the SMACNA "HVAC Duct Construction Standards Metal and Flexible" latest edition. This shall be subsequently referred to as the SMACNA Manual. All ductwork must comply with all local, state and federal code requirements.
- B. Refer to Section 23 05 00 for requirements which are applicable to this section.
- C. The SMACNA Manual, ASHRAE Handbooks, International Mechanical Code, and NFPA Pamphlet 90A shall apply to this work.
- D. Provide labor, material, equipment, and supervision necessary to install a complete air handling system as indicated on the drawings and specified herein.
- E. Contractor is to furnish and install volume dampers in all supply, return, exhaust, and outside air branch ductwork. If these are omitted from the drawings, the contractor is to make an allowance to install them.

1.02 SUBMITTALS

- A. Ductwork shop drawings must be properly submitted. Any ductwork installed without prior approval by the engineer and found to be incorrect, shall be replaced at the expense of the contractor.
- B. Submit shop drawings of all sheet metal for review. Drawings shall be not less than 1/4" scale and show all light fixtures, steel, piping, conduit, equipment and architectural features. It is unacceptable to resubmit and modify McHugh design documents for sheet metal drawing purposes.
 - 1. Indicate structural steel and elevation of bottom of beams and joists or floor to bottom dimension.
 - 2. Indicate ductwork elevation and/or floor to bottom of duct. Verify ductwork fits in available space.
 - 3. Indicate waste and storm piping where it occurs in the area of ductwork.
 - 4. Locate electrical gear on plan. Ductwork is not to run above panels.
 - 5. Ductwork is to be shown double line with indicated width and height.
 - 6. Allowance to be made for lining and/or insulation.
 - 7. Duct sizes shown on contract drawings may be flattened to a 4 to 1 ratio when necessary to establish clearance. Such transitions are to be included in the contract price.
 - 8. Ductwork fabrication shall not proceed until shop drawings are submitted for review.
 - 9. All dampers, grilles, registers, diffusers, access panels, louvers, coils, filters, and other components of the system are to be indicated.
 - 10. Provide detail of fire damper assembly.
 - 11. Provide drawing sections when requested by the engineer. Coordinate sheet metal drawings with light fixture layout and sprinkler system piping and heads and shown on the drawing.
- C. Submit manufacturer's literature and performance data of equipment and devices for review.
- D. Samples: Furnish at request of A/E.
- E. Contractor to coordinate work with sprinkler piping and head locations.

1.03 QUALITY ASSURANCE

- A. The contractor must comply with the enclosed specification in its entirety. If on inspections, the

specifier finds changes have been made without prior approval, the contractor will make the applicable changes to comply with this specification, at the contractor's expense.

- B. At the discretion of the specifier, sheet metal gauges, and reinforcing may be checked at various times to verify all duct construction is in compliance.

PART 2 - PRODUCTS

2.01 FABRICATED DUCT REQUIREMENTS - DUCTMATE

- A. All interior rectangular ducts shall be constructed with G-60 or better galvanized steel (ASTM A-653-94) LFQ, chem treat. Exterior ductwork shall be G-90 or better galvanized steel LFQ, chem treat. Kitchen, shower, or dishwasher exhaust shall be aluminum with aluminum joints.
- B. Materials: Support, access doors not part of ducts, bar or angle reinforcing damper rods and items made of uncoated mild steel shall be painted with two coats of primer or provide galvanized equivalent.
- C. Longitudinal Seams. Pittsburgh lock shall be used on all longitudinal seams. All longitudinal seams will be sealed with mastic sealant. Snaplock is not acceptable.
- D. Flanged interior Gasket. Ductmate 440 or a Butyl Rubber Gasket which meets Mil-C 18969B, Type II Class B, TT-C-1796 A, Type II Class B, and TTS-S-001657 must also pass UL-723. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type vehicle that will support fungal and/or bacterial growth associated with dark, damp areas of ductwork. The recommended test procedure for bacterial and fungal growth is found in 21CFR 177, 1210 closures with sealing gaskets for food containers.
- E. Ductmate or W.D.C.I. proprietary duct connection systems will be accepted. Duct constructed using these systems will refer to the manufacturers guidelines for sheet gauge, intermediate reinforcement size and spacing, and joint reinforcements.
- F. Formed - on flanges (T.D.C./T.D.F./T-25A/T-25B) be accepted. Formed on flanges will be constructed as SMACNA T-25 flanges, whose limits are defined on page 1.36 1995 SMACNA Manual, Second Edition. No other construction pertaining to formed - on flanges will be accepted. Formed on flanges shall be accepted for use on ductwork 42" wide or less and must include the use of corners, bolts, and cleat. (Over 42", the reinforcement/joint deflection criteria no longer conform with the UMC).
- **
- G. Rectangular ductwork in the pool and pool equipment room shall be aluminum construction with stainless steel (317L or 904L) hangers, supports, and fasteners.
- **
- H. Rectangular ductwork above the roof or outside shall be 4" water gauge construction.
- **
- I. Pool return or exhaust ductwork above the roof shall be 4" water gauge aluminum.
- J. All ductwork in moist areas (Toilet Rooms, locker rooms, kitchens, etc) shall be aluminum construction with aluminum hangers, supports, and fasteners.

2.02 DUCTWORK - SMACNA STANDARDS

- A. All sheet metal supply, exhaust, relief, outside and return ductwork shall be formed from galvanized steel sheet unless otherwise specified.
- B. Galvanizing shall conform to SMACNA Standards.
- C. Exposed rectangular ductwork in finished areas shall have drive slip joints on transverse seams and Pittsburgh lock joints on longitudinal seams.

- D. Commercial round ductwork shall be spiral wound with snap lock seams in accordance with SMACNA standards, double wall, 1" insulation, perforated liner. (Does not apply to concealed residential ductwork systems)
- E. Rectangular/round spiral ductwork in the pool and shall be aluminum construction. All supports, fasteners, and hangers shall be stainless steel (317L or 904L).
- F. Rectangular ductwork in the pool and pool equipment room shall be coated with 4 mils PVC both inside and outside.
- G. Rectangular ductwork above the roof or outside shall be medium pressure construction (4" wg)
- H. Pool return or exhaust ductwork above the roof shall be coated inside and outside with 4 mils PVC.
- I. Round spiral air conditioning ductwork supply shall be double wall lined. This applies to round ductwork in the Gymnasium and the Game Room.
- J. Exterior ductwork shall be 4" w. g. pressure construction per SMACNA. Watertight seams.
- K. All ductwork in moist areas (Toilet Rooms, locker rooms, kitchens, etc.) shall be aluminum construction with aluminum hangers, supports, and fasteners.

2.03 ROUND AND FLAT OVAL DUCTS

- A. Construction: In accordance with HVAC Duct Construction Standards, Section III.
- B. Round ductwork shall be spiral seam construction only. Gauges shall be in accordance with SMACNA Duct Construction Standard and fittings in accordance with SMACNA Duct Construction Standard, except as noted:
 - 1. Joints 0"-20" diameter, interior slip coupling beaded at center, fastened to duct, with sealing compound applied continuously around joint before assembling and after fastening. Wrap joints with 3 inch wide duct tape.
 - 2. Joints 21" - 72" diameter, use 3 piece, gasketed, flanged joints consisting of 2 internal flanges (with integral mastic sealant) split to accommodate minor differences in duct diameter, and one external closure band designed to compress gasketing between internal flanges. Example: Ductmate Spiralmate or equal.
 - 3. Joints 73" diameter and up, use companion angle flanged joints only as defined on page 3-6 of the SMACNA Manual. Refer to manual for proper sizing and construction details. Ductwall to be welded longitudinal seams.
 - 4. Flat Oval Ducts shall be joined with the Ovalmate Connection System manufactured by Ductmate Industries. Consult the manufacturer for installation and construction guidelines. As an option, beaded sleeve joints may be used.
 - 5. Provide double wall with 1" insulation and perforated liner for all air conditioning supply ducts.
- **
- 6. Round ductwork in the pool shall be aluminum with stainless steel (317L or 904L) hangers, supports, and fasteners.
- C. All ductwork in moist areas (Toilet Rooms, locker rooms, kitchens, etc.) shall be aluminum construction with aluminum hangers, supports, and fasteners.

2.04 FIBERGLASS DUCTBOARD

- A. Fiberglass ductboard is not acceptable.

2.05 SEALERS

- A. Duct sealer shall be flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall seal out water, air and moisture. Sealer shall be UL listed and conform to ASTM E84. Sealer shall be Ductmate PROseal or an approved equal.

- B. All joints shall be sealed.

2.06 DUCTWORK HANGER/SUPPORT

- A. Hang and support ductwork as defined by SMACNA, Section IV 1995 Manual, Section Edition, or as defined within. Hanger spacing not to exceed 8'.
- B. Not Permitted: Sheetmetal screws in a metal deck.

2.07 ACCESS DOORS IN DUCTWORK

- A. Access doors shall be hinged or Ductmate Sandwich Type Access Doors manufactured by Ductmate Industries, Inc. Doors shall be of adequate size to allow easy access to hardware which needs to be maintained.

2.08 TURNING VANES

- A. Turning vanes shall be Harper single wall turning vanes fabricated from the same material as the duct. Tab spacing shall be SMACNA standard. Rail systems with non-standard tab spacing's shall not be accepted. All tabs shall be used, do not skip tabs. Mounting rails shall have friction insert tabs which align the vanes automatically. Vanes shall be subjected to tensile loading and be capable of supporting 250 lbs. when fastened per the manufacturer's instructions. Approved Systems: Ductmate PRO-Rail.

2.09 SOUND ATTENUATING DUCT LINING

- A. Includes:
 - 1. All interior supply air ductwork.
 - 2. All exterior supply air ductwork. Refer to exterior ductwork specifications (23 07 00) for additional requirements.
 - 3. All interior return ductwork.
 - 4. Return ductwork: Line the first 10'-0" of the main return ductwork extending from the air handling units.
 - 5. All outside air ductwork.
 - 6. All transfer air ductwork.
 - 7. No kitchen supply and return ductwork shall be lined.
- B. Duct liner shall have a flame spread of not over 25, a fuel contributed of not over 50 and a smoke developed of not over 50.
- C. Liner shall be minimum 1 inch thick, 1.5 Lbs./Cu. Ft. density with a thermal conductance of .24 at 50 deg. F. mean temperature. (Conductance: BTU/Sq. Ft./F/Hr.).
- D. Liner shall not spall or deteriorate at air velocities to 4000 FPM when installed in accordance with the manufacturer's recommendations.
- E. Liner shall be Johns-Manville Linacoustic or approved substitute by Owens-Corning, CertainTeed, or Knauf. Observe all installation instructions.
- F. Any ductwork in unconditioned spaces or outdoors shall have insulation totaling R-8.3.

2.10 FLEXIBLE INSULATED DUCTWORK

- A. Contractor may utilize flexible factory insulated ductwork for short connections from trunk ducts to diffusers when concealed. Lengths shall not exceed 10 feet.
- B. Pressure rating: Minimum 10" w.g.
- C. Outer Jacket: Aluminum equivalent to Flexmaster 5M 4.2 vapor barrier
- D. Insulation for ductwork in conditioned spaces: R-4.2.

- E. Insulation for ductwork in unconditioned spaces/outdoors - R-8.
- F. Liner: Wire with laminated mylar
- G. Manufacturer: Atco, Flexmaster. Or prior approved equal.
- H. Applies to supply ductwork only. Exhaust and return ductwork to be rigid ductwork.
- I. Flexible insulated ductwork to comply with 25/50 flame spread and smoke density ratings.

2.11 FLEXIBLE CONNECTIONS

- A. Between all fans, air handlers, A/C units and ductwork.
- B. Material: Woven fiberglass with mounting accessories.
- C. Minimum 1" and maximum 4" between adjacent sections.

2.12 DAMPERS

- A. Location: Where required to control flow of air or to balance air systems. Additionally, includes at each supply/return/outside/exhaust air branch ductwork, each air device, individual duct risers, branch ductwork off duct risers, VAV box inlet.
- B. Type: Opposed blade, bearings at each end, adjustment quadrant and locking device for ducts over 1 square foot. Under 1 square foot dampers may be single blade with locking device.
- C. Leakage: 8 cfm maximum at 4" S.P. for 4 Sq. Ft. damper. Class 1.
- D. Material: galvanized steel in galvanized steel ductwork, extruded aluminum in aluminum ductwork.

2.13 FIRE DAMPERS

- A. Furnish and install pre-manufactured dampers with 1 1/2 hr. UL Label where required by code or indicated on the drawings.
- B. Fusible links shall be set at 160 deg. F. Provide 10 % extra links to the owner.
- C. SET FIRE DAMPERS IN 20 GAUGE SLEEVES WITH BREAKAWAY CONNECTIONS TO THE DUCTWORK ON EACH SIDE. SEE STANDARD SMACNA DETAILS FOR INSTALLATION. DAMPERS INSTALLED INCORRECTLY WILL BE REQUIRED TO BE REMOVED AND REPLACED CORRECTLY.
- D. Damper shall be set in wall or floor construction.
- E. Install in accordance with manufacturer's instructions and the authority having jurisdiction.
- F. Damper blades shall be held out of airstream for ducts smaller than 14".
- G. Provide 12" x 12" access door in ductwork for access to each damper. Label "FIRE DAMPER ACCESS" with 2" high stenciled letters.
- H. Manufacturers; Prefco, American Warming and Ventilating, Air Balance, Phillips, Nailor-Hart, Lloyd.
- I. Fire dampers in fiberglass ductboard systems shall be installed in steel sleeves. The fiberglass duct shall be terminated and the steel sleeve installed at the fire wall or floor. Rigid ductboard shall not continue thru the fire wall.

2.14 SMOKE DAMPERS (COMBINATION SMOKE/FIRE DAMPERS)

- A. Furnish and install smoke dampers of the size indicated on the drawings or required by the sheet metal shop drawings as a result of field coordination.
- B. Dampers shall meet all of the requirements per the latest edition of NFPA 90.
- C. Dampers shall be furnished with both the 1 1/2 hour (or 3 hour) UL label for fire dampers - UL 555 and the UL label for leakage resistance (smoke) - UL 555S. The leakage rating of the dampers shall be no more than 11 CFM/2 @ 1" W.G. after exposure to 1,000 deg. F. for one (1) hour. To maintain this leakage rating the amount of torque required to hold the damper closed shall not exceed 0 Lb. In.
- D. Dampers shall incorporate an integrated resettable and reusable UL listed electric link / mechanical

lock assembly replacing standard fusible links and separate locking devices. The link shall be activated and the damper shall close and lock by either smoke detector signaled release (120V or 24V A.C. /D.C.) or excessive duct ambient temperature. Upon cessation of the detector signal or normalization of the duct ambient temperature the link assumes its original position enabling the damper to be reopened by the motor actuator automatically.

- E. Dampers shall be installed in accordance with the manufacturers UL installation instructions.
- F. All combination smoke/fire dampers shall be Prefco Products, Cesco, Inc. model 5010 or equal by Phillips or Nailor-Hart.

2.15 SPIRAL DUCT LINING

- A. Supply spiral duct shall be lined with 1" Johns Manville Spiracoustic Plus or Spiracoustic round duct liner or prior approved equal.
- B. Material shall meet NFPA 90A and 90B as well as FHC 25/50 flame/smoke ratings.
- C. Material shall conform to ASHRAE 62/89.
- D. Install per manufacturer's instructions.
- E. Spiracoustic Plus is round liner board. Spiracoustic is preformed round liner.

2.16 VOLUME DAMPER CONTROL - REMOTE EXTERNAL CONTROL

- A. Applications: Drywall ceilings or where shown on drawings.
- B. Location: In ductwork where required to control air flow or balance air systems.
- C. Volume damper type: Opposed single blade round butterfly damper for external control, EPDM low leakage seals, scoop and spin-in type shell, Young Regulator Co. 5020 CC Series. Rectangular: #830-CC Series.
- D. Leakage: 10 CFM maximum at 4" s.p. for 4 square foot damper.
- E. Material: Galvanized steel in galvanized steel ductwork, extruded aluminum in aluminum ductwork.
- F. Controls: Bowden Cable Control Kit 270-896C to include hardware, for ceiling mounting in conjunction with external control of round or rectangular dampers, flush 7/8" diameter cold rolled steel cover is zinc plated for painting, 12" wrench (damper adjustments), metal clad control cable.

PART 3 - EXECUTION

3.01 DUCTWORK

- A. Dimensions on drawings are inside of lining.
- B. Ducts shall be concealed unless otherwise indicated.
- C. Changes in direction shall be made with radius bends or turning vanes.
- D. Ducts shall be cross-broken or machine grooved over 18 inches in width.
- E. Supports: Galvanized steel per SMACNA.
- F. Longitudinal joints; Pittsburg Lock or Inside Groove.
- G. Connections to wall louvers shall be sloped down to louver connection to prevent water draining into interior.
- H. All ducts to have nested takeoffs, 45 degree cants, or adjustable turning vanes at all branch duct takeoffs.

3.02 ACCESS DOORS

- A. Furnish and install at all fire dampers, heating coils, humidifiers, filters, smoke dampers, valves,

volume dampers and wherever indicated on the drawings.

- B. Minimum 12" x 12" double thick 22 gauge with 1" fiberglass, fully gasketed and with cam lock or latches.

3.03 LOUVERS

- A. Ductwork to an intake or exhaust louver shall slope down to the louver as to prevent water entering the ductwork.

3.04 LEAK SEALING

- A. All joints shall be sealed to prevent leakage.
- B. Systems shall be sealed with high velocity duct sealant.

END OF SECTION

SECTION 23 31 21 - DUCTWORK CLEANING**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 23 05 00 for requirements which are applicable to this section.
- B. Refer to NFPA and International Mechanical codes.
- C. Refer to ASHRAE, ASTM, OSHA and UL standards.
- D. Refer to NADCA (National Air Duct Cleaners Association) standards.
- E. Refer to ACR 2006 assessment, cleaning, and restoration of HVAC systems.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to inspect, clean and internally coat the existing supply air and return air duct system.

1.03 SUBMITTALS

- A. Submit manufacturers' data sheets of coating.

1.04 QUALITY ASSURANCE

- A. Provide adequate supervision of labor force to see that cleaning and coating operations are performed correctly.
- B. Work shall be performed by certified National Air Duct Cleaners Assoc. Specialists.
- C. Provide NADCA certificate at completion of work.

PART 2 - PRODUCTS**2.01 FUNGICIDAL PROTECTIVE COATING**

- A. Polyacrylate copolymer emulsion specifically formulated for long term fungicidal activity, with no loss of activity on aging shall contain fungicides that will effectively prevent the growth and spread of molds and bacteria on its surface and provide a tough, elastic protective finish that allows for movement without splitting to create lodging places for bacteria.
- B. Properties:
 - 1. Color: White
 - 2. Application Consistency: Brush or Airless Spray
 - 3. Average non-volatile (ASTM C 461) - 58% by volume.
 - 4. Coverage Range (FSTM 71) - Wet coverages shown are for smooth non-porous surfaces. Porous or rough surfaces may require higher gallonage to obtain required dry thickness. 1.25 gal. /100 square feet 2 (0.51 1/m 2); .020 in. Wet thickness (.51 mm); .011 in. Dry thickness (.27 mm).
 - 5. Drying Time (ASTM D 1640) - Set to touch: 4 hours; dry through: 16 hours.

6. Water Vapor Permeance (ASTM F 1249) - Tested at 90% R. H. differential and 100 deg. F (38 deg. C) 6.0. Perms at .011 in. (4.0 metric perms at .26 mm).
 7. Service Temperature Limits (FSTM 70) (Temperature at coated surface) - Minus 20 deg. F to 200 deg. F (-29 deg. C to 93 deg. C).
 8. Safety - Wet flammability (ASTM D 3278). No flash to boiling 210 deg. F (99 deg. C).
 9. Surface Burning Characteristics (ASTM E 84) - Flame Spread: 15 - Smoke Developed: 5. Tested at coverage rate of 80 square feet per gallon. Applied to inorganic reinforced cement board. The flame spread may vary at different product thicknesses and/or when applied over other surfaces.
- C. Manufacturer: Foster 40-20.

PART 3 - EXECUTION

3.01 DUCT CLEANING

- A. Preparing and protecting work areas with 4ml. Poly, as necessary.
- B. Performing the work in compliance with the Occupational Safety and Health Administration (OSHA) Standards requiring compliance by all private employers on an ongoing basis under the General Industry (29CFR 1910) and Construction Industry (29CFR 1926). Regulations, which include but is not limited to:
 - o Record keeping OSHA 1910.20.
 - o Confined Space Entry Requirements OSHA 1910.146
 - o Respiratory Protection OSHA 1910.134
 - o Hazardous Communications OSHA 1910.1200
 - o Lock-Out/Tag-Out Protection OSHA 1910.147
- C. Marking the position of all balancing dampers prior to cleaning process.
- D. Removing and cleaning supply registers and exhaust air grills and louvers. (If removable)
- E. Providing access ports in accordance with SMACNA standards where necessary to thoroughly clean the entire system. Provide pre-manufactured latchable access panels.
- F. Removing, inspecting and installing upon completion all filtration devices. Install new filters matching existing filters.
- G. Removing of all visible debris and contaminants from the outside air duct system and other associated components. This is to be performed in accordance with NADC Standards 1992-01.
- H. Leaving all work areas in a neat and orderly fashion, and removing all accumulated debris from work site.
- I. All registers, grilles louvers to be securely reinstalled and mechanical dampers restored to their original positions.
- J. Checking total system upon completion to ensure functional operation in similar manner in which system was operating prior to cleaning process.
- K. Any deficiencies reported to project engineer.

3.02 INTERNAL DUCT CLEANING AND COATING

- A. After cleaning and vacuuming inspect internal duct for damage and/or deterioration. Upon completion of the inspection, repair ductwork is required.
- B. After installation of the required access doors in the duct work and the removal of all loosened contaminants is completed, resurfacing, shall be accomplished as follows:

1. Using a spraying system with approved resurfacing agent, Foster 40-20, apply a one (1) mil thickness wet application to the liner surfaces, or as recommended by the manufacturer's specifications. Ensure even coating with broad spray tip.
2. Odors shall be controlled through the filters in the collection devices. Collection devices shall be connected to the targeted duct section so that a minimum negative pressure is maintained. Pressure within the area being resurfaced may be adjusted based on the size of the duct to restrict over spray or removal of the resurfacing. The intent of the negative pressure is to eliminate odors and to assist in the drying process, not to draw resurfacing agent into collection systems. A minimum negative pressure of .125" wg shall be used.
3. Resurfacing agent shall be approved for use inside of air distribution systems. Additives for agents shall be approved by the Owner and shall be accompanied by a current MSDS.

3.03 FUNGICIDAL COATING

- A. Material Preparation: Do not thin. Keep container closed when not in use. Do not apply outdoors in damp or rainy weather.
- B. HVAC Systems: Galvanized surfaces need to be vacuumed or washed clean of all accumulated mold, dust and loose particles. Following complete cleaning procedures, sanitize the entire air duct surfaces with an approved sanitizer following manufacturer's directions. Insure that all interior surfaces are thoroughly dry before applying 40-20. All rusted metal surfaces must be primed with Foster 40-26 before application of 40-20. Lined air ducts should be lightly vacuum cleaned to remove all mold, dust and loose particles, being careful not to tear or loosen the liner. Following complete cleaning procedures, the entire air duct surfaces are to be sanitized as above.
- C. Application: Apply Foster 40-20 to all surfaces by brush, airless spray at a rate of approximately 1.25 gal. Per 100 square foot. Always ensure adequate ventilation. Brushing will require two coats applied at 90 degrees to each other. Under normal circumstances a spray application can be completed in one coat, but for extremely porous or irregular surfaces, a second coat may be required. Insure that the finished surface is smooth and homogeneous. For airless spray application, use an electric 30:1 unit such as a Graco EH-433 with a .021-.025 fluid tip and 800-900 psi atomizing pressure at the gun.
- D. For HVAC systems interior surfaces: Always ensure negative air pressure in the HVAC system during application. After one hour has elapsed from completion of application, circulate fresh air throughout the system to dry the coating. Be sure exhausted air is odorless before ventilating into occupied room areas.
- E. Clean-up - Use fresh water to clean brushes and equipment before product dries. Dry product may be removed with chlorinated solvents (non-flammable) or Xylol (flammable).
- F. Hazard Statement: Harmful if swallowed or absorbed through skin. Causes moderate eye irritation. Prolonged skin contact may cause irritation. Acute overexposure to vapors may cause dizziness, headache, nausea, and unconsciousness. Since emptied containers may retain product residue, follow label warnings even after container is empty.

3.04 CERTIFICATION

- A. At completion of the work submit certification of the National Air Duct Cleaners Association stating that work was performed in accordance with their standards.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Fire dampers.
 - 5. Smoke dampers.
 - 6. Flange connectors.
 - 7. Turning vanes.
 - 8. Duct-mounted access doors.
 - 9. Flexible connectors.
 - 10. Duct accessory hardware.
- B. Related Requirements:
 - 1. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
 - 2. Section 283000 "Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product data showing compliance with ASHRAE 62.1.
 - 2. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS**2.01 ASSEMBLY DESCRIPTION**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with 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.

2.02 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G60 for indoor applications and G90 for exterior applications.
 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and smooth finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
 2. Greenheck Fan Corporation.
 3. Lloyd Industries, Inc.
 4. Nailor Industries Inc.
 5. NCA Manufacturing, Inc.
 6. Pottorff.
 7. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2500 fpm.
- D. Maximum System Pressure: 2-inch wg
- E. Frame: Hat-shaped, 0.063-inch-thick extruded aluminum or 0.05-inch-thick stainless steel, with welded corners or mechanically attached and mounting flange.
- F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.050-inch-thick aluminum sheet with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
- I. Blade Axles:
1. Material: Stainless steel.
 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings: Synthetic pivot bushings.
- M. Accessories:
1. Adjustment device to permit setting for varying differential static pressure.
 2. Counterweights and spring-assist kits for vertical airflow installations.
 3. Screen Mounting: Rear mounted.
 4. Screen Material: Aluminum.

- 5. Screen Type: Insect.
- 6. 90-degree stops.
- N. Air Leakage: Class I – Not to exceed 8 CFM/FT2 @ 4" w.g. AMCA Certified.

2.04 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Warming and Ventilating; a Mestek Architectural Group company.
 - b. Flexmaster U.S.A., Inc.
 - c. McGill AirFlow LLC.
 - d. Nailor Industries Inc.
 - e. Pottorff.
 - f. Ruskin Company.
- 2. Standard leakage rating.
- 3. Suitable for horizontal or vertical applications.
- 4. Frames:
 - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized steel, 0.064 inch thick.
- 6. Blade Axles: Galvanized steel.
- 7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Warming and Ventilating; a Mestek Architectural Group company.
 - b. McGill AirFlow LLC.
 - c. Nailor Industries Inc.
 - d. Pottorff.
 - e. Ruskin Company.
- 2. Standard leakage rating.
- 3. Suitable for horizontal or vertical applications.
- 4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
 - e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.
- 6. Blade Axles: [Galvanized steel] [Stainless steel] [Nonferrous metal].
- 7. Bearings:

- a. [Oil-impregnated bronze] [Molded synthetic] [Stainless-steel sleeve].
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Tie Bars and Brackets: Aluminum.
- C. Jackshaft:
 - 1. Size: 1-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- D. Damper Hardware:
 - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.05 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a Mestek Architectural Group company.
 - 2. Arrow United Industries.
 - 3. Greenheck Fan Corporation.
 - 4. Lloyd Industries, Inc.
 - 5. McGill AirFlow LLC.
 - 6. Metal Form Manufacturing, Inc.
 - 7. Nailor Industries Inc.
 - 8. Pottorff.
 - 9. Ruskin Company.
 - 10. Tamco
 - 11. Young Regulator Company.
- B. Frames:
 - 1. Hat, U, or Angle shaped.
 - 2. 0.05-inch thick stainless steel.
 - 3. Mitered and welded corners.
- C. Blades:
 - 1. Multiple blade with maximum blade width of 6 inches.
 - 2. Opposed blade design.
 - 3. Aluminum.
 - 4. 0.0747-inch- thick dual skin.
 - 5. Blade Edging: Closed-cell neoprene.
 - 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- D. Blade Axles: 1/2-inch-diameter; nonferrous metal; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 - 1. Operating Temperature Range: From minus 40 to plus 200 deg. F.
- E. Bearings:
 - 1. Molded synthetic.
 - 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 3. Thrust bearings at each end of every blade.
- F. Air Leakage: Class I – Not to exceed 8 CFM/FT2 @ 4"w.g.. AMCA Certified.

2.06 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a Mestek Architectural Group company.
 - 2. Arrow United Industries.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Pottorff.
 - 6. Ruskin Company.
 - 7. Vent Products Co., Inc.
- B. Type: Static; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2500-fpm velocity.
- D. Fire Rating: 1 ½ and 3 hours. Coordinate with wall rating.
- E. Frame: Curtain type with blades inside airstream for duct heights larger than 14" and curtain type with blades outside airstream for duct heights 14" and below; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg. F rated, fusible links. Provide 10 % extra links to the owner.
- K. SET FIRE DAMPERS IN 20 GAUGE SLEEVES WITH BREAKAWAY CONNECTIONS TO THE DUCTWORK ON EACH SIDE. SEE STANDARD SMACNA DETAILS FOR INSTALLATION. DAMPERS INSTALLED INCORRECTLY WILL BE REQUIRED TO BE REMOVED AND REPLACED CORRECTLY.
- L. Provide 12" x 12" access door in ductwork for access to each damper. Label "FIRE DAMPER ACCESS" with 2" high stenciled letters.

2.07 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a Mestek Architectural Group company.
 - 2. Greenheck Fan Corporation.
 - 3. Nailor Industries Inc.
 - 4. Pottorff.
 - 5. Ruskin Company.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Shall be provided by the Fire Alarm Contractor / Electrical Contractor and installed by the Mechanical Contractor.
- D. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with interlocking, gusseted or mechanically attached corners and mounting flange.
- E. Blades: Roll-formed, horizontal, interlocking, 0.063-inch thick, galvanized sheet steel.
- F. Leakage: Class I.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, 0.05-inch thick, galvanized sheet steel; length to suit wall or floor application [with factory-furnished silicone calking].
- I. Damper Motors: two-position action.

- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg. F.
 6. Nonspring-Return Motors: For damper's larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 7. Electrical Connection: 24 V.

2.08 COMBINATION SMOKE/FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
 2. Greenheck Fan Corporation.
 3. Nailor Industries Inc.
 4. Pottorff.
 5. Ruskin Company.
- B. General Requirements:
1. Dampers shall be furnished with both the 1 1/2 hour (or 3 hour) UL label for fire dampers - UL 555 and the UL label for leakage resistance (smoke) - UL 555S.
 2. Refer to the requirements of Fire Dampers and Smoke Dampers for additional requirements.

2.09 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
- B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.10 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aero-Dyne Sound Control Co.
 2. Ductmate Industries, Inc.
 3. Duro Dyne Inc.
 4. Elgen Manufacturing.
 5. Hardcast, Inc.
 6. METALAIRE, Inc.

7. SEMCO LLC.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Double wall.

2.11 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. American Warming and Ventilating; a Mestek Architectural Group company.
 2. Ductmate Industries, Inc.
 3. Elgen Manufacturing.
 4. Flexmaster U.S.A., Inc.
 5. Greenheck Fan Corporation.
 6. McGill AirFlow LLC.
 7. Nailor Industries Inc.
 8. Pottorff.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside handles.

2.12 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. 3M.
 2. Ductmate Industries, Inc.
 3. Flame Gard, Inc.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum

2000 deg. F.

- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.13 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Elgen Manufacturing.
 3. Hardcast, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5 ¾ inches wide attached to two strips of 2 ¾ -inch-wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd.
 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg. F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd.
 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg. F.

2.14 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.15 VOLUME DAMPER CONTROL - REMOTE EXTERNAL CONTROL

Applications: Drywall ceilings or where shown on drawings.

1. Location: In ductwork where required to control air flow or balance air systems.
2. Volume Damper Type: Opposed single blade round butterfly damper for external control, EPDM low leakage seals, scoop and spin-in type shell, Young Regulator Co. 5020 CC Series. Rectangular: #830-CC Series.
3. Leakage: 10 CFM maximum at 4" s.p. for 4 square dampers.
4. Material: Galvanized steel in galvanized steel ductwork, extruded aluminum in aluminum ductwork.
5. Controls: Bowden Cable Control Kit 270-896C to include hardware, for ceiling mounting in conjunction with external control of round or rectangular dampers, flush 7/8" diameter cold rolled steel cover is zinc plated for painting, 12" wrench (damper adjustments), metal clad control cable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft or control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot spacing.
 - 8. Upstream from turning vanes.
 - 9. Upstream or downstream from duct silencers.
 - 10. Control devices requiring inspection.
 - 11. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- N. Connect diffusers or light troffer boots to ducts with maximum 10 feet lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.

- Q. Install volume damper control – remote external control when balancing dampers are located above in accessible ceilings similar to gypsum board.

3.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.

END OF SECTION

SECTION 23 33 46 - FLEXIBLE DUCTS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Insulated supply flexible ducts.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product data showing compliance with ASHRAE 62.1.
 - 2. Product Data: For adhesives and sealants, indicating VOC content.
 - 3. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
 - 4. Laboratory Test Reports: For Insulation, indicating compliance with requirements for low-emitting materials.
 - 5. Product Data: For insulation, indicating that R-values comply with tables in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
- C. Shop Drawings: For flexible ducts.
 - 1. Include plans showing locations and mounting and attachment details.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS**2.01 ASSEMBLY DESCRIPTION**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.02 INSULATED FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Atco

2. Flexmaster U.S.A., Inc.
 3. Flex-Tek Group.
 4. McGill AirFlow LLC.
 5. Thermaflex.
 6. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene [aluminized] vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 10-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 210 deg. F.
 4. Insulation R-Value: Comply with ASHRAE/IES 90.1 - R4.2 in conditioned space, R8.0 in unconditioned space/outdoors.
 5. Comply with 25/50 flame spread and smoke density ratings.

2.03 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Applies to supply ductwork only. Exhaust and return ductwork to be rigid ductwork.
- C. Flexible air connectors and flexible ducts shall not be used to make 90 degree or greater.
- D. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- E. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- F. Connect diffusers or light troffer boots to ducts with maximum 10'-0" lengths of flexible duct clamped or strapped in place.
- G. Connect flexible ducts to metal ducts with liquid adhesive plus tape.
- H. Install duct test holes where required for testing and balancing purposes.
- I. Installation:
 1. Install ducts fully extended.
 2. Do not bend ducts across sharp corners.
 3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
 5. Install flexible ducts in a direct line, without sags, twists, or turns.
- J. Supporting Flexible Ducts:
 1. Suspend flexible ducts with bands 1 ½ inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
 2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
 3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.

4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION

SECTION 233423 - HVAC POWER VENTILATORS**PART 1 - GENERAL****1.01 SUMMARY****A. Section Includes:**

1. Ceiling-mounted ventilators.
2. In-line centrifugal fans.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 1. Detail 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.
 3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 4. Design Calculations: Calculate requirements for selecting vibration isolators [and seismic restraints] and for designing vibration isolation bases.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.04 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**2.01 CEILING-MOUNTED VENTILATORS**

- A. Commercial Application Manufacturers: Greenheck Fan Corporation, Loren Cook, PennBarry.
- B. Residential Application (Apartments, Houses, Condominiums) Manufacturers: Panasonic, Nutone, and Broan.
- C. Housing: Steel, lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 - 3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
 - 4. Motion Sensor: Motion detector with adjustable shutoff timer.
 - 5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
 - 6. Filter: Washable aluminum to fit between fan and grille.
 - 7. Isolation: Rubber-in-shear vibration isolators.
 - 8. Manufacturer's standard roof jack or wall cap, and transition fittings.
 - 9. Energy Star Fans
 - a. Multi-speed module to allow the fan to run continuously on low speed and ramp up to a higher speed.
 - b. Condensate Sensor / humidity sensor switch
 - c. Motion Sensor Control

2.02 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Greenheck Fan Corporation, Loren Cook, PennBarry.
- 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; with wheel and inlet cone.
- D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Provide variable frequency drive (VFD). The motor shall be rated for use with a VFD.
 - 3. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 4. Companion Flanges: For inlet and outlet duct connections.
 - 5. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
 - 6. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.03 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.04 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room

Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment Mounting:
 - 1. Install power ventilators on cast-in-place concrete equipment base(s).
 - 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. Refer to architectural specification sections for installation of roof curbs.
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
- G. The ceiling exhaust fan shall be supported from construction above, not ceiling tiles or ceiling runners or grids. Connect to ductwork and extend ductwork to the perimeter of the building.
- H. Each fan shall be connected to ductwork with a flexible connection.
- I. Kitchen exhaust fan shall be installed within the requirements of NFPA.
- J. Any steel shall be primed with Rustoleum and coated with 2 coats of enamel paint.

3.02 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 in electrical sections.
- D. Connect wiring according to in electrical sections.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: On systems greater than 5,000 CFM, engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- 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. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel

- free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. 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.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION

SECTION 23 37 13.13 - AIR DIFFUSERS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
 - 2. Perforated diffusers.
 - 3. Louver face diffusers.
 - 4. Linear slot diffusers.
 - 5. Louvers
 - 6. Air Filters
- B. Related Requirements:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
 - 2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.
 - 3. The SMACNA Low Velocity Duct Manual, ASHRAE Handbooks, International Mechanical Code, and NFPA Pamphlet 90A shall apply to this work.
 - 4. Refer to Section 23 31 13 Ductwork.

1.02 WORK INCLUDED

- A. Provide labor, material, equipment, and supervision necessary to install a complete air handling system with all supply and return distribution devices as indicated on the drawings and specified herein.
- B. Contractor is to furnish and install a volume damper in all supply, return, exhaust, and outside air branch ductwork. If these are omitted from the drawings, the contractor is to make an allowance to install one.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Submit manufacturer's literature and performance data of equipment and devices for review.
- C. Samples; Furnish at request of A/E.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with manufacturer's warranty requirements.
- B. Provide adequate supervision of labor force to see that installations are correct.

PART 2 - PRODUCTS**2.01 RECTANGULAR AND SQUARE CEILING DIFFUSERS**

- A. Furnish and install terminal air diffusers of the size and capacity indicated on the drawings.
- B. Room terminal air velocity shall not exceed 50 fpm. NC level shall not exceed 40. Air static pressure drop shall not exceed 0.10" wg.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Anemostat
 - 2. Carnes Company.
 - 3. Hart & Cooley Inc.
 - 4. Krueger.
 - 5. METALAIR, Inc.
 - 6. Nailor Industries Inc.
 - 7. Price Industries.
 - 8. Titus.
 - 9. Tuttle & Bailey.
- D. Devices shall be specifically designed for variable-air-volume flows.
- E. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
- F. Finish: Baked enamel, white
- G. Face Size: 12 by 12 inches for up to 150 cfm, 24 by 24 inches for all other size.
- H. Face Style: Plaque.
- I. Mounting: Each diffuser shall have a mounting flange specifically selected for the particular type of ceiling finish. Contractor to coordinate with architectural ceiling details.
- J. Pattern: Fixed
- K. Dampers: Radial opposed blade
- L. Accessories:
 - 1. Equalizing grid.
 - 2. Plaster ring.
 - 3. Sectorizing baffles.
 - 4. Operating rod extension.
- M. Performance shall be tested in accordance with ASHRAE 70-2006 (RA 2011).

2.02 LOUVER FACE DIFFUSERS

- A. Furnish and install terminal air diffusers of the size and capacity indicated on the drawings.
- B. Room terminal air velocity shall not exceed 50 fpm. NC level shall not exceed 40. Air static pressure drop shall not exceed 0.10" wg
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Anemostat
 - 2. Carnes Company.
 - 3. METALAIR, Inc.
 - 4. Nailor Industries Inc.
 - 5. Price Industries.
 - 6. Titus.
 - 7. Tuttle & Bailey.
- D. Devices shall be specifically designed for variable-air-volume flows.
- E. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
- F. Finish: Baked enamel, white
- G. Face Size: 24" x 24"
- H. Mounting: Each diffuser shall have a mounting flange specifically selected for the particular type of ceiling finish. Contractor to coordinate with architectural ceiling details.
- I. Pattern: Fixed
- J. Pattern: One-way, Two-way, Two-way corner, Three-way or Four-way core style.

- K. Dampers: Radial opposed blade
- L. Accessories:
 - 1. Square to round neck adaptor.
 - 2. Adjustable pattern vanes.
 - 3. Throw reducing vanes.
 - 4. Equalizing grid.
 - 5. Plaster ring.
 - 6. Sectorizing baffles.
 - 7. Operating rod extension.
- M. Performance shall be tested in accordance with ASHRAE 70-2006 (RA 2011).

2.03 LINEAR SLOT DIFFUSERS

- A. Furnish and install linear type air diffusers of the lengths and capacities indicated on the drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Anemostat Products; a Mestek company.
 - 2. Carnes Company.
 - 3. Hart & Cooley Inc.
 - 4. Krueger.
 - 5. METALAIR, Inc.
 - 6. Nailor Industries Inc.
 - 7. Price Industries.
 - 8. Titus.
 - 9. Tuttle & Bailey.
- C. Devices shall be specifically designed for variable-air-volume flows.
- D. Material - Shell: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
- E. Material - Pattern Controller and Tees: Aluminum.
- F. Finish - Face and Shell: Baked enamel, black.
- G. Finish - Pattern Controller: Baked enamel, black.
- H. Finish - Tees: Baked enamel, white.
- I. Slot Width: 1 inch
- J. Number of Slots: One, Two, Three or Four
- K. Length: As noted in the Air Device Schedule
- L. Accessories: Plaster frame for drywall or plaster ceilings

2.04 LOUVERS

- A. Louvers shall be extruded aluminum with 12 gauge blades and frames 2" deep up to 12" in height. 4" deep from 12" to 36" in height, and 6" deep above 36" in height. Louvers shall be storm proof design and shall not pull rain through the blades at the capacity required by the system.
- B. Furnish a bird screen on each louver mounted at the inside face.
- C. Frames shall be miter welded with reinforced corners.
- D. Louver finish shall be determined by the architect. Contractor to coordinate.
- E. Manufacturer: American Warming and Ventilating, Ruskin, Greenheck and Pottorff, United Enertech.

2.05 AIR FILTERS

- A. Refer to drawings and schedules for certain air filtration requirements for various systems.
- B. These filters are to be installed in air handling equipment if the equipment is capable of receiving them. If not, the contractor shall install the filters in a filter frame with gasketed doors on the entering side of the unit. The filter frame in either case shall provide an airtight fit with gaskets.

- C. Furnish and install a red oil manometer for each filter of efficiency of 30 percent or more and with a range of 0 to 30 inches water gage. Gauge to be Dwyer Instruments, Inc.
- D. The filter shall meet a minimum of MERV (xx) @ 2000 cfm (500 fpm) per ASHRAE Standard 52.2-2007 and shall be required to meet the same MERV-A value when tested per "Appendix j" of the aforementioned Standard. A filter with a MERV -A value lower than the MERV rating is not acceptable.
- E. Manufacturers: CAMFIL/FARR Co., ECO Air Filters, Flanders, American Air Filter.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install diffusers level and plumb.
- B. Supports: Galvanized steel per SMACNA.
- C. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- D. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

3.03 LOUVERS

- A. Louvers shall be set plumb in wall openings left by general contractor.
- B. Coordinate openings with G. C.
- C. Louvers shall be anchored in masonry construction.
- D. Frames shall be caulked watertight. Color of caulking shall be acceptable to the architect.
- E. Connections to wall louvers shall be sloped down to louver connection to prevent water draining into interior.

3.04 FILTERS

- A. All filters shall be clean prior to acceptance by the owner. Renewable media filters shall be replaced with new filters. Cleanable filters shall be removed and cleaned just prior to acceptance.
- B. Provide one spare set of replaceable filters for each system to the owner prior to acceptance of the work.

END OF SECTION

SECTION 23 37 13.23 - REGISTERS AND GRILLES**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Adjustable blade face registers and grilles.
 - 2. Fixed face registers and grilles.
- B. Related Requirements:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
 - 2. Section 233713.13 "Air Diffusers" for various types of air diffusers.
 - 3. The SMACNA Low Velocity Duct Manual, ASHRAE Handbooks, International Mechanical Code, and NFPA Pamphlet 90A shall apply to this work.
 - 4. Refer to Section 23 31 13 Ductwork.

1.02 WORK INCLUDED

- A. Provide labor, material, equipment, and supervision necessary to install a complete air handling system with all supply and return distribution devices as indicated on the drawings and specified herein.
- B. Contractor is to furnish and install a volume damper in all supply, return, exhaust, and outside air branch ductwork. If these are omitted from the drawings, the contractor is to make an allowance to install one.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Submit manufacturer's literature and performance data of equipment and devices for review.
- C. Samples; Furnish at request of A/E.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with manufacturer's warranty requirements.
- B. Provide adequate supervision of labor force to see that installations are correct.

PART 2 - PRODUCTS**2.01 REGISTERS**

- A. Furnish and install terminal air registers of the size and capacities indicated on the drawings.
- B. Adjustable Blade Face Register:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anemostat Products; a Mestek company.

- b. Carnes Company.
 - c. Krueger.
 - d. METALAIR, Inc.
 - e. Nailor Industries Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.
- 2. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
- 3. Finish: Baked enamel, white.
- 4. Face Blade Arrangement: Horizontal, spaced -1/2 inch centers for return and exhaust and 3/4 inch centers for supply, single set at 45 degrees for return or exhaust and double deflection adjustable for supply. Reinforced corners, mitered.
- 5. Core Construction: Removable.
- 6. Rear-Blade Arrangement: Vertical, spaced 1/2 inch centers for return and exhaust and 3/4 inch centers for supply.
- 7. Frame: 1 inch wide.
- 8. Mounting Frame: Provide separable frames in drywall, plaster, or masonry construction as noted on the architectural drawings.
- 9. Mounting: Countersunk screw
- 10. Damper Type: Adjustable opposed blade
- C. Fixed Face Register
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes Company.
 - c. Krueger.
 - d. Nailor Industries Inc.
 - e. Price Industries.
 - f. Titus.
 - g. Tuttle & Bailey.
 - 2. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
 - 3. Finish: Baked enamel, white.
 - 4. Face Blade Arrangement: Horizontal, spaced 1/2 inch centers for return and exhaust and 3/4 inch centers for supply, single set at 45 degrees for return or exhaust and double deflection adjustable for supply. Reinforced corners, mitered.
 - 5. Face Arrangement: Perforated core.
 - 6. Core Construction: Removable.
 - 7. Frame: 1 inch wide.
 - 8. Mounting Frame: Provide separable frames in drywall, plaster, or masonry construction as noted on the architectural drawings.
 - 9. Mounting: Countersunk screw
 - 10. Damper Type: Adjustable opposed blade
 - 11. Accessory: Filter.
- D. Furnish and install turning vanes for connections to ducts.
- E. Where registers are located low near floor, they shall be heavy duty 14 gauge steel with fixed 45 degree blades on 1/2" centers. In damp areas, they shall be extruded aluminum.
- F. Where drawings indicate linear return grilles, they shall be linear extruded aluminum with 1/8" bars 3/4" long on 1/4" centers.

2.02 GRILLES

- A. Furnish and install terminal air registers of the size and capacities indicated on the drawings.
- B. Adjustable Blade Face Grille:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes Company.
 - c. Krueger.
 - d. METALAIRE, Inc.
 - e. Nailor Industries Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.
 - 2. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
 - 3. Finish: Baked enamel, white.
 - 4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
 - 5. Core Construction: Removable.
 - 6. Rear-Blade Arrangement: Horizontal, spaced 1/2 inch centers for return and exhaust and 3/4 inch centers for supply, single set at 45 degrees for return or exhaust and double deflection adjustable for supply. Reinforced corners, mitered.
 - 7. Frame: 1 inch.
 - 8. Mounting Frame: Provide separable frames in drywall, plaster, or masonry construction as noted on the architectural drawings.
 - 9. Mounting: Countersunk screw.
 - 10. Accessories:
 - a. Filter.
- C. Fixed Face Grille
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes Company.
 - c. Krueger.
 - d. Nailor Industries Inc.
 - e. Price Industries.
 - f. Titus.
 - g. Tuttle & Bailey.
 - 2. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
 - 3. Finish: Baked enamel, white
 - 4. Face Blade Arrangement: Horizontal, spaced 1/2 inch centers for return and exhaust and 3/4 inch centers for supply, single set at 45 degrees for return or exhaust and double deflection adjustable for supply. Reinforced corners, mitered.
 - 5. Face Arrangement: Perforated core.
 - 6. Core Construction: Removable.
 - 7. Frame: 1 inch
 - 8. Mounting Frame: Provide separable frames in drywall, plaster, or masonry construction as noted on the architectural drawings.
 - 9. Mounting: Countersunk screw.
 - 10. Accessory: Filter.
- D. Furnish and install turning vanes for connections to ducts.

- E. Where registers are located low near floor, they shall be heavy duty 14 gauge steel with fixed 45 degree blades on 1/2" centers. In damp areas, they shall be extruded aluminum.
- F. Where drawings indicate linear return grilles, they shall be linear extruded aluminum with 1/8" bars 3/4" long on 1/4" centers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Supports: Galvanized steel per SMACNA.
- C. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- D. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 81 27 - DUCTLESS SPLIT SYSTEM**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 23 05 00 for requirements which are applicable to this section.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to furnish, install, and place into operation ductless split systems as specified herein.
- B. Power wiring will be provided under the Electrical portion of the work.
- C. Control wiring shall be furnished under this portion of the work.
- D. Furnish ductless split system heat pumps or air conditioning units of the quantity, size and capacity shown on the equipment schedules.
- E. System shall be a complete factory package consisting of compressor, evaporator coil, fan and motor, condenser coil fan and motor and complete refrigeration and heat pump temperature controls, and interconnecting wiring and refrigerant piping.
- F. Unit shall be rated in accordance with latest version ARI Standard 380 and shall be U.L. listed.

1.03 SUBMITTALS

- A. Submit shop drawings of all equipment.
- B. Submit manufacturers' data sheets of capacity.
- C. Submit wiring diagrams of control system.
- D. Submit piping diagrams of refrigeration interconnection.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.

PART 2 - PRODUCTS**2.01 INDOOR UNIT**

- A. The unit shall have a self-diagnostic function, 3-minute time delay mechanism.
- B. Factory pre-charge of R410A adequate for 33 feet of total length.
- C. The indoor units shall have a white, "flat screen" finish.
- D. The cabinet shall be supplied with a mounting plate to be installed onto a wall for securely mounting the cabinet.
- E. The cabinet includes an "intelligent-eye" motion sensor capable of setting back the set point temperature for energy savings. This feature may be disengaged on the wire remote controller.
- F. The evaporator fan shall be an assembly consisting of a direct-driven fan by a single motor. The fan shall be statically and dynamically balance and operate on a motor with permanent lubricated

bearings.

- G. The return air filter provided will be a removable and washable filter.
- H. The evaporator coil shall be a nonferrous, aluminum fin on copper tube heat exchanger with factory pressure tested.

2.02 OUTDOOR UNIT

- A. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be complete factory assembled and pre-wired with all necessary electronic and refrigerant controls.
- B. The cabinet shall be Ivory White with a finished powder coated backed enamel paint.
- C. The fan shall be a direct drive, propeller type fan.
- D. The motor shall be inverter drive, permanently lubricated type bearings, inherent.
- E. The fan shall be capable of operating in "silent operation" which lowers the outdoor fan speed in either cool, heat or auto modes.
- F. A fan guard is provided on the outdoor unit to prevent contact with fan operation.
- G. The outdoor coil shall be nonferrous construction with corrugated fin tube.
- H. The compressor shall be a rotary swing inverter-driven compressor.
- I. The outdoor unit shall have an accumulator, four-way reversing valve.
- J. The compressor shall have an internal thermal overload.
- K. The outdoor unit can operate with a maximum vertical height difference of 49 feet and overall maximum length of 66 feet without any oil traps, liquid or suction line changes.

2.03 REMOTE CONTROLLER

- A. Microprocessor technology with remote controller with LCD display.
- B. Operation Mode Setting (Heat, Auto, Cool/Dry).
- C. Temperature setting (in units of two degrees Fahrenheit)
- D. Self-Diagnostic Display.
- E. Room Temperature Display.
- F. Twenty-Four Hour On/Off Timer.
- G. Fan Speed Indicator.
- H. Auto/Speed Vane Operation
- I. Memory (for storing operation functions)
- J. Low Ambient Operation
- K. Whisper-Quiet Operation
- L. EMS Gateway Available to Management System via RS-232 Cable.

2.04 MANUFACTURERS

- A. Manufacturer: Daikin or equal by Mitsubishi, Sanyo, EMI.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install units in accordance with manufacturer's instructions.
- B. Mount compressors on Neoprene pads on roof curbs.

- C. Mount indoor unit on concealed blocking for additional support.
- D. Install pre-charged refrigerant lines through manufactured roof curbs by Pate or equal. Maintain watertight integrity of penetration.

END OF SECTION

SECTION 23 81 27 - SPLIT-SYSTEM HEAT PUMP**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.03 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.06 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: One year(s) from date of Substantial Completion.
 - c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier Corporation.
 2. Daikin
 3. Lennox Industries, Inc.
 4. Trane.
 5. YORK; a Johnson Controls company.

2.02 INDOOR UNITS (5 TONS OR LESS)

- A. Concealed Evaporator-Fan Components:
1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
 2. Insulation: Faced, glass-fiber duct liner.
 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
 4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
 5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
 6. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 8. Filters: Permanent, cleanable.
 9. Condensate Drain Pans:
 - a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 2 inches deep.
 - b. Single-wall, galvanized-steel sheet.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: NPS 1.5-inch
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
 - e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
 10. Condensate overflow switch
 11. Low leakage Cabinet (Qleak) less than 2%.

2.03 OUTDOOR UNITS -5 TONS OR LESS

- A. Air-Cooled, Compressor-Condenser Components:
 - 1. 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.
 - 2. 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.
 - a. Compressor Type: Scroll.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant Charge: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
 - 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
 - 4. Fan: Aluminum-propeller type, directly connected to motor.
 - 5. Motor: Permanently lubricated, with integral thermal-overload protection.
 - 6. Low Ambient Kit

2.04 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Section 230933 Automatic Temperature Control or 230933 Building Automation System
- B. Solid-State Thermostat: Wall-mounted programmable, microprocessor-based unit with automatic switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, vacation mode, and battery backup protection against power failure for program settings. Automatic-reset timer to prevent rapid cycling of compressor.
- C. Refrigerant Line Kits For 5 Tons and Under: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- D. Drain Hose: For condensate.

PART 3 - EXECUTION

3.01 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 support curbs.
- D. Equipment Mounting:
 - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). The base shall be a minimum of 4" thick and set on 6"s of crushed stone.
 - 2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
 - 3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Coordinate the electrical requirements of the unit with the electrical contractor prior to ordering or installing the equipment.
- F. Furnish and install all controls and control wiring. Wiring shall be in accordance with the NEC. Control wiring above the roof shall be in galvanized steel conduit with watertight fittings.

- G. Installations shall be in accordance with the instructions of the manufacturer and meet all requirements.
- H. Protect and be responsible for equipment until accepted in place by the owner.
- I. Provide condensate drain and discharge to a suitable discharge point which shall be acceptable to the owner and A/E.
- J. Contractor shall interlock the air handling unit controls with the remote condensing unit and electric resistance heaters. Contractor is to furnish and install an air proving switch or current sensor at the air handler's blower and be interlocked with the associated condensing unit and electric resistance heater controls to shut down if power to the blower is disconnected.
- K. All filters shall be new at time of acceptance by the owner.

3.02 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.
- C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- 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.
- E. Any equipment marks, blemishes, scratches, abrasions, or other surface imperfections shall be sanded, primed, and refinished to match adjacent surfaces.
- F. No equipment will be accepted by the owner which has rust, corrosion, or otherwise in progress.
- G. Equipment shall not be used for temporary heat unless separately negotiated with the owner.
- H. All bare ferrous metal shall be painted prior to acceptance.

3.04 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 23 82 19 - FAN COIL UNITS (IEC)**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 23 05 00 for requirements which are applicable to this section.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to install and place into operation the fan/coil units shown on the drawings and specified herein.

1.03 SUBMITTALS

- A. Submit shop drawings of fan/coil units.
- B. Submit manufacturers' data sheets of performance characteristics.
- C. Submit wiring diagrams of controls.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Provide adequate supervision of labor force to see that installations are correct.
- C. Coils shall be tested in accordance with ARI Standard 410-2001. Each coil shall be factory tested for leakage at 300 psig air pressure with coil submerged in water. Insulation and adhesive shall meet NFPA-90A requirements for flame spread and smoke generation. Base or "standard" units shall be UL listed.

PART 2 - PRODUCTS**2.01 MANUFACTURER**

- A. Basis of design shall be fan coils by International Environment Corporation. Equivalents by Trane, Carrier, York or prior approved equal.

2.02 CONFIGURATION

- A. General:
- B. Factory assembled vertical fan coil units complete with water coil, fan, motor, drain pan, and all required wiring, piping and controls.
- C. FHY, LHA, LHW Floor Hideaway Units:
 - 1. Cabinet shall be made of heavy gauge galvanized steel.
 - 2. Interior surfaces shall be lined with ½" thick fiberglass Tuf-Skin® II (½" Tuf-Skin Exact-OKote, ½" foil face, or ¼" closed cell) insulation.
 - 3. Units shall be supplied with a 1" collar for duct connection.
 - 4. Units shall have a combination condensate drain pan and fan deck constructed of 16-gauge

- galvanized (stainless) steel and extending the entire length of the unit.
- 5. Galvanized drain pans shall be coated with a 2-part closed cell foam insulation.
- 6. Units shall have 1" throwaway (permanent or pleated) filters.
- D. FXY, FSY, LXA, LHW Floor Exposed Units:
 - 1. Units shall be constructed of heavy gauge galvanized steel.
 - 2. The interior surfaces shall be lined with ½" thick fiberglass Tuf-Skin® II (½" Tuf-Skin Exact-O-Kote, ½" foil face, or ¼" closed cell) insulation.
 - 3. Cabinet shall have an Arctic White (or the color specified on the equipment schedule) powder-coat finish.
 - 4. Cabinet shall be free standing with two access doors (or no access doors).
 - 5. Top panel shall be supplied with a stamped (double deflection, steel or aluminum FXY, FSY only) supply grille.
 - 6. Top panel on the FSY unit shall slope down from back to front at an angle of 25 degrees.
 - 7. Standard stamped (or reverse-stamped grille) on the FSY unit shall provide discharge into the room at a nominal 60 (or 30) degrees from the vertical.
 - 8. Galvanized drain pans shall be coated with 2-part closed cell foam insulation.
 - 9. Units shall have 1" throwaway (permanent or pleated) filters.
 - 10. Optional tamper proof fasteners shall be installed on cabinet control doors.

2.03 CERTIFICATION

- A. Safety: Units shall be listed by Underwriters Laboratories, Inc. with the C-UL-US listing indicating the units comply with the minimum requirements of the U.S. and Canadian national product safety standard, UL 1995/CSA C22.2 No. 236.
- B. Capacities: Coil capacities are tested in accordance with ARI Standard 410-2001.

2.04 MATERIALS

- A. Coils: All coils shall have ½" copper tubes, manual (or automatic) air vents, and aluminum fins, 10 fins per inch spacing. Coil fins shall be mechanically bonded to copper tubes. Copper tubes must comply with ASTM B-75. Fin thickness shall be 0.0045" and tube thickness shall be 0.016". All coils shall be leak tested with air at 300 psig under water.
 - 1. For installation in a 2-pipe system, unit shall be equipped with:
 - a. 3-row coil (or 4-row on FHY, FXY, FSY) as shown on equipment drawings.
 - b. 2 ball valves
 - c. 1 control valve
 - 2. For installation in a 4-pipe system, unit shall be equipped with:
 - a. 2/1 (LHA, LXA), 3/1, 3/2 or 4/1 (FHY, FSY, FXY) row-split coil, as shown on equipment drawings.
 - b. 4 ball valves
 - c. 2 control valves
- B. Motorized control valves:
 - 1. Shall be rated at 300 psig.
 - 2. Shall be rated to operate with fluid temperatures between 40°F and 190°F.
- C. Fans:
 - 1. Fans shall be direct-drive, double-width fan wheels with
 - 2. forward-curved blades.
 - 3. Blower wheels shall be statically and dynamically balanced.
 - 4. Scrolls and fan wheels shall be constructed of galvanized steel.
 - 5. Shall be easily removable.
- D. Fan Speed and Temperature Control: 3 (high, medium, low) or 2 (high, low) speed control, (off, on, auto), (wall or unit) (auto or manual) thermostat.

- E. Motors:
 - 1. Motors shall be 3 speed, single phase, 60 Hz permanent split capacitor type for 115 (208, 230, or 277) volts, permanently lubricated, with sleeve bearings.
 - 2. Motors shall be equipped with quick connect electrical plugs.
 - 3. Motors shall have thermal overload protection with automatic reset.
- F. Controls and Safeties:
 - 1. Controls: Unit shall be furnished with a 3-speed, 4-position fan switch (on a wall plate for field installation).
 - 2. Safeties: Unit fan motor shall be equipped with integral thermal protection.
- G. Operating Characteristics:
 - 1. A 2-pipe system shall be capable of providing heating or cooling as determined by the operating mode of the central water supply system.
 - 2. A 4-pipe system shall be capable of providing heating and cooling on demand.
- H. Electrical Requirements:
 - 1. Standard unit shall operate on 115V (208, 230, or 277V), single phase, 60Hz electrical power, and all exposed wiring shall be in flexible conduit.
- I. Option and Accessories:
 - 1. Unit shall be equipped with sheath electric heaters for total or auxiliary electric heat as specified on the equipment schedule.
 - a. Heaters shall be protected by an automatic reset safety cutout switch and a fusible link.
 - b. Heater capacity shall be as specified on the equipment schedule.
 - c. Heaters shall be single phase, 120, 208, 240 or 277 volts as specified on the equipment schedule.
 - d. For total electric heat, unit controls shall include a sequenced heating/cooling thermostat in lieu of the heating/ cooling thermostat and automatic changeover device.
 - e. A junction box and fuse shall be factory furnished and installed to protect the motor and control circuit when electric heaters are installed in a unit with a single power source.
 - 2. Service switch shall be factory installed.
 - 3. Units shall be equipped with 24V controls.
 - 4. Units shall be equipped with high level condensate switch.
 - 5. Factory installed outside air damper shall be motorized (FHY, FXY, FSU only) or controlled manually.
 - 6. Wall panels, painted with specified color, shall be furnished for top discharge or front discharge recessed unit (FHY).
 - 7. Outside air wall boxes shall be furnished for field installation.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install with galvanized steel drain pan with condensate drain to suitable discharge point.
- B. Provide ball valves on water connections.
- C. Provide 2 or 3-way control valves as indicated.
- D. Install with flexible duct connections.
- E. Provide clearance for filter removal.
- F. Suspend horizontal units on vibration isolating hangers.

END OF SECTION

SECTION 23 82 30 - CONVECTORS, EXTENDED FIN RADIATION, UNIT HEATERS**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 23 05 00 for requirements which are applicable to this section.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to install and place into service the convectors, radiators, and unit heaters described in these specifications.

1.03 SUBMITTALS

- A. Submit shop drawings of all equipment.
- B. Submit manufacturers' data sheets of equipment capacity.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install systems and equipment in accordance with the IBC 2003 Code and the National Electrical Code.

PART 2 - PRODUCTS**2.01 BASEBOARD EXTENDED FIN RADIATION**

- A. Size and capacity as indicated on drawings.
- B. 3/4" copper tube 2 1/8" X 2 5/16 .007" aluminum elements, 51 FPF.
- C. Enclosure with baked enamel finish, damper assembly, front panel, element guide.
- D. Complete with inside and outside corners, front splices, end caps and end pieces.
- E. 600 BTU per foot at 180 deg. 4 GPM.
- F. Weil McLain Model 75WLT-3 ThermaTrim Baseboard.

2.02 CONVECTORS

- A. Furnish and install convectors of the size and capacity indicated on the drawings. Convectors shall be recessed, semi-recessed, wall, or floor mounted as indicated. Cabinets shall be 16 gauge steel front and top with 20 gauge steel enclosures. Cabinets shall be phosphatized and painted inside and out with one coat of combination light beige prime finish baked on. A baked enamel finish in a color selected by the Architect from manufacturer's color chart shall be provided.
- B. Recessed and semi-recessed models shall be provided with a matching steel wall frame which shall overlap the opening edges and remain permanently in place. The cabinet front shall fit into a

gasketed recess to form a flush front cabinet line on recessed models. Front panels shall be fastened with tamper proof Allen head machine screws.

- C. Access panels shall be provided for access to control and shut off valves.
- D. Convectors fed from below shall be provided with a brass air chamber vent assembly.
- E. Heating elements shall be 1/2 inch round seamless copper tubes with aluminum fins and 1 inch seamless copper headers. Tubes shall be mechanically expanded into fin spacing collars and silver solder brazed to the headers. Header tapping's shall be 3/4 inch FPT. Heating elements shall be tested at 320 PSI hydrostatic pressure.
- F. Convectors shall have inlet and outlet grilles die formed with directional louvers.

2.03 EXTENDED FIN RADIATION

- A. Furnish and install extended fin radiation of the size and capacity indicated on the drawings.
- B. Units shall be wall mounted with 20 gauge steel back plate extending the full height of the enclosure.
- C. Elements shall be copper tube mechanically expanded into .018" thick aluminum fins.
- D. Enclosures shall be 16 gauge steel.
- E. Provide end caps, outside corners, inside corners, and end enclosure with access door.
- F. Slope top units shall have expanded steel discharge grille.
- G. Units shall have extruded aluminum top grilles.
- H. Manufacturers; Airtherm, Vulcan, Slant-Fin, Trane, Standard Fin Pipe.

2.04 UNIT HEATERS - CABINET TYPE

- A. Wall mounted, recessed, or semi-recessed as indicated on the drawings.
- B. Seamless copper tube elements, filters and filter rack, direct drive fans, double extended shaft. Fan and motor mounted on a single motor board, die formed fan housing.
- C. Front panels removable, acoustically insulated, access door to motor, end piping compartment, 16 gauge cabinets, inlet grille in base, and 2 way adjustable discharge grille.
- D. Manufacturers; Airtherm, Vulcan, Slant-Fin, Trane.

2.05 UNIT HEATERS - PROPELLER TYPE

- A. Wall mounted or ceiling mounted propeller type as indicated on the drawings.
- B. Seamless copper tube elements with plate fins, direct drive fan, permanently lubricated split capacitor motor.
- C. Manufacturers; Airtherm, Vulcan, Slant-Fin, Trane.
- D. Casings phophatized and painted with baked enamel.
- E. Horizontal and vertical adjustable louvers.

2.06 FLOOR RECESSED EXTENDED FIN.

- A. Floor recess formed by others.
- B. Install heating element, bracket, baffles and supports along with all necessary pipe, valves and fittings.
- C. Continuous baffle 20 gauge steel.
- D. 16" x 1 1/2" brackets at maximum 4'-0" on center.
- E. Capacity as scheduled on the drawings.
- F. Furnish and install top extended aluminum bar grille to span opening. Provide steel angle iron recessed frame.
- G. Paint brackets, baffles, elements and piping flat black. Paint inside of trench flat black.
- H. Manufacturer: Vulcan, Sterling, or approved equal.

2.07 PERIMETER RADIATION - FIELD BUILT ENCLOSURES

- A. Furnish and install wall mounted extended fin radiation complete with valves, fittings, brackets and supports.
- B. Element and tube size as indicated on the drawings.
- C. Copper tube, aluminum fin elements tested at 300 psi.
- D. Extruded aluminum discharge grille with .162" bars on 1/2" centers. 67% free area cross bars on 6" centers. Vulcan type VA or equal.
- E. Enclosure fabricated as detailed on the architectural drawings.

2.08 PEDESTAL RADIATION

- A. Single width units shall be 6 1/4" wide, double width shall be 11 3/16" wide by 5 1/4" high with 3 7/8" pedestals, 18 gauge front and back panels.
- B. Units shall have extruded top grille.
- C. Units shall have copper tube, aluminum fin coils of the size and capacity indicated on the drawing.
- D. Units shall be available in a choice of 8 baked enamel colors.
- E. Units shall be Trane Type E3A.

PART 3 - EXECUTION**3.01 CONVECTORS, RADIATION, AND UNIT HEATERS**

- A. Provide rough opening information to the General Contractor to allow for proper wall openings during construction.
- B. Field measure each existing recessed opening for the actual dimension of the required convector. Provide a shop drawing indicating the room number of each space, the opening size, and the type of convector to be provided in the recess. Indicate as to whether the convector is to be recessed, semi-recessed, wall, or floor mounted, and the heating capacity and conditions of performance.
- C. Provide a color chart for selection of color by the Architect.
- D. Install the convector or unit heater with 1 inch rigid fiberglass insulation behind and around the convector where placed in outside walls.
- E. Piping to all elements shall be provided with unions, an automatic control valve on the return side, flow measuring device set to the GPM quantity indicated in the schedule, and shut off valves for servicing.
- F. Provide a mockup of the first unit for review and acceptance by the A/E prior to installation of remaining units. This shall also be reviewed by the owner's representatives prior to further installations.

END OF SECTION

CONTENTS**DIVISION 26 - ELECTRICAL
DIVISION 27 - COMMUNICATIONS**

<u>SECTION</u>	<u>TITLE</u>
26 00 00	STANDARD CONDITIONS FOR ELECTRICAL WORK
26 01 26	EXISTING EQUIPMENT TO BE REUSED
26 05 26	GROUNDING SYSTEMS: GENERAL
26 09 00	LIGHTING CONTROLS
26 24 16	PANELBOARDS
26 27 00	BASIC MATERIALS AND EQUIPMENT
26 28 16	SAFETY SWITCHES - HEAVY DUTY
26 50 00	LED LIGHTING
27 05 28	LOW VOLTAGE CONDUIT SYSTEM

DIVISION 26 - ELECTRICAL**SECTION 26 00 00 - STANDARD CONDITIONS FOR ELECTRICAL WORK****PART 1 - GENERAL****1.01 REGULATIONS, CODES, STANDARDS**

- A. Reference Codes, applicable sections of the following codes and standards shall be considered as binding to the work of this project:
- | | |
|-------|---|
| NEMA | National Electrical Manufacturers' Association |
| NEC | National Electrical Code (NFPA 70) - 2017 Edition |
| NECA | National Electrical Contractors' Association |
| NEIS | National Electrical Installation Standards |
| EGSA | Electrical Generating Systems Association |
| IBC | International Building Code |
| NFPA | National Fire Protection Association |
| IEEE | Institute of Electrical and Electronics Engineers |
| UL | Underwriter's Laboratories, Inc. |
| IES | Illuminating Engineering Society |
| OSHA | Occupational Safety and Health Administration |
| ANSI | American National Standards Institute |
| ASTM | American Society for Testing and Materials |
| FM | Factory Mutual |
| IRI | Industrial Risk Insurers |
| ISO | Insuring Services Office |
| IPCEA | Insulated Power Cable Engineers Assoc. |
| ADA | Americans with Disability Act |
| NETA | InterNational Electrical Testing Association |
- B. All local codes to be incorporated.
- C. Latest adopted codes and latest editions of standards shall be the basis of conformance.
- D. Obtain and pay for all permits and inspections, and any associated charges.
- E. Inspection Agency Certificate of Inspection to be provided at completion of the work. Inspection by Middle Dept or other local inspection agency.
- F. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.
- G. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

1.02 SUBMITTALS

- A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
- B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the A/E. Submissions will be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.

- C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
- D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
- E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- F. Performance test data and wiring diagrams of all electrical equipment.
- G. Submissions shall include warranties by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, shall be combined in a single brochure with all items being furnished clearly identified.
- H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and coordinated with all other trades.
- I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified so as to be clear on what is being provided.
- J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.
- K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150/hr billable to the contractor.

1.03 SUBSTITUTIONS

- A. Substitution of other than specified manufacturers shall not be allowed after bid date.
- B. Prior approval is required for other manufacturers. If the contractor wishes alternate materials or equipment be considered, he must submit information at least 10 days before bid date. If acceptable, an addendum will be issued which will allow the contractor to utilize the alternate.
- C. Samples shall be provided when directed by the architect or engineer.
- D. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service by the engineer at the rate of \$150.00/hr. for such services. Also, billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval or rejection.
- E. If the contractor elects to submit alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the drawings and specifications, it is the contractor's responsibility to coordinate the work with other trades and pay for any associated costs with the substitution or change.
- F. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to

the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and equipment in manufacturer's original cartons or on skids.
- B. Store materials in dry enclosure out of way of work progress.
- C. Protect equipment, fixtures, and lenses after placement.

1.05 REFERENCE

- A. Requirements established within the portions of this Project Manual titled Division 1, General Requirements are collectively applicable to the work of this section.
- B. Instructions to Bidders, Special Conditions and Addenda as issued are part of this specification.
- C. Electrical drawings along with all other project drawings represent the work of this Division.
- D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section,
- E. by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

1.06 WORK SUMMARY

- A. Provide labor, materials, equipment and supervision necessary to install complete operating electrical systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the require work.
- B. Contractor shall provide all demolition necessary to remove, replace, repair, install new or modify existing work whether it be walls, floors, ceilings, structure, mechanical or electrical required to install his work. Contractor shall replace all work to leave in a finished condition. Pipe, conduit, ductwork and wiring shall be cut back behind wall surfaces above ceilings and below floor levels so that a patch can be placed over the opening.
- C. Demolition:
 - 1. Contractor shall disconnect and remove the entire existing electrical system including panels, fixtures, transformer, conduit, wiring, supports, fasteners, starters, fire alarm devices and wiring, telephone equipment and wiring, battery packs, switches, outlets and devices within the renovation area.
 - 2. Electrical contractor shall verify all existing conditions prior to commencing work.
 - 3. Remove branch circuits back to the power source or the nearest device to remain active. Restore all circuits interrupted by the demolition work to maintain circuit continuity.
 - 4. Tag all circuits which become spares as a result of demolition. Update the effected panelboard directories.
 - 5. Relocate existing branch circuits which interfere with new construction whether specifically identified or not. Refer to architectural drawings for new walls, structure, millwork, etc. which may require existing conduit, wire, etc. to be relocated.
 - 6. It is the intent that power remain active in adjacent areas during the construction. Contractor is to modify existing wiring arrangement to comply.
 - 7. All equipment and appurtenances removal are to be disposed of properly. Refer to local, state and federal requirements.
- D. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every

feature and detail of the work.

- E. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
- F. Provide roof penetrations for electrical work and all associated roof work.
- G. Provide addressable fire alarm system with battery backup, (horn/strobes) (speaker/strobes), pull stations, detectors, strobes, duct detectors, remote annunciator, telephone auto dialer, fire fighter phones, and all associated controls and appurtenances.
- H. Provide fire alarm system with battery backup, horns, strobes, pull stations, annunciator panel, duct detectors, and all associated controls and appurtenances.
- I. Provide exit and emergency lighting throughout with emergency power supply in addition to normal power.
- J. Provide power to HVAC and plumbing equipment as necessary to have complete operating systems.
- K. Provide lighting throughout, with exterior lighting at all exit doors.
- L. Provide site lighting for all parking areas, roadways, walkways, as well as security lighting.
- M. Provide telephone conduit system. Provide (2) CAT 3 plenum rated telephone cables from the telephone demarcation point to the fire alarm control panel for the auto dialer.
- N. Provide Uninterruptible Power Supply System (UPS) with input filter, transformer, battery, and all associated controls and appurtenances.
- O. Provide grounding system for facility in accordance with the National Electrical Code.
- P. Provide addressable security system with battery backup, intrusion detection sensors, signal equipment, system controls, alarm displays, alarm indicating devices, telephone auto dialer, and manual keypads to change system status and associated cable and appurtenances.
- Q. Provide closed circuit television system to monitor all entrances and exits complete with monitors, cameras, tilt/pan controller, 16 channel multiplexers, cable and appurtenances.
- R. Provide communication/sound throughout complete with controller, receivers, CD/tape decks, microphones, speakers, antennae, loudspeakers, equipment racks, associated cable and appurtenances.
- S. Base bid is to provide all primary cable, transformer coils, busways, switchboards, panelboards and all feeders as copper conductors. Alternate bid is to provide all as aluminum conductors of equivalent current carrying capacity.
- T. Provide code required signage (i.e., NEC 110.34, NEC 700.8, and 695.4 B3).
- U. Provide third party certification of all packaged systems by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399 as well as Pamphlet #70 and National Electrical Code Article 90-7.
- V. Refer to Commissioning of Systems Specification for additional scope of work.

1.07 SITE INSPECTION

- A. Visit site, inspect, and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of a bid will be deemed evidence of having complied with this requirement. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.
- C. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

1.08 UTILITY CONNECTION AND CHARGES

- A. The contractor shall be responsible for coordination of the work with the Electric Utility Company.

Make arrangements in a timely fashion for connection of the service.

- B. The Electrical Contractor shall be responsible for utility connection charges, meter charges, and other installation charges as may be applied, by the local utility company.
- C. Contact the utility company during the bidding period for connection charges and include same with bid.
- D. Provide connections, terminations, hand holes, manholes, pads, transformers, vaults, conduits, wiring, and all required materials and labor as may be required by the utility company to obtain service for the facility. Any costs for service work shall be included with the bid.

1.09 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
- B. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.
- C. If there is a conflict between the drawings and specifications it is to be understood that the more strict or more expensive interpretation shall govern. Also, if a conflict exists between specification sections or between drawing plans and details, it is to be understood that the more strict or more expensive interpretation shall govern.
- D. The architects or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.
- E. If a question arises after bidding the A/E interpretation shall govern.
- F. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.

1.10 MINIMUM INTEGRATED EQUIPMENT SHORT CIRCUIT RATING:

- A. Where the contract documents indicate secondary service from the utility Company (208/120V, 3 phase or 480/277V, 3 phase) available short circuit currents including system motor contribution (amperes RMS symmetrical) at the line terminals of the UL service entrance labeled main distribution panelboard or switchboard, shall be in accordance with the following tabulation:

Service Minimum	Service Entrance	Panelboard Rating	Transformer Rating
KVA	%Z	208/120	480/277
75	1.5	14,500	10,000
112.5	1.5	22,000	10,000
150	1.5	29,000	13,000
225	1.5	43,000	19,000
300	1.5	58,000	25,000
500	1.5	96,000	42,000
750	5.5	42,200	18,000
1000	5.5	56,100	24,500
1500	5.5	85,000	37,000
2000	5.5		49,000
2500	5.5		51,000

3000

5.5

73,500

-
- B. The Integrated Equipment short circuit rating of the MDP or switchboard shall meet or exceed the tabulated minimum values. This shall be construed to mean that the equipment withstands capability (bus bracing), and interrupting capacities of main and feeder devices, shall each meet or exceed the tabulated minimum values.
 - C. Service transformer ratings shall be as indicated on the drawings. If said ratings are not indicated, the contractor shall contact the engineer and/or utility company for clarification.
 - D. The only deviations from this tabulation that are permissible shall be the results of a short circuit study (if and as specified in Section 26 05 73 Power System Studies), or documented data from the utility company.

1.11 PROGRESS SCHEDULE

- A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

1.12 COST SCHEDULE

- A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.
- B. AIA forms are required for this submission.

1.13 OFFICE

- A. The contractor shall set up his job office (desk) where directed by the owner.

1.14 STORAGE

- A. Material shall be stored only where directed by the owner.

1.15 SANITARY

- A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
- B. Toilet will be located where directed by the owner.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials and equipment shall be new and in present production of major manufacturers.
- B. All materials and equipment shall be in conformance with accepted trade standards as a minimum. Where specifications exceed any minimum standard, the specifications shall govern.
- C. Reference of equipment in the singular shall be deemed to apply to as many such items as may be required to complete the work.
- D. The word "provide" means "furnish and install complete, tested, and adjusted as necessary with all accessories, circuiting, switching, lenses, mounting hardware, cover plates, hangers and supports".

2.02 FASTENERS AND SUPPORTS

- A. All work shall be securely fastened to building construction.
- B. Utilize toggle or machine bolts in hollow construction.
- C. Utilize machine screws for steel construction.
- D. Utilize expansion shields for masonry construction.
- E. Utilize lag bolts for wood construction.
- F. All fasteners shall be galvanized or plated with rustproof finish.
- G. Maximum load on fasteners shall be at a safety factor of 4 to 1 for a tested sample.

2.03 MOTOR STARTERS AND CONTACTORS

- A. Single phase manual motor starters with overloads shall be provided under the electrical portion of the work for fractional horsepower motors up to ½ HP.
- B. Polyphase motor starters and motor starters above ½ HP shall be furnished under other portions of the work.
- C. The starters in A or B above shall be installed under the electrical portion of the work.
- D. Polyphase starters shall be magnetic combination type, across-the-line electrically operated, electrically held, three pole assemblies, with arc extinguishing characteristics, silver to silver renewable contacts, 3 pole thermal bi-metallic, red run pilot light, individual phase protection, with overload heaters matched to motors installed and with 4 auxiliary contacts, Hand-Off-Auto switch, and control transformer.
- E. For single phase motors above ½ HP provide magnetic combination, single phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120 volt control transformer with dual primary fusing, auxiliary contacts.
- F. Starters shall be as manufactured by G.E., Cutler Hammer, Siemens, Square D or Allen Bradley.
- G. Contactors shall be across the line, electrically operated, mechanically held 3 pole assemblies for tungsten and ballast lighting loads. Acceptable manufacturers: GE, Cutler Hammer, Siemens, Square D or Allen-Bradley.
- H. Manual motor starters without overloads in NEMA 1 enclosure equal to G. E. Type TC shall be used for the following load:
 - 1. 30 amperes or less continuous
 - 2. 1 hp or less at 120 volts
 - 3. 2 hp or less at 240 volts

2.04 MANUFACTURERS' NAMES

- A. Manufacturers' names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer's name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being names in the specification. Any deviations from this must be acknowledged at bid time by the supplier and he shall be solely responsible for any and all costs associated with the application of his product in the project.
- B. A design cannot be prepared which accommodates the installation of all suppliers and is not intended to do so. If certain modifications must be made to accommodate one particular supplier's equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

PART 3 - EXECUTION

3.01 WELDING

- A. All electric power for arc welding shall be supplied by the contractor performing the work.

3.02 VEHICLES

- A. Vehicle access to the site will be as directed by the owner.

3.03 RUBBISH DISPOSAL

- A. Except for items or materials identified to be reused, salvaged, reinstalled, or otherwise indicated to remain property of the owner or tenant, demolished materials shall become the contractor's property and shall be removed, recycled or disposed from the project site in an appropriate and legal manner.
- B. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

3.04 WORKMANSHIP

- A. Maintain all public walks and access ways.
- B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.
- C. Plug or cap open ends of piping systems and conduit.
- D. Stored materials shall be covered to prevent damage by inclement weather, sun, dust or moisture.
- E. Protect all installed work until accepted in place by the owner. Protect lighting fixtures.
- F. Do not install plates, covers, and other finished devices until masonry, tile, and painting operations are complete or protect otherwise.
- G. Protect all existing or new work from operations which may cause damage such as hauling, welding, soldering, painting, insulation and covering.
- H. All devices and exposed raceways are to be plumb and true. All exposed raceways in finished areas are to be coordinated with the architect/engineer prior to installation.

3.05 SCAFFOLDING

- A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

3.06 SITE UTILITIES

- A. The contractor may use the existing water and electric power for temporary construction needs.
- B. The owner will direct where these services may be tapped.
- C. Those services that are used during construction, but are to remain, shall be refurbished to a new condition before turning back to the owner.

3.07 CLEAN-UP

- A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from fixtures and equipment.
- B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
- C. Remove all trash and debris from the premises.

3.08 LUBRICATION

- A. Furnish and install and maintain all required lubrication of any equipment operated prior to acceptance by the owner. Lubrication shall be as recommended by the equipment manufacturer.
- B. Provide one year's supply of lubricants to owner at date of acceptance.
- C. Verify that required lubrication has taken place prior to any equipment start up.

3.09 EQUIPMENT START UP

- A. Verify proper installation by manufacturer or his representative.
- B. Advise A/E 2 days prior to actual start up.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to A/E.

3.10 OPERATING INSTRUCTIONS AND MANUALS

- A. Properly and fully instruct owner's personnel in the operation and maintenance of all systems and equipment.
- B. Insure that the owner's personnel are familiar with all operations to carry on required activities.
- C. Such installation shall be for each item of equipment and each system as a whole.
- D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, owners' personnel, vendor, and that a full operating and maintenance manual has been reviewed.
- E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. 3 manuals shall be provided to owner.
- F. Submit manuals for review prior to operating instruction period. Manuals shall be 8 1/2" x 11" with hard cover suitably bound.
- G. Provide to the owner any special tools necessary to operate any of the equipment.

3.11 PENETRATION SEALING

- A. All penetrations of Natatorium walls, fire walls, smoke walls, and floors shall be sealed around conduits and wiring to prevent the flow of gases or smoke.
- B. The sealant shall be foamed in place between the conduit or wiring and the adjacent walls and floors with DOW Corning RTV foam or Fire Stop Caulk.
- C. All penetrations through roof structure shall be coordinated with other trades to minimize the potential for water seepage and leakage through such penetrations.
- D. When electrical boxes located on opposite side of a fire resistance rated wall assembly are within 24" horizontally of each other, both devices are to be wrapped with Spec Seal Putty Pads as manufactured by Specified Technologies, Inc. or approved equivalent.

3.12 EQUIPMENT SETTING

- A. Furnish and install as a minimum, a 4" thick concrete pad beneath all floor mounted equipment.
- B. Furnish and install as a minimum, spring vibration isolators under any equipment 10 HP and over and rubber-in-shear vibration isolation under all equipment less than 10 HP.
- C. Reinforce concrete with No. 4 rods 12' on center both ways.
- D. Pad to have 3/4" dowels into concrete at 1 per 4 square feet.

3.13 INSTALLATION MOUNTING HEIGHTS

- A. To be verified by Architect, but in general shall be as follows (top of device elevation above finished floor):

Lighting switches, controls:	3 ft. 10 in.
Duplex receptacles:	1 ft. 8 in.
Duplex receptacles over counters:	+8" above countertop
Telephone data wall plate and modular jack, desk phone:	1 ft. 8 in.
Telephone, data wall plate and modular jack, wall phone:	3 ft. 10 in.
Special outlets:	As required for equip.
Fire alarm annunciating devices:	85"
Fire alarm manual pull stations:	3 ft. 10 in.
Clock receptacles:	As indicated on dwgs.
CATV wall plates and modular jacks:	1 ft. 8 in.
CATV wall plates and modular jacks mounted near ceiling:	Coordinate mounting height with Architect.
Thermostats (forward reach):	3 ft. 10 in.
Thermostats (side reach):	3 ft. 10 in.
Thermostats with lockable cover:	4 ft. 6 in.

Requirements of the Americans with Disability Act and/or ANSI A117.1 shall be met.

- B. Structural and mechanical details shall be coordinated before roughing in.

3.14 COORDINATION

- A. Coordinate with work of other trades prior to installation.
B. Arrange for minor variations for complete coordinated installation. Provide all necessary offsets to install the work and to provide clearances for other trades.

3.15 CUTTING AND PATCHING

- A. Provide for cutting and patching for all electrical work.
B. Patching to be performed by tradesmen skilled in the particular trade.
C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

3.16 BALANCING AND TESTING

- A. Electrically balance connected loads in panels.
B. The entire wiring system shall be tested to be free from grounds and faults.
C. Identify all circuits and all phase wiring at terminations.

3.17 EQUIPMENT FURNISHED BY OTHERS

- A. This contractor shall make final electrical connections to equipment furnished by other contractors or the owner.
B. Provide electrical service and disconnects as required by code to supply such equipment.

3.18 EXCAVATION, SHORING, PUMPING, BACKFILLING

- A. Perform all excavation required to install the work. Deposit excavated material as so not to create a slide hazard.
- B. Maintain excavations free of water.
- C. Backfill with clean material and pneumatically tamp in 8 inch layers. Remove excess material, including rock, from site or as directed by the A/E.
- D. Return to original conditions any areas disturbed for excavation.
- E. Install all work neat, trim, and plumb with building lines.
- F. Install work in spaces allocated.
- G. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

3.19 RECESSES

- A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment or devices which is to be recessed in walls.
- B. Make offsets or modifications as required to suite final locations.

3.20 LABELING

- A. All equipment panels, controls, safety switches, and devices shall be provided with permanent black laminated micarta white core labels with 3/8 inch letters.
- B. This shall also apply to all controllers, remote start/stop pushbuttons, equipment cabinets, and where directed by the A/E.
- C. This shall not apply to individual room thermostats, and local light switches.

3.21 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of 1 year of operation from date of acceptance by the owner unless otherwise specified.
- B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.

3.22 AS BUILT DRAWINGS

- A. At the completion of the work and prior to final payment, the contractor shall furnish a reproducible as-built drawing to the A/E for approval. The drawings shall indicate all work installed and its actual size, location and identify all systems installed with locations of concealed devices, conduit, piping and other equipment and complete wiring diagrams of all systems. If acceptable, the A/E will submit the as-built drawings to the owner as record drawings. If not acceptable, the A/E will return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
- B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.
- C. To aid in the preparation of as-built drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150/hr. billable to the contractor.

3.23 SAMPLE CONSTRUCTION

- A. (One double and one single patient room) (one apartment) (one tenant space) shall be constructed and approved by the owner, architect/engineer, and local code officials (electrical inspector or underwriter, building code official, fire marshal) before all other rooms are constructed.
- B. This room shall represent the standard against which all others will be constructed.
- C. Installation will include all units, ducts, piping, wiring, fixtures, devices, etc. which are required for complete rooms.

3.24 MAIN ELECTRICAL ROOM DRAWING

- A. Provide 3/8" = 1'-0" scale drawings of the Main Electrical Room indicating all electrical, mechanical, plumbing, telephone, security, fire alarm and life safety equipment to be installed within this room. Exact dimensions of equipment, pads, etc., are to be indicated. Show two cross sections at important points.
- B. Obtain information from other subs as appropriate.
- C. Submit for review and approval along with electrical equipment submittals. Equipment will not be approved prior to review of this drawing.

3.25 WORK COMPLETION

- A. The contractor shall promptly correct work rejected by the engineer or failing to conform to the requirements of the contract documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

3.26 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

- A. All RFI's shall include the following information based on AIA Document G716:
 1. To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
 2. Provide a description with specification and/or drawing references.
 3. Provide the senders recommendation including cost and/or schedule considerations.
 4. Provide receiver's reply space.
 5. Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

3.27 SHOP DRAWING REQUIREMENTS

- A. The following is a list of required shop drawings for this project.

ELECTRICAL	DATE REC'D	ACTION	DATE REC'D	ACTION
Basic Materials and Equipment (Section 26 05 00 and 26 27 00)				
High Voltage Cable and Equipment				
Fusible Switchboard (Section 26 24 13)				
Panelboards (Section 26 24 16)				

ELECTRICAL	DATE REC'D	ACTION	DATE REC'D	ACTION
Bus Duct (Section 26 25 00)				
Safety Switches - (Section 26 28 16)				
Automatic Transfer Switch (Section 26 36 23)				
Secondary Unit Substation (Section 26 11 16)				
Packaged Meter Centers (Section 26 27 13)				
Transformers (Section 26 22 00)				
Surge Suppression (Section 26 43 13)				
Lighting (Section 26 50 00 and 26 09 00)				
Lightning Protection (Section 26 41 13)				
Emergency Power System (Section 26 30 00)				
Static Uninterruptible Power Supply (Section 26 33 53)				
Fire Alarm and Detection Systems (Section 28 30 00)				
Low Voltage Systems (CCTV, Security, DATA, Phone Entry, etc.)				
As-Builts				
Warranties				
Maintenance Manuals				
Instructions				
Ground Test				

END OF SECTION

SECTION 26 01 26 - EXISTING EQUIPMENT TO BE REUSED**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 26 00 00 for requirements which are applicable to this section.
- B. Refer to National Electrical Testing Association Standards, particularly NETA MTS-1997 and NETA ATS-1999.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to refurbish existing equipment as specified herein and place into operation.
- B. All work and accessories required to perform the intended work is to be included in the scope of work.

1.03 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturer's recommendations.
- B. Install systems and equipment in accordance with present applicable codes.
- C. Provide adequate supervision of labor force to see that installations are complete and correct.
- D. Testing Agency's Field Supervisor and/or Technicians are to be certified according to NETA ETT-2000.

1.04 SCOPE

- A. It is the intent to totally refurbish existing equipment to as-new operating condition and efficiency. All parts to be made operable, corrosion removed, repainted, adjusted, cleaned, lubricated, and repaired as necessary.
- B. Schedule outages with Owner - Minimize downtown. Have parts and supplies for repairs available beforehand.

PART 2 - PRODUCTS**2.01 PARTS**

- A. Replacement parts shall be manufactured by the original equipment supplier or approved substitute. Any substitute to be submitted to the engineer before use.

PART 3 - EXECUTION

3.01 PANELS BOARDS, SWITCH BOARDS, LOAD CENTERS

- A. Visually inspect enclosures, bus and all cable terminations. Report signs of cable overheating, insulation degradation, excessive moisture, rust, etc.
- B. Clean, wire brush and paint with Rustoleum/Gavanoleum to match existing, all corroded and rusted areas.
- C. Undo cable terminations, as necessary, clean with approved electrical cleaner, and reconnect to manufacturers recommended torque.
- D. Replace existing circuit breakers with new breakers of similar AIC ratings. This applies to all circuit breakers 100 Amps or less and more than 20 years old.
- E. Switchboard fused switches are to be cycles on/off several times to ensure operability. Lubricate pivot point as necessary as recommended by the manufacturer.
- F. Provide fuse clamps to each fused switchboard switch in excess of 100 Amps.

3.02 TRANSFORMERS

- A. Visually inspect enclosure, bus or cable terminations. Report signs of cable overheating, insulation degradation, excessive moisture, rust, etc.
- B. Clean, wire brush and paint with Rustoleum/Gavanoleum to match existing, all corroded and rusted areas.
- C. Undo cable terminations, as necessary, clean with approved electrical cleaner, and reconnect to manufacturers recommended torque.
- D. Vacuum coils, core and enclosure. Blow out with dry Nitrogen.
- E. Meggar transformer - Report test results and return to operation.

3.03 UNINTERRUPTIBLE POWER SUPPLY

- A. Contact a manufacturer recommended service technician to perform tests, inspection, maintenance etc.
- B. Replace components as necessary to ensure proper operation.

3.04 SAFETY SWITCHES

- A. Visually inspect enclosure, bus or cable terminations. Report signs of cable overheating, insulation degradation, excessive moisture, rust, etc.
- B. Clean, wire brush and paint with Rustoleum/Gavanoleum to match existing, all corroded and rusted areas.
- C. Cycle switch on/off to ensure operability. Lubricate pivot point as necessary as recommended by manufacturer.
- D. Replace switch as necessary.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING SYSTEMS: GENERAL**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of system described in other Sections.
- B. Related Sections include the following:
 - 1. Division 26 Section "Lightning Protection" for additional grounding and bonding materials.

1.03 SUBMITTALS

- A. Product Data - For the following:
 - 1. Ground rods.
 - 2. Chemical rods.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- C. Field Test Reports: Submit written test reports to include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Comply with UL 467.
- C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Chance/Hubbell
 - b. Copperweld Corp.
 - c. Erico Inc.; Electrical Products Group.
 - d. Framatome Connectors/Burndy Electrical
 - e. Galvan Industries, Inc.
 - f. Ideal Industries, Inc.
 - g. Kearney/Cooper Power Systems.
 - h. Korns: C.C. Korns Co.; Division of Robroy Industries.
 - i. Lyncole XIT Grounding.
 - j. O-Z/Gedney Co.; a business of the EGS Electrical Group.\
 - k. Racor, Inc.; Division of Hubbell.
 - l. Salisbury: W.H. Salibury & Co.
 - m. Superior Grounding Systems, Inc.
 - n. Thomas & Betts, Electrical

2.02 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Section 26 27 00.
- B. Material: Aluminum, copper-clad aluminum, and copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two band of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
 1. Solid Conductors: ASTM B 3.
 2. Assembly of stranded Conductors: ASTM B8.
 3. Tinned Conductors: ASTM B33.
- H. Copper Bonding Conductors: As follows:
 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules: 1-5/8" wide and 1/16" thick.
 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules: 1-5/8" wide and 1/16" thick.
- I. Aluminum Bonding Conductors: As follows:
 1. Bonding Cable: 10 strands of No. 14 AWG aluminum conductor 1/4" in diameter.
 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded aluminum conductor.
 3. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules: 1-5/8" wide and 1/16" thick.
- J. Ground Conductor and Conductor Protector for Wood Poles: As follows:
 1. No. 4 AWG aluminum, soft-drawn copper conductor.
 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.
- K. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.03 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes and combinations of conductors and connected items.

- B. Bolted Connectors: Bolted-pressure type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
- B. Ground Rods: Section type; copper-clad steel.
 - 1. Size: 5/8 in diameter.
- C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
 - 2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
- F. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.02 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
 - 1. Feeders and branch circuits.
 - 2. Single-phase motor branch circuits.
 - 3. Three phase motor branch circuits.
- D. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- E. Bond metal parts, motor frames, fittings, plumbing pipes, drains, metal conduit, metal surfaces within 5', and all electrical devices and controls within 5'.
- F. Motors shall be grounded by means of a grounding conductor in the same raceway with the motor feeder connected to the grounding bushing at the motor terminal box and the ground bus in the motor control center or to the incoming conduit grounding bushing of an individually mounted motor

starter.

3.03 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

3.04 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
 - 1. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- F. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.05 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance

- level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81. (Ensure that the test is performed with all ground -to -neutral bonds broken. The grounding system must be completely isolated for the test to be valid.)
3. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 09 00- LIGHTING CONTROLS**PART 1 - GENERAL****1.01 REFERENCE**

- A. This section includes manually operated, digital lighting controls with external signal source, relays, and control module.
- B. Refer to Section 26 00 00 for other requirements of this section.
- C. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.
- D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- F. Comply with NFPA 70.
- G. Refer to 26 27 00 for other lighting controls (switches, motion sensors, etc.)

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to furnish and install complete, operating, lighting control system specified herein.

1.03 SUBMITTALS

- A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
 - 1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - 2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
 - 3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
- C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and system specified in other Sections.
 - 1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
 - 2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet inter-operability requirements of the network protocol.
 - 3. Show equipment locations on floor plans of similar scale as contract documents.
- D. Field quality control test reports.
- E. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
- F. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

1.04 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
 - 1. Match components and interconnections for optimum performance of lighting control functions.
 - 2. Coordinate lighting controls with HVAC controls. Design display graphics showing building areas controlled; include the status of lighting controls in each area.
 - 3. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

1.05 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of software input/output to execute switching or dimming commands.
 - b. Failure of modular relays to operate under manual or software commands.
 - c. Damage of electronic components due to transient voltage surges.
 - 2. Warranty Period: Two years from date of Substantial Completion.

1.06 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Leviton Mfg. Company Inc.
 - 2. Lighting Control & Design, Inc.
 - 3. Lightolier Controls; a Genlyte Company.
 - 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 5. Lutron Electronics Company, Inc.
 - 6. MicroLite Lighting Control Systems.
 - 7. Watt Stopper (The).

2.02 SYSTEM REQUIREMENTS

- A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.
- B. Performance Requirements: Manual switch operation, an internal timing and control unit and external sensors, send a signal to Programmable system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits to groups of lighting fixtures or other loads.

2.03 CONTROL MODULE

- A. Control Module Description: Comply with UL 916 (CSA C22.2, No. 205); Microprocessor based, solid-state, 365-day timing and control unit. Control units shall be programmable and capable of receiving inputs from indicated sensors and hand-held programmer. Output circuits shall be pilot-duty relays compatible with power switching devices. Output circuits shall include digital circuits arranged to transmit control commands to remote preset dimmers. Modules and their associated control panels shall include the following features:
1. Multichannel output.
 2. Multiple inputs and multichannel output arrangements.
 3. Multiple inputs for occupancy sensors, daylight sensors, and dimming systems with associated daylight sensors.
- B. * Control Module Description: Comply with UL 508 (CSA C22.2, No. 14); Microprocessor based, programmable, control unit; mounted in preassembled, modular relay panel. Low-voltage-controlled, latching-type, single-pole lighting circuit relays shall be prime output circuit devices. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays. Control units shall be capable of receiving inputs from sensors and other sources. Line-voltage components and wiring shall be separated from low-voltage components and wiring by barriers. Control module shall be locally programmable.

2.04 POWER DISTRIBUTION COMPONENTS

- A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.
1. Cabinet: Steel with hinged, locking door.
 - a. Barriers separate low-voltage and line-voltage components.
 - b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
 - c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
 2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.
 - a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
 - b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
 - c. Endurance: 50,000 cycles at rated capacity.
 - d. Mounting: Provision for easy removal and installation in relay cabinet.

2.05 MATERIALS

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 27 00 Section "Basic Materials."
- B. Class 1, 2, and 3 Control Cables: Multi-conductor cable with copper conductors as recommended by the manufacturer.
- C. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable.
- D. Manual Controllers: Comply with Division 26 27 00 Section "Basic Materials."

PART 3 - EXECUTION

3.01 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install wiring in raceways except where installed in accessible ceilings.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- E. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

3.02 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Test for circuit continuity.
 - 2. Verify that the control module features are operational.
 - 3. Check operation of local override controls.
 - 4. Test system diagnostics by simulating improper operation of several components.

3.03 SOFTWARE INSTALLATION

- A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

3.04 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls and software training for PC-based control systems.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for additional requirements of this section.
- B. Refer to requirements of the National Electrical Code, UL, and the NFPA.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment and supervision necessary to furnish and install panelboards as specified.

1.03 SUBMITTALS

- A. Submit manufacturers shop drawings of all equipment specified in this section.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturers' warranty requirements.

PART 2 - PRODUCTS**2.01 DISTRIBUTION PANELBOARDS (MDP or PP)**

- A. GENERAL - Furnish and install distribution and power panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.
- B. BUSSING ASSEMBLY AND TEMPERATURE RISE - Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Bus shall be plated copper.
- C. CIRCUIT BREAKERS - Circuit breakers shall be equipped with individually insulated, braced and protected connectors. Circuit breakers shall be flush with each other. Tripped indication shall be clearly shown. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Mechanical lugs are to be copper. For 480 V applications over 1000 Amp, the main breaker is to include electronic trip with LSIG characteristics.
- D. EQUIPMENT SHORT CIRCUIT RATING (FULLY RATED) - Each panelboard shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
- E. ARC ENERGY REDUCTION – Where circuit breakers rated 1200A or higher are installed, provide arc flash mitigation documentation to those authorized to design, install, operated, or inspect the installation. Provide energy-reducing maintenance switching with local status indicator as means to reduce clearing time of the fuses or the breakers.
- F. CABINET - Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of

steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel. Baked enamel finish electro-deposited over cleaned phosphatized steel.

- G. SAFETY BARRIERS - The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.
- H. UL LISTING - Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When required, panelboards shall be suitable for use as service equipment.
- I. NAMEPLATES - Provide laminated black phenolic resin with white core with 3/16 inch high engraved lettered nameplates for each circuit breaker to indicate the feeder, panelboard and equipment served. Mounted, with plated screws, adjacent to or on front of the breaker.
- J. Panelboards shall be by Square D, Siemens, Cutler Hammer or ABB Group.

2.02 LIGHTING & RECEPTACLE PANELS (LP or RP)

- A. GENERAL - Furnish and install circuit breaker lighting panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic molded case circuit breakers with frame and trip ratings as shown on the schedule.
- B. CIRCUIT BREAKERS - Shall be quick-make, quick-break, thermal-magnetic, trip indicating and have common trip on all multipole breakers. Trip indication shall be clearly shown by the breaker handle taking position between "ON" and "OFF" when the breaker is tripped. Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker to prevent repeated arcing shorts resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V AC and carry the SWD marking. UL Class A ground fault circuit protection shall be provided on 120V AC branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker. A UL listed combination arc fault circuit interrupter (AFCI) shall be provided for all 120V, 15 or 20 Amp branch circuits as indicated on the plans or panelboard schedule or as required by the National Electrical Code. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for the branch circuit wiring. This breaker shall require no more panelboard branch circuit space than a conventional circuit breaker. Connections to the bus shall bolt-on.
- C. PANELBOARD BUS ASSEMBLY - Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Single phase, three-wire panelboard bussing shall be such that any two adjacent single pole breakers are connected to opposite polarities in such a manner that two pole breakers can be installed in any location. Three phase, four-wire bussing shall be such that any three adjacent single pole breakers are individually connected to each of the three different phases in such a manner that two or three pole breakers can be installed at any location. All current carrying parts of the bus assemble shall be plated copper. Mains ratings shall be shown in the panelboard schedule or on the plans.
- D. WIRING TERMINALS - Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type of conductor specified.
- E. CABINETS AND FRONTS - The panelboard bus assemble shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA and UL Standards.

The box shall be fabricated from galvanized steel or equivalent rust resistant steel.

Fronts shall include doors and have flush, cylinder tumbler-type locks with catches and spring-loaded stainless steel door pulls. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge steel.

**Front panel cover is to be door in door construction with piano hinge.

- F. EQUIPMENT SHORT CIRCUIT RATING (FULLY RATED) - Each panelboard shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
- G. UL LISTING - Panelboards shall be listed by Underwriters Laboratories and bear the UL label. Equal panelboards may be provided by Square D, G.E., Cutler Hammer, or Siemens.
- H. ELECTRONIC GRADE - Panels indicated to be electronic grade to have 200% rated neutrals, and an isolated ground bar in addition to the equipment ground bar.

PART 3 - EXECUTION

3.01 PANELS

- A. Tops not to exceed 72 inches above floor.
- B. Provide labeling and complete directories.
- C. Ductwork or piping shall not pass over panels.
- D. Space shall be clear 36" in front of panel floor to structural slab or roof above.
- E. All conduit entering the panel shall have a screwed hub with an insulated bushing and no sharp edges.
- F.
 - 1. Wires shall be labeled and neatly arranged in the wiring gutters with wires cut to proper lengths and neatly racked.
- G. Electronic grade panels shall have feeder neutrals rated at 200% to maintain the UL listing of the panel and be provided with isolated ground conductor back to service entrance or feeder transformer.

3.02 GROUNDING

- A. All panels shall be grounded to the building equipment grounding system per NEC 408.40. Ground resistance shall not exceed NEC values.

END OF SECTION

SECTION 26 27 00 - BASIC MATERIALS AND EQUIPMENT - NM and NMC**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for additional requirements of this section.
- B. Refer to NECA 1-2000 for general installation requirements.

1.02 SHOP DRAWINGS

- A. Provide shop drawings of all switches and receptacles in this section.
- B. Provide shop drawings of all specified items unless waived by the engineer.

PART 2 - PRODUCTS**2.01 NM, NMC CABLE**

- A. NEC; Article 334. NM: Flame and Moisture Resistant. NMC: Flame, moisture and corrosion resistant.
- B. Applications: Permitted for both exposed and concealed work in dry locations. Should be protected from physical damage. Not permitted in any dwelling or structure exceeding three floors above grade.

2.02 RIGID STEEL CONDUIT

- A. Steel, zinc coated Fed. Spec. WW-C-581d, ANSI C801. Fittings of malleable iron.

2.03 ELECTRICAL METALLIC TUBING (EMT)

- A. Galvanized steel, U.L. labeled, Fed. Spec. ANSI/UL797, ANSI C80.3. Fittings threadless compression type. Installation in accordance with Article 358 of National Electrical Code and U.L. General Information Card #FJMX. EMT shall be as manufactured by Allied Tube & Conduit Corp. or approved equal.

2.04 FLEXIBLE METALLIC CONDUIT

- A. Fed. Spec. AA-55810 Hubbell, Allied Tube and Conduit Corporation, AFC, Electri-flex Company.

2.05 RIGID SCHEDULE 40 PVC CONDUIT

- A. U.L. 651, ANSI/NEMA TC-2, Federal Military Spec. WC-1094A, U.L. listed for use in accordance with Article 352 of National Electrical Code. 90 deg. Wire Rated and Sunlight Resistant. Carlon Schedule 40 Electrical Conduit.

2.06 CONDUCTORS

- A. Type; THHN, 98% conductivity copper, 600 volt, dry locations. Type THWN for wet locations. Conductors shall be U.L. listed.
- B. Equipment terminations for circuits rated 100 Amps or less (#14 AWG - #1 AWG) shall be rated 60 degrees C (140 degrees F). Equipment termination for circuits rated over 100 Amps (#1/0 or larger) shall be rated 75 degrees C (167 degrees F). Refer to NEC for allowable exceptions. 90 degrees C (194 degrees F) rated conductors shall be used as indicated on the drawings or as indicated within these specifications.
- C. Solid copper conductors for #10 and #12 wire size. #8 and larger shall be stranded copper.
- D. All conductors shall be color coded as follows:
 - 120/208 Volt Systems
 - Phase A Black
 - Phase B Red
 - Phase C Blue
 - Neutral Grey or Natural White
- E. Minimize size conductor shall be #12 AWG except that #14 AWG shall be used for control wiring. All circuit conductors shall be run in the same raceway system.
- F. A grounding conductor shall be provided to each electrical device in accordance with the National Electrical Code.
- G. Conductor sizes shall be as shown on drawings and/or specified in this specification.
- H. Conductors shall not be installed in raceways until construction is advanced to allow conductors to be installed completely without damage to conductors and there is not possibility of water or other contaminants entering the raceway system. Conductors shall be installed between convenient terminating points.
- I. An approved pulling compound shall be used to assist in pulling of conductors.

2.07 JUNCTION BOXES

- A. Galvanized steel, accessible, Keystone, Hubbell, Penn Panel and Box Company or approved equal.

2.08 OUTLET AND SWITCH BOXES

- A. Galvanized steel, Crouse Hinds Co., Steel City Div, RACO Inc. or approved equal.

2.09 PLATES

- A. .040-inch-thick metal brushed stainless steel.
- B. Ivory painted steel.

2.10 RECEPTACLES

- A. Duplex, three wire grounding type. 20 Amp., 120V A.C., Federal Specification WC 896 596 Impact Resistant, Ivory, Leviton 5362, Cooper Wiring Devices, Pass & Seymour, Hubbell, or approved equivalent.

- * Those receptacles installed on the emergency system shall be clearly identifiable as distinct from normal system receptacles.
(RED)

2.11 GROUND FAULT CIRCUIT INTERRUPTING RECEPTACLES

- A. Furnish and install receptacles with ground fault circuit interrupters as indicated on plans and specifications.

- B. Receptacles shall be NEMA 5 - 20R configuration with 120V. ac 20 ampere circuit rating and ivory in color.
- C. GFCI Receptacle shall have Safe Lock protection.
- D. All receptacles shall be of such depth as to permit mounting in outlet boxes 1" or greater in depth without the use of spacers. Units shall have line and load terminal screws such that connection to load terminals will provide ground fault protection for other receptacles or loads connected to these terminals.
- E. All receptacles shall accept standard duplex wall plates.
- F. All receptacles shall be noise suppressed to reduce nuisances tripping and shall be Underwriters Laboratories listed.
- G. Exterior receptacles shall be waterproof.
- H. Pre-wired pigtail connectors that accommodate Fed. Spec. receptacles are approved. Must be crimped and welded terminal right angle application within the connector.
- I. Receptacle shall be Federal Specification, WC896 596 compliant. Marking should be clearly identifiable on face or strap.
- J. Manufacturers; Leviton- 6899 RGF15, RGF20, Hubbell, Cooper Wiring Devices, Pass & Seymour.

2.12 TAMPER RESISTANT RECEPTACLES

- A. UL Listed, Federal Specification WC 896 596 "tamper proof", in compliance with NEC 406.11 and 517.18 (C), three wire plug. The design of the tamper resistant receptacles may not incorporate any switching mechanisms. Available in both 15 and 20 Amp, 125 volt, 2 pole 3 wire grounding, in standard duplex configurations, as well as lighted face and isolated ground versions, as manufactured by Cooper Wiring Devices, or equivalent by Pass & Seymour, Leviton, or Hubbell. (For pediatric and psychiatric locations).

2.13 ISOLATED GROUNDING TYPE RECEPTACLES

- A. Type: 20 Amp. 125V A.C., Heavy Duty Grade, Grounded contacts in receptacle face isolated from mounting strap, Green dot and Orange triangle on each face. UL 498, Federal Specification WC 896 596. Ivory wall plates. Manufacturer: nylon, stamped "Isolated Ground" by Hubbell, Leviton, Cooper Wiring Devices, Pass & Seymour.

2.14 RECEPTACLES - FLOOR OUTLET

- A. Solid brass covered plate with matching flush fitting brass cap. Receptacle made of durable thermoplastic. Supplied with foam rubber gasket. O-ring and metal 18" cubic box. In compliance with UL 498 and Federal Specification WC 896 596. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.

2.15 SWITCHES

- A. Heavy duty, toggle handles, quiet, Ivory, 20 Amp, 120-277V A.C., Federal Specification WC 596 WS 896, Leviton CS 120-2, Cooper Wiring Devices, Pass & Seymour, Hubbell.

2.16 ROCKER SWITCHES

- A. 20 Amp., 120-277V A.C., Federal Specification WC 596 WS 896, specification grade, Ivory, quiet type, Leviton 5621-2, 5622-2, 5623-2 or 5624-2 or equivalent by Cooper Wiring Devices, Pass & Seymour, Hubbell.

2.17 LIGHTED ROCKER SWITCHES

- A. 20 Amp., 120-277V A.C., Federal Specification WC 596 WS 896, specification grade, ivory, quiet type, lighted rocker handles, Leviton 5628-2, 5638-2, 5629-2 or 5639-2 or equivalent by Cooper Wiring Devices, Pass & Seymour, Hubbell.

2.18 TIME DELAY SWITCH

- A. UL Listed, 120V
 - On: Light on and Fan on
 - Snap off: Light off and Fan runs for 0-10 min. adjustable.

2.19 AC MOTOR RATED SWITCH

- A. 30 A and/or 40 A, 600 V AC rated.
- B. Double pole or triple pole, single-throw.
- C. UL 508, UL 94 (flammability) Listed.
- D. All molded parts are made of thermoplastic material to assure superior resistance to repeated impact, chemical degradation, extreme temperature fluctuations, tracking and arcing.
- E. Positive-contact design enhances fast make/slow break mechanism by minimizing bounce and arcing upon contact closure and teasing upon separation.
- F. Free-travel toggle design protects closed contacts from accidental disengagement and contact teasing.
- G. Silver alloy contacts provide maximum conductivity and prolonged service life.
- H. Side and back wire terminal screws accept up to #10 AWG solid copper wire.
- I. For standard #8 AWG wire, remove terminal clamp and use ring terminal.
- J. Oversized #10, triple-combination, vibration-resistant terminal screws.
- K. Mounting yoke is made from nickel-plated brass for superior corrosion resistance.
- L. Insulating barriers between terminal screws provide isolation from each phase.
- M. Devices are permanently marked with catalog number, amperage, voltage and horse-power ratings to assist with identification.
- N. Large toggle provides positive actuation, even when operated with gloved hand.
- O. Leviton MS302 (30 A, 2 P), MS 303 (30 A, 3 P), MS402 (40 A, 2 P) or MS403 (40 A, 3 P) or equivalent by Cooper Wiring Devices, Pass & Seymour, Hubbell.

2.20 AIR CONDITIONING DISCONNECTS

- A. 30A or 60A 240 V Rated.
- B. Double – Pole
- C. UL 1429 (Non-Fusible), UL 94 (Flammability)
- D. Enclosure: Metallic
- E. Easy to remove high strength protective shield for easier wiring and mounting.
- F. Factory installed tamper resistant, weather resistant receptacles are available.
- G. Device accepts up to #2 stranded wire.
- H. Device shall be permanently marked with catalog number, amperage, voltage, and horsepower rating to assist in identification.
- I. Eaton DPU222R (60A-2 pole non-fused) or equivalent by Siemens, ABB Group, or Square D.

2.21 DIMMER SWITCHES

- A. UL listed, full range 2000 watt 120 volt, slide control, Lutron NT-2000 or equivalent by Leviton, Cooper Wiring Devices, Pass & Seymour, Hubbell.

2.22 MULTISERVICE RECESSED WALL BOX (FLAT SCREEN TVs, MONITORS)

- A. 3 gang box, plastic housing, white finish. Flush mount appearance allows for snug-to-wall placement of flat-screen TV or monitor.
- B. Surge-protective duplex power outlet and up to 12 multimedia connections.
- C. Position either line voltage or low voltage devices in all 3 openings.
- D. Low voltage connectors offer both terminated and pull-through capability so plugs and multimedia connections stay recessed behind the surface of the wall.
- E. Accepts standard TP wall plate.
- F. Legrand TV3WTVSSW. (ACTS standard)
- G. Acceptable Manufacturers: Hubbell, Thomas & Betts.

2.23 AC WIRED SMOKE ALARM

- A. Dual Sensor (Photo Electric and Ionization)
- B. 120V AC and 9V battery back-up.
- C. 85 dB at 10 ft. alarm.
- D. Five year warranty, UL Listed.
- E. Manufactured by Kidde P12000, BRK Electronics, First Alert or approved equivalent.

2.24 AC WIRED STROBE LIGHT

- A. Bright Candela Strobe Light, flash rate 1 Hz
- B. 120V AC
- C. Dual Mode (smoke and heat detectors cause steady flash; CO detectors cause intermittent flash)
- D. Five year warranty, UL Listed.
- E. Manufactured by Kidde SL177i, BRK Electronics, First Alert or approved equivalent.

2.25 AC WIRED CARBON MONOXIDE ALARM

- A. Electrochemical sensor.
- B. 120V AC and 9V battery back-up.
- C. 85 dB at 10 ft. alarm.
- D. Five year warranty.
- E. Manufactured by Kidde KN-COB-IC, BRK Electronics, First Alert or approved equivalent.

PART 3 - EXECUTION**3.01 WIRING DEVICES**

- A. Lighting outlet boxes to have fixture studs - 3/8 inch.
- B. Exterior boxes shall be gasketed and watertight.
- C. Switch and device plates to be mounted with all 4 corners touching adjacent surface.
- D. All devices to be installed true and plumb.
- E. Switch plates and receptacles shall not be placed back to back in adjacent rooms. Offset locations a minimum of 3 inches to restrict noise transfer. This shall also apply to TV outlets, telephone outlets, and data outlets.
- F. All devices on opposite side of a fire resistance rated wall assembly are to be separated by a horizontal distance of not less than 24 inches.

- G. Ground fault circuit interrupters shall be provided on all outdoor receptacle circuits, receptacle circuits within toilet and bathrooms, areas in close proximity to water, and wherever else indicated on the drawings or required by Code. While-in-use type covers are to be used in exterior wet locations.
- H. Tamper resistant receptacles are to be installed in day care areas, pediatric health care, psychiatric care as well as where indicated on the drawings. Refer to NEC 406.11 and 517.18 (C).
- I. Arc fault circuit interrupters shall be provided on all 15 Amp & 20 Amp receptacle circuits in dwelling unit bedrooms.
- J. AC smoke alarms within individual dwelling units are to be interconnected to allow annunciation of all devices in the event of an alarm signal from any one device. This system is to be testing in accordance with applicable code.
- K. Within accessible dwelling units the AC smoke alarms and the AC strobe lights are to be interconnected to allow visual annunciation of all devices in the event of an alarm signal from any one device. This system is to be testing in accordance with applicable code.
- L. Dimmer switch devices shall be appropriately sized for derating when a minimum of two or more are ganged together in a common wall box.

3.02 Wiring Methods

- A. Exposed interior wiring; EMT. Any raceway that is to be exposed in a finished area is to be coordinated with the architect/engineer prior to installation.
- B. Concealed wiring above suspended ceilings and in stud spaces; Type NM cable.
- C. Wiring in concrete slabs or decks; PVC conduit
- D. Exposed exterior wiring; Intermediate rigid conduit.
- E. Wiring below concrete slabs in earth; PVC conduit. * Provide GRS conduit sweep elbow through concrete slab.
- F. Service wiring; rigid steel conduit
- G. Concrete encasement; Secondary service from transformers to buildings.

3.03 GROUNDING

- A. All electrical equipment and systems shall be grounded.
- B. Grounding system shall consist of a ground bus bar connected to a driven ground rod. Utilize ground type clamp fitting.
- C. All connections to conduit, equipment and devices shall be made with compression type connections.
- D. The grounding system shall comply with the NEC.
- E. All outside lighting fixtures and poles shall be grounded.
- F. All equipment and devices shall be grounded in accordance with the manufacturer's recommendations.
- G. The ground system shall have a resistance of 25 ohms or less in compliance with the NEC.
- H. Furnish a ground system test report at the completion of the work.
- I. Substation area grounding shall be in accordance with local utility company standards.

3.04 POWER WIRING

- A. Wire between motors, starters, disconnects and source.
- B. Verify proper motor rotation.
- C. Furnish and install weatherproof disconnects, as indicated.
- D. All panel feeders shall be run in EMT raceway system.
- E. All wiring to roof top units, fans, equipment, and HVAC units shall be installed complete between panels and disconnect switches.
- F. Disconnects shall be mounted adjacent to electrical and mechanical equipment. Indoor installations

shall utilize NEMA 1 enclosures. Outdoor installations shall utilize NEMA 3R enclosures.

END OF SECTION

SECTION 26 28 16 - SAFETY SWITCHES - HEAVY DUTY

- * **Industrial, commercial, all 480 V applications.**

PART 1 - GENERAL**1.01 REFERENCE**

- A. Refer to section 26 00 00 for requirements which are applicable to this section.
- B. Refer to NFPA and in particular the National Electrical Code.
- C. Refer to NEMA, UL, and IEEE Standards.

1.02 WORK INCLUDED

- A. Provide all labor, material, equipment, and supervision necessary to furnish and install and place into operation safety switches where indicated on the drawings and specified herein.

1.03 SUBMITTALS

- A. Submit manufacturer's shop drawings of devices.

1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install systems and equipment in accordance with the National Electrical Code and local codes having jurisdiction.
- C. Provide adequate supervision of labor force to see that installations are correct.

PART 2 - PRODUCTS**2.01 HEAVY DUTY SAFETY SWITCHES****A. APPLICATION DATA**

- 1. 30-1200 amperes
- 2. 600 volts AC for 480 V applications
- 3. 240 Volt-AC for 208 V applications.
- 4. NEMA 1 - General Purpose, painted sheet steel
- 5. NEMA 3R - Rainproof, painted galvanized steel
- 6. Maximum - Time delay (dual element) fuse

B. CONSTRUCTION

- 1. Visible blades
- 2. Handle attached to box, not cover
- 3. Handle position indicates "ON" or "OFF"
- 4. Top hinged cover on NEMA 3R
- 5. Operating mechanism is quick-make, quick-break
- 6. Plated current carrying parts
- 7. Provisions for padlocking the switch in the "OFF" position
- 8. Class R fuse standard for 30 - 600 Amp switches.

- 9. Class L fuses standard for 800-1200 Amp switches.
- C. NEUTRAL AND GROUNDING
 - Provisions for field installation of solid neutral assembly.
 - Ground kits for field installation
- D. TERMINALS
 - UL listed for Al or Cu wires
 - UL listed for 60 deg. or 75 deg. C. wires
 - Meets UL 486 B requirements
- E. FUSE CLIPS
 - Spring reinforced
 - Plated
- F. APPLICATION
 - Fusible - Class R or Class L as indicated above
 - Not fusible
- G. NEMA STANDARDS
 - KS1 - 1975
- H. UL LISTING
 - UL 98 Enclosed Switches
 - Maximum HP ratings
- I. UL LISTED SHORT CIRCUIT RATING:
 - 200,000 RMS Symmetrical Amperes with proper rejection kit and Class R fuses.
- J. Acceptable Manufacturers:
 - 1. Siemens
 - 2. Cutler Hammer
 - 3. ABB Group.
 - 4. Square D

PART 3 - EXECUTION

3.01 SAFETY SWITCHES

- A. Furnish and install safety switches on all motors which do not have integral equipment disconnect devices, local starters and/or where indicated on the drawings.
- B. Furnish and install safety switches where indicated on the drawings.
- C. Safety switches shall be installed to meet the area classification as to standard, hazardous, rainproof, etc.
- D. Safety switches shall be installed securely to building structure or be provided with supplemental support steel such as angle iron or uni-strut when required to locate on other than building structure.
- E. All safety switches shall be grounded.

END OF SECTION

SECTION 26 50 00 - LIGHTING**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for other requirements of this Section.
- B. All work to conform to the National Electrical Code.
- C. Refer to standards of the Illuminating Engineering Society.
- D. All exit and emergency lighting shall comply with NFPA Life Safety Code 101, ADA, and other local codes as may apply.

1.02 SCOPE

- A. Furnish and install a complete and operating lighting system, including all luminaires, wiring, lamps, and 0-10V dimmable LED drivers.
- B. All lighting outlets shall have a fixture. If a fixture designation is missing, furnish and install a fixture in similar use in the project.
- C. All luminaires shall have a home run. If these are omitted on the drawings the contractor shall allow for a home run to the nearest appropriate panel.
- D. All rooms are to be provided with lighting controls. Provide manual switch and code required control devices as appropriate. If controls are not indicated within a space, controls are to be provided for the space in a similar manner as adjacent or similar spaces.
- E. Provide exit and emergency lighting as required by Code in all spaces to meet requirements of the AHJ. Allow for ten additional luminaires to be installed where directed by the AHJ.

1.03 MOUNTING

- A. The contractor shall be responsible for selecting mounting arrangements of luminaires to suit the construction or ceiling types. Contractor or his agent shall review architectural drawings to establish ceiling types prior to preparing shop drawings for submission. It is NOT to be understood that the fixture schedule accounts for the mounting types. Frequently ceiling types are changed after the fixture schedule has been completed.
- B. Luminaires shall be mounted on structurally secure supports. The contractor shall provide miscellaneous steel supports to span between structural elements to provide a base of support for the luminaires at the locations shown on the drawings. Refer to architectural and structural drawings for locations of beams, joists, purlins, etc.
- C. Exterior luminaires shall be mounted with anchor bolts of suitable size secured into concrete bases. The mounting arrangement shall be capable of withstanding a continuous wind of 100 mph with gales to 130 mph. EPA of fixture shall be rated with pole to provide required performance.

1.04 APPROVALS

- A. Furnish shop drawings and catalog cuts of all luminaires for review by the engineer prior to ordering.
- B. Provide samples of any particular fixture or luminaires when requested by the owner, architect, or engineer.
- C. Provide a point by point lighting level calculation for parking areas, areas when requested by the engineer, and for high profile areas (i.e., main lobbies, atriums, pools, gymnasiums, etc.), when an alternate manufacturer or fixture is being presented for approval. Calculation shall be provided by

the manufacturer or the local manufacturer's representative. Footcandle levels are to be indicated at a maximum of 10'-0" intervals (exterior) or 5'-0" intervals (interior). A drawing is to be provided at the same scale as the contract documents.

PART 2 - PRODUCTS

2.01 LUMINAIRE REQUIREMENTS

- A. Luminaires shall be complete with wiring, lamp holders, lamps, reflectors, glassware, canopies, shades, bases, pendants, etc.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Luminaires shall be wired with type AF fixture wire.
- D. Plastic lenses shall not be used. Provide either virgin acrylic, high impact polycarbonate or tempered glass or as specified in the fixture schedule. Lens thickness shall be a minimum of 1/8".
- E. Any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks either between fixture components or between fixture and adjacent surface.
- F. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.
- G. Hinged door closure frames shall operate smoothly and easily without binding when installed and latches shall function easily by finger action without the use of tools.
- H. Recessed luminaires installed in an insulated ceiling shall be listed for use in insulated ceilings.
- I. Luminaires in damp areas shall be gasketed, vapor tight, and fabricated with aluminum instead of steel. These luminaires shall have pressure clamping devices in lieu of latches.
- J. Luminaires located in other harsh environments are to be of suitable construction and finish for the intended environment in addition to the requirements listed in the Lighting Fixture Schedule.
- K. All fixture lenses shall, from the manufacturer, be shipped within a protective covering, i.e. plastic bag, paper wrapped, to prevent dust, dirt, smudges prior to final acceptance.
- L. Drivers shall be easily serviceable when installed and shall not be mounted to removable reflectors or wire way covers.
- M. Luminaires shall have a minimum CRI of 80 and a CCT of 3500 K.
- N. Luminaires shall have a rated lamp life of 50,000 hours to L70.
- O. Luminaires shall be dimmable from 100% to 10% of maximum output.

2.02 LED DRIVERS

- A. Shall be internal.
- B. Shall be designed for 10-year operational life.
- C. Shall be designed to withstand electrostatic discharges according to IEC 61000-4-2.
- D. Shall be furnished with poke-in wire trap connectors, color coded to ANSI standard C82.11.
- E. Shall operate from a line voltage range of 108 - 305 volts, 50/60 Hz.
- F. Input current shall have Total Harmonic Distortion (THD) of less than 20% with a power factor of >.90% to comply with ANSI standard C82.11
- G. Shall meet UL 8750, UL 1012, and UL 1310 as applicable in NFPA compliant installations.
- H. Shall have no visible output change at $\pm 10\%$ line voltage input.
- I. Shall have a Class A sound rating (inaudible at 27dBA ambient noise level).
- J. Shall have a universal input voltage (120-277V/ 50-60Hz).
- K. Shall be Underwriters Laboratories (UL) Listed (Class P) and CSA Certified where applicable and

rated for use in air handling spaces.

- L. Shall carry a five year warranty from the date of manufacture for operation at a case temperature of 75°C or less. When operated at a case temperature between 75°C and 85°C, the warranty shall be three years from the date of manufacture.

2.03 LED EQUIVILANT LAMPS

- A. LED: ENERGY STAR Certified, NRTL compliant, FM Global compliant. Recessed luminaires shall comply with NEMA LE4, CRI: 80, CCT: 3500 K. Lamps dimmable from 100 percent to 10 of maximum light output, 50,000 hour lamp rated life, internal driver must be UL Listed, dimmable with any standard dimmer switch, smooth, flicker-free dimming.
- B. Manufacturers; Philips, Feit, Sylvania, GE, Archipelago.
- C. Contractor is to coordinate lamp color for all luminaires. Lamp color is to be similar in all spaces.

2.04 EMERGENCY LIGHTING UNITS

- A. General requirements: Self-contained units, thermoplastic enclosure, comply with UL 924. Units include the following features:
 - 1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10 year nominal life and special warranty, 12 volt, remote capacity as required.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
 - 4. Wire Guard: Where indicated, heavy-chrome-plated wire guard arranged to protect lamp heads or luminaires.
 - 5. Integral Time Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.
 - 6. Test switch and LED pilot light
 - 7. Self-diagnostic circuitry.
- B. Manufacturers: Emergi-Lite, Dual-Lite, Chloride or Edge-Lit.

2.05 EMERGENCY LED POWER SUPPLY UNIT

- A. Integral Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.
 - 1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - 2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
 - 3. Charger: Fully automatic, solid-state, constant-current type.
 - 4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamp and battery is automatically recharged and floated on charger.
 - 5. Light output:
 - a. Minimum 1400 lumens for LED luminaires.

2.06 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction. Refer to Lighting Fixture Schedule on

drawings.

B. Internally lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type) Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

PART 3 - EXECUTION

3.01 FIXTURES

- A. All recessed LED troffers (2' x 2', 2' x 4', and 1' x 4') and recessed luminaires weighing up to 20 lbs. are to be installed in grids with mounting clips and with grid secured at diagonal corners of fixture to the building structure. (4' x 4') luminaires to be secured at 4 corners.
- B. Recessed luminaires between 20 and 50 pounds are to have, in addition to above, 12 gauge steel safety chains at opposite corners hung slack from the building structure. Luminaires above 50 pounds to be independently supported directly from the structure with approved hangers and angular sway bracing according to manufacturer's installation guidelines.
- C. Surface mounted and pendant luminaires under 15 pounds can be supported directly from the outlet box when all of the following apply: screws pass through round holes and not key slots in the fixture body, the outlet box is attached to a main ceiling runner, and the outlet box is supported vertically from the building structure.
- D. Surface luminaires between 15 and 50 pounds shall be bolted to the ceiling independent of the outlet box. Luminaires over 50 pounds shall be secured to the building structure using a manufacturer's approved mounting method.
- E. Luminaires to be set plumb.
- F. Provide 6'-0" flexible leads on recessed luminaires to allow for easy removal.
- G. Recessed luminaires shall be set with mounting frames.
- H. Coordinate final location of all luminaires with other disciplines to avoid interferences and potential obstructions as the work progresses.
- I. Luminaires used for temporary lighting during construction shall be removed, cleaned, and re-installed prior to acceptance of the lighting system.
- J. Luminaires shall be cleaned and free of all dirt, dust, smudges, and surface imperfections just prior to final acceptance.
- K. Luminaires which are recessed in a fire rated ceiling shall be provided with an enclosure around the fixture which shall maintain the fire rating integrity of the ceiling system. The installation of the enclosure shall meet the requirements of the authority having jurisdiction. The fixture shall be

insulation rated for higher temperature operation.

- L. All recessed or surface mounted luminaires on or in sloped ceilings shall have sloped ceiling adapters to allow for vertical light distribution.

3.02 SWITCHING

- A. Provide lighting control switch legs to wall switches for all fixtures except for those operated by integral switches.
- B. Provide 3-way or 4-way control where indicated and for rooms with more than one entrance.
- C. Provide a single time clock, contactors and relays as indicated on the drawings and as necessary for site lighting and parking lot lighting control.
- D. Provide interior lighting controls to meet IBC 2015/IECC 2015/ ASHRAE 90.1. Refer to Specification Section 26 09 00 for additional requirements.

END OF SECTION

SECTION 27 05 28 – LOW VOLTAGE CONDUIT SYSTEM**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for requirements which are applicable to this section.

1.02 WORK INCLUDED

- A. Provide labor, material, and supervision necessary to install all service and distribution as outlined in this section.

PART 2 - PRODUCTS**2.01 WALL BOXES - TELEPHONE**

- A. Single gang galvanized steel with single gang device ring and wall plates.
- B. Modular jack to accept phone system wiring with two RJ-11 connectors.

2.02 WALL BOXES - DATA

- A. Single gang galvanized steel with single gang device ring and wall plates.
- B. Face plate to accommodate data system wiring.

2.03 WALL BOXES - TELEPHONE AND DATA

- A. Double gang galvanized steel with steel divided raceway.
- B. Double face plate with modular RJ-11 jacks for telephone and 2 data outlet grommets.
- C. Two raceways to accessible ceiling space.

2.04 WALL BOXES – CATV

- A. Single gang galvanized steel with single gang device ring and wall plate.
- B. Face plate to accommodate "F" type connectors.

2.05 CONDUIT

- A. 3/4" EMT from boxes to accessible ceiling space.
- B. Two 4" conduits from backboard through building foundation to exterior of the building, with pull wires.
- C. Provide 4" conduit raceway from Demarcation Room to Auxiliary Rooms on each floor.

2.06 PLYWOOD BACKBOARDS

- A. Furnish and install 3/4" thick marine grade plywood backpanels of the size and location where

indicated.

- B. Install as a minimum a standard quad outlet and an isolated ground outlet at each location.
- C. Install a ground bar and insulated ground cable back to the building electrical service entrance ground.

PART 3 - EXECUTION

3.01 CONDUIT SYSTEM

- A. Provide and install where indicated for the device being installed.
- B. Provide pull wire in empty conduit.
- C. Provide ground for system.
- D. Provide 120 volt quad receptacle at telephone backboard.
- E. Provide a 3/4 " thick marine plywood telephone backboard where indicated for use by the Telephone Company for the mounting of equipment.

END OF SECTION

SECTION 024113

SITE DEMOLITION

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: Furnishing labor, materials and equipment necessary for demolition, dismantling, cutting and alterations as indicated, specified, or required for completion of the Work. Includes items such as the following:

1. Protection of existing improvements to remain.
2. Cleaning existing improvements to remain.
3. Disconnecting and capping utilities.
4. Removing debris, waste materials, and equipment.
5. Removal of items for performance of the Work.
6. Salvageable items to be retained by the Owner.

- B. Related Sections:

1. The Contract Drawings.

1.3 DEFINITIONS AND ABBREVIATIONS

- A. ASTM: American Society For Testing and Materials.
- B. ANSI: American National Standards Institute.
- C. ASSP: American Society of Safety Professionals.

1.4 REFERENCES

- A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Society For Testing And Materials (ASTM)
 - a. E 3073-17 Standard guide for development of waste management plan for construction, deconstruction, or demolition project.
2. American National Standards Institute (ANSI)
3. American Society of Safety Professionals (ASSP)
 - a. ASSP A10.6 Safety And Health Program Requirements For Demolition Operations.

1.5 ACTION SUBMITTALS

A. General:

1. Make submittal in compliance with all provisions of Division 01 pertaining to submittals and quality assurance.
2. Render submittals and receive approval prior to delivery of installation.
3. Approval in writing by the Engineer of submitted products, samples, test reports, and certificates, does not constitute final acceptance.

B. Shop Drawings: Submit Shop Drawings indicating the extent of items and systems to be removed. Indicate items to be salvaged or items to be protected during demolition. Indicate locations of utility terminations and the extent of abandoned lines to be removed. Include details indicating methods and location of utility terminations. Include correct sequence, limits, methods, and schedule.

1.6 INFORMATION SUBMITTALS

A. None.

1.7 QUALITY ASSURANCE

- A. Perform the Work of this section by workers skilled in the demolition of historic designated buildings, structures, utilities and sites. Perform the Work of this section under direct superintendence at all times.
- B. Prior to commencement of Work, schedule a walkthrough with the ENGINEER, to confirm Owner property items have been removed from scheduled Work areas. Identify and mark remaining property items and schedule their removal.
- C. Coordinate demolition for the correct sequence, limits, and methods. Schedule demolition Work to create least possible inconvenience to the public and facility operations.
- D. Related Standard: ANSI/ASSP A10.6.

1.8 PROJECT CONDITIONS

- A. Drawings may not indicate in detail all demolition Work to be performed. Examine existing conditions to determine the full extent of required demolition.
- B. Repair damage to existing improvements or damage due to excessive demolition.
- C. Provide all measures to avoid excessive damage from inadequate or improper means and methods, improper shoring, bracing or support.
- D. If conditions are encountered that varies from those indicated, promptly notify the ENGINEER for clarification before proceeding.

PART 2 - PRODUCTS

2.1 HANDLING OF MATERIALS

- A. Items scheduled for salvage by the Owner shall be stored and protected on the project at a location designated by the CONTRACTOR. Items shall be cleaned, packaged, and labeled for storage.
- B. Items scheduled for reuse shall be stored on the Project site and protected from damage, theft and other deleterious conditions.
- C. Extent of items to be salvaged and items for re-use are as shown on the Drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. Protection:
 - 1. Do not commence demolition until safety partitions, barricades, warning signs and other forms of protection are installed.
 - 2. Provide safeguards, including warning signs, lights and barricades, for protection of workers, occupants, and the public.
- B. If safety of existing construction appears to be endangered, take immediate measures to correct such conditions; cease operations and immediately notify the ENGINEER.

3.2 DEMOLITION

- A. Do not throw or drop materials. Furnish ramps or chutes as required by the Work.
- B. Remove existing construction only to extent necessary for proper installation of Work and interfacing with existing construction. Cut back finished surfaces to straight, plumb or level lines as required for a smooth transition.
- C. Where openings are cut oversize or in improper locations, replace or repair to required condition.

3.3 CUTTING EXISTING CONCRETE

- A. Cutting of existing concrete shall be performed by skilled workers familiar with the requirements and space necessary for placing concrete. Perform concrete cutting with concrete cutting wheels and hand chisels. Do not damage concrete intended to remain.
- B. Extent of cutting of structural concrete shall be as indicated on Drawings. Cutting of non-structural concrete shall be as indicated on Drawings or as reviewed by the ENGINEER or structural engineer. Replace concrete demolished in excess of amounts indicated.
- C. Prior to cutting or coring concrete, determine locations of hidden utilities or other existing improvements and provide necessary measures to protect them from damage.

- D. Concrete that has been cut shall be crushed and reused as indicated on Drawings.

3.4 CRACKING EXISTING CONCRETE

- A. Cracking of existing concrete shall be performed by skilled workers familiar with the requirements and space necessary for placing concrete. Perform concrete cracking with concrete cutting wheels, hydraulic ram, hand chisels, or other mechanical means and equipment deemed suitable. Do not damage concrete intended to remain.
- B. Extent of cracking of concrete shall be as indicated on Drawings or as reviewed by the ENGINEER or structural engineer. Replace concrete demolished in excess of amounts indicated.
- C. Prior to cracking or coring concrete, determine locations of hidden utilities or other existing improvements and provide necessary measures to protect them from damage.
- D. Concrete that has been cracked shall be relocated as indicated on Drawings.

3.5 REMOVAL OF OTHER MATERIALS

- A. Masonry: Cut back to joint lines and remove mortar without damaging units to remain. Allow space for repairs to backing where applicable.
- B. Remove existing improvements not specifically indicated or required but necessary to perform Work. Cut to clean lines, allowing for installation of Work.
- C. Remove existing vegetation as indicated on Drawings.

3.6 PATCHING

- A. Patch or repair materials to remain when damaged by the performance of the Work of this section. Finish material and appearance of patch and/or repair Work shall match existing.

3.7 CLEANING

- A. Clean existing materials to remain with appropriate tools and equipment.
- B. Protect existing improvements during cleaning operations.
- C. Debris shall be dampened by fog water spray prior to transporting by truck.
- D. Debris pick-up area shall be kept broom-clean and shall be washed daily with clean water.
- E. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 311010

SITE PREPARATION

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. Protecting buildings, walls, pavements, utilities, existing vegetation, site improvements, miscellaneous structures, equipment to remain.
 - a. Protecting site from construction traffic including guarding areas of planting and lawn work from over compaction, adhering to load limitations, and as otherwise directed by the Engineer.
2. Providing staging areas, project signs, and other preparatory work.
3. Selective removal of designated trees (including stump grinding), shrubs, groundcover, lawn and other vegetation.
4. Demolition and removal of all above grade site improvements and pavements indicated on the Drawings.
7. Demolition and removal of all below grade site improvements, including footings, walls, and all other structures indicated on the Drawings.
8. Clean up and removal of rubble and debris including maintaining site areas raked clean until Project completion.
9. Disconnecting, capping, sealing, abandoning, and removing site utilities.
10. Temporary erosion and sedimentation control measures.
11. Removal and salvage of existing fences.

- B. RELATED SECTIONS

1. Division 31 Section - EARTHWORK.
2. Section 024116 Site Demolition

1.3 DEFINITIONS AND ABBREVIATIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 REFERENCES

- A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
 - 1. Standards for Soil Erosion and Sediment Control in New York

1.5 ACTION SUBMITTALS

- A. General:
 - 1. Make submittal in compliance with all provisions of Division 01 pertaining to submittals and quality assurance.
 - 2. Render submittals and receive approval prior to delivery of installation.
 - 3. Approval in writing by the Engineer of submitted products, samples, test reports, and certificates, does not constitute final acceptance.
- B. Schedule: Submit proposed methods and sequence of site preparation work to the Engineer for review prior to start of Work.

1.6 INFORMATIONAL SUBMITTALS

- A. None.

1.7 QUALITY ASSURANCE

- A. Preconstruction meeting: Arrange a preconstruction meeting between the Owner's representative, the Civil Engineer, and the General Contractor. Review items including the proposed schedule, areas and structures to be salvaged stored, and protected, limits of Work, and soil stockpiling.
- B. REGULATORY REQUIREMENTS
 - 1. Comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary to make Work comply with such requirements without additional cost to Owner.
 - 2. Investigate the conditions of public thoroughfares and roads as to availability, clearances, loads, limits, restrictions, and other limitations affecting transportation to and ingress and

egress at the site. Conform to all governmental regulations regarding the transportation of materials.

3. Procure and pay for permits and licenses required for Work.

PART 2 - PRODUCTS

2.1 SIGNS

- A. Project Signs - as established in conjunction with the Owner's requirements.

2.2 MISCELLANEOUS

- A. Earth Fill- For use in preparations, protections, and temporary conditions of fill: Provide controlled fill material as specified in Section 312000, Earthwork.

PART 3 - EXECUTION

3.1 VERIFICATIONS

- A. Obtain limits of excavation and filling work, sequencing, limits of work, and verify areas of load limitations.
- B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

3.2 PROTECTIVE MEASURES

- A. Use every precaution to prevent damage to, and provide protection as necessary of, areas outside of the contract limit line and existing features, improvements, and utilities indicated to remain within the contract limit line. Repair or replace to original condition, as acceptable to the Engineer and at no cost to the Owner, any material or Work damaged or destroyed while performing Work.
- B. Prior to the start of any site disturbance, including Demolition and Site Preparation, install protective fencing and silt fence. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place. Engineer to approve layout before any work shall begin.
- C. Preservation of Property From Damage: Existing structures, site improvements, adjacent property, utilities, walls, gates, curbs, statues and other facilities; and trees that are not to be removed shall be protected from injury or damage.
 1. Provide protection of existing curbs and sidewalks at locations with crossing construction traffic. Use materials that are suitable for details of installation and that protect surface finishes and resist imposed loads, as approved by Engineer.
 2. Exercise extreme care in demolition or excavation atop underground structures.
 3. The surface of the required excavations or grading work may expose soft grades during the course of the Work. The Contractor shall take whatever actions necessary to allow the progress of the Work to continue and to make the site accessible to its equipment. These actions may require the furnishing and temporary placement of rock, crushed

stone, or other materials. Conditioning of the site shall be at the Contractor's expense with no additional cost to Owner.

D. Barricades

1. In addition to existing controls or protection items installed as specified herein, provide barricades, other protections, and signs to exclude persons, except those connected with work, from entering the work area. Do not interfere with the use of adjacent sidewalks and crosswalks, and maintain free and safe passage.
2. Coordinate on-site traffic as required. Establish traffic routes on-site clearly marked with construction safety fence and the like to avoid compaction in areas of future plant bed areas and lawns. Use future pavement areas wherever possible.

E. Dust Palliation

1. Dust resulting from demolition, removal, and other construction operations shall be controlled to avoid creation of a nuisance or damage to the surrounding areas. Use approved dust control methods to prevent excessive dust accumulation on foliage of trees to be preserved.
2. Excessive use of water for dust control will not be permitted when it will result in, or create, hazardous or objectionable conditions such as flooding or pollution.

3.3 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.4 EXISTING UTILITY SECTION

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 1. Arrange with utility companies to shut off indicated utilities.
 2. Owner will arrange to shut off indicated utilities when requested by Contractor.

- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.

3.5 SELECTIVE TREE REMOVAL

- A. Prior to starting selective tree removal, mark trunks of only those trees to be removed with a bright color. Notify Engineer after trees to be removed have been identified. Perform no removals until Engineer has visited the site and approved trees to be removed.
- B. All depressions excavated below the original ground surface, or caused by the removal of stumps and roots, shall be refilled with suitable material compacted to the density, grade, and contour of the surrounding earth as specified in Section 312000 - Earthwork.
- C. Carefully fell trees designated to be removed, following standards of safety and exercising care to not damage existing trees or structures to remain.

3.6 SHRUB, GROUNDCOVER AND TURF REMOVAL

- A. Prior to starting removal operations, stake out limits of all areas to be removed and receive approval of Engineer before any work is to begin.
- B. Remove selected shrubs, groundcover, turf, roots, logs, stones, boulders and other organic matter at or above the existing ground level as indicated on Drawings.
- C. All depressions excavated below the original ground surface, or caused by the removal of stumps and roots, shall be refilled with suitable material compacted to the density, grade, and contour of the surrounding earth as specified in Section 312000 - Earthwork.

3.7 STRIPPING AND STOCKPILING TOPSOIL

- A. Prior to starting general excavation, remove all topsoil within the limits of work, as indicated on the Drawings. Topsoil shall be stripped to its entire natural depth.
 - 1. Remove sod and grass before stripping topsoil.
 - 2. Prevent intermingling with subsoil or other waste materials.
 - 3. Remove subsoil and non-soil materials from topsoil including clay lumps, gravel, and other objects more than 2 inches in diameters including trash, debris, weeds, roots and other waste material.
- B. Do no stripping without clear understanding of existing soil, planting, and site conditions to be preserved.
- C. Topsoil stripped from site may be used for lawn and planting areas provided that it meets the requirements of new off-site topsoil.

- D. All topsoil shall be stockpiled on the site within the work limit lines. Stockpile area for topsoil shall be approved by Engineer. Should the topsoil be stockpiled in any area without prior approval of the Engineer, the Contractor may be directed to relocate such stockpile to another portion of the site, and the Contractor shall do so at no additional cost to the Owner.
- E. Stockpile topsoil no higher than 3 feet (3') high, and shape stockpiles to drain. Should site constraints dictate that the soil must be piled higher than 3 feet (3'), Contractor shall provide aeration piles within the topsoil pile to prevent the soil from becoming anaerobic. (Cover to prevent windblown dust and erosion by water).
- F. No stockpiles to occur within the driplines of existing trees to remain.
- G. Perform soil stripping, handling, and stockpiling only when the topsoil is dry or slightly moist.

3.8 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.9 SALVAGED MATERIALS

- A. Carefully remove items indicated to be salvaged as indicated on the Drawings and store and protect on Owner's premises where indicated.
- B. Materials, items and equipment removed during site preparation work and not indicated to be reinstalled or salvaged for the Owner's use are property of the Contractor.
 - 1. Items of salvage value to the Contractor shall be removed as work progresses and promptly removed from the site.
 - 2. Storage and sale of Contractor's salvage items on the site will not be permitted.

3.10 CLEAN UP AND DISPOSAL

- A. Legally dispose of off-site all refuse and debris from these operations. Remove or neatly store material at the end of each day's work. Burning of material or dumping on the site is prohibited.
 - 1. Maintain segregation of man-made materials, debris, organic matter, and soil material as may be required for conditions of disposal.
 - 2. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

3. Transport materials over legal haul routes and obtain necessary permits for transporting and disposal as required by Federal, State and local regulations.
 4. Removals at Completion: Remove all temporary preparation and protection measures installed on Project site at completion of Work and at a time approved by Engineer.
- B. Maintain the site in an orderly condition during the progress of Work. Continuously and promptly remove excess and waste materials; keep lawn areas, walks and roads clear. Store materials and equipment where directed. Immediately remove rejected materials from the property. Promptly remove equipment, surplus material, and debris and trash resulting from operations under this Contract upon completion and prior to initial acceptance of Work. Leave the site in a neat, orderly condition, "broom clean".
1. Prior to and during earthwork and other on-site construction operations, the site areas shall be maintained raked clean with no buried debris. Pieces of rock, brick, or concrete smaller than two inches (2") in their maximum dimensions are not considered debris.

END OF SECTION

SECTION 312000

EARTHWORK

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. Furnishing all materials, labor, supervision, tools, equipment, tools, and performing all operations and incidentals necessary for earthwork.
2. Earthwork activities include but are not limited to subgrade preparation, excavating, backfilling, and compaction for structures and foundations, pavements, sidewalks, landscape areas, and utilities. The Contractor shall pay for and coordinate the services of a geotechnical engineer and testing agency to perform quality control of the earthworks.

B. Related Sections:

1. Section 311010 Site Preparation.

1.3 DEFINITIONS AND ABBREVIATIONS

A. Definitions

1. Backfill: Soil materials used to fill an excavation.
2. Structural fill: On-site soils should not be used as fill beneath foundations. Soils to be imported for use as structural or load-bearing fill should be granular material meeting the NJDOT 2A stone specification and should be compacted to a level equivalent to at least 95 percent of the maximum dry density as determined by the laboratory procedures set forth in ASTM D1557 (modified Proctor). This material should be placed in horizontal lifts of not more than 8 inches in loose thickness when compacted with heavy compaction equipment and not more than 6 inches in loose thickness when compacted with hand-operated equipment.
3. Base Course: Layer placed between the subgrade and paving.
4. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
5. Borrow: Approved soil materials imported from off-site for use as fill or backfill.
6. Classification: All material shall be classified as either Regular, Hard Material, or Rock.

7. Degree of Compaction: Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated hereinafter as percent laboratory maximum density. For granular material, relative density is determined in accordance with ASTM D 4254.
8. Excavation: Removal of material encountered down to subgrade elevations:
 - a. Bulk Excavation: Excavation more than 10 feet in width.
 - b. Overexcavation: Excavation of existing unsuitable material beyond limits shown on the Drawings for replacement with structural fill as directed by the Owner.
 - c. Unauthorized Excavation: Excavation below subgrade elevations or beyond limits shown on the Drawings without direction by the Owner.
9. Hard Material: Weathered rock, dense consolidated deposits, or buried construction debris (i.e., demolished brick walls, concrete, etc.) which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.
10. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cubic yard. for bulk excavation or 3/4 cubic yard. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment without systematic drilling, ram hammering, ripping, or blasting, when permitted
11. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base or topsoil materials.
12. Subbase: Material between the pavement base and subgrade.
13. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

B. Abbreviations

1. None.

1.4 REFERENCES

- A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
 - a. C 33 Concrete Aggregates
 - b. D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - c. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³.)
 - d. D 2167 Density and Unit Weight of Soil in Place by the Rubber Balloon Method

- e. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, and Rock
- f. D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- g. D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- h. D 2937 Density of Soil in Place by the Drive-Cylinder Method ASTM D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
- i. D 3740 Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- j. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- k. D 4254 Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

1.5 ACTION SUBMITTALS

A. General:

- 1. Make submittal in compliance with all provisions of Division 01 pertaining to submittals and quality assurance.
- 2. Render submittals and receive approval prior to delivery of installation.
- 3. Approval in writing by the Engineer of submitted products, samples, test reports, and certificates, does not constitute final acceptance.

B. Testing Agency Qualifications: Provide a statement of qualifications of the geotechnical engineer and testing agency that will perform the quality control tasks required.

- 1. The geotechnical engineer shall be an experienced inspector working under the direction of a professional engineer licensed to practice in the State of New York who is experienced in providing engineering services related to earthworks.
- 2. The testing agency shall be an independent laboratory having a minimum of 3 years of experience in conducting the testing indicated herein.
- 3. The testing laboratory shall meet the requirements of ASTM D 3740.

C. Material Test Reports: Shall be provided from the testing agency indicating and interpreting test results for compliance on the following:

- 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.

2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill; provide for each material type and for every 5,000 cubic yards of each material.
3. Material Gradation Tests.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified contractor. Include list of similar projects completed by Contractor demonstrating Contractor's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of Owners' contact persons.

1.7 QUALITY ASSURANCE

- A. The Contractor shall engage the services of a testing agency to perform quality control of the concrete.

1.8 DELIVERY, STORAGE AND HANDLING

- A. None.

1.9 PROJECT CONDITIONS

- A. Codes and Standards: Perform earthwork complying with federal, state, and local regulations including the Occupational Safety and Health Act of 1970 as amended.
- B. All applicable regulations regarding notification of utility companies.
- C. Any pumped water shall be discharged from the Site in accordance with federal, state and local codes and regulations. Comply with all local, county, and state permit requirements.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil or suitable backfill materials are not available from excavations.
- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SP, SM, SW, SC, GC, SC, ML and CL or a combination of these group symbols.
 1. Low plasticity (plasticity index less than 10).
 2. Less than 15 percent, by weight, of particles larger than 2 inches in greater dimension.
 3. Less than 2 percent deviation from optimum moisture content.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups MH, CH, OL, OH, and PT, or a combination of these group symbols, or materials not conforming to the requirements for satisfactory soils, including:
 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2. Debris, waste, frozen materials, vegetation and other deleterious matter.
3. Otherwise not meeting the requirements for satisfactory soil materials.
4. Materials containing excessive amounts of deleterious materials including construction debris, wood, glass, ash, or organic material as determined by Owner.

D. Backfill and Fill Materials: Satisfactory soil materials.

1. Class B backfill shall be granular, well graded friable soil; free of rubbish, ice, snow, tree stumps, roots, clay and organic matter; with 30% or less passing the No. 200 sieve; no stone greater than two-third (2/3) loose lift thickness, or six inches, whichever is smaller.
2. Select backfill shall be granular, well graded friable soil, free of rubbish, ice snow, tree stumps, roots, clay and organic matter, and other deleterious or organic material; graded within the following limits:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
3"	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

E. Imported topsoils, or manufactured soil blends designed to serve as topsoil, may not be mined from the following locations (unless these soils are a byproduct of a construction process):

1. Greenfield sites
2. Prime farmland, unique farmland, farmland of statewide importance, or farmland of local importance as defined by the U.S. Natural Resources Conservation Service (or local equivalent for projects outside the United States)

F. Structural Fill: Satisfactory soil materials.

G. Base Course: 2A coarse aggregate, Type C or better. Recycled crushed concrete will not be allowed.

1. Salvage and re-use existing onsite asphalt material or dense graded aggregate where indicated on the Drawings and as approved by the Licensed Site Remediation Professional.

H. Bedding: No. 8 (AASHTO) coarse aggregate or as specified herein.

I. Rip-Rap at flush curb areas in stormwater bumpouts: 3" to 6" river rock.

1. Braen Supply Haledon, New Jersey, or approved equal.
2. Smooth finish.
3. Color: Blend of grey, blue, brown, and earth tones.

2.2 ACCESSORIES

- A. Detectable Warning Identification Tape: Acid-and-alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities. Warning tape shall be a minimum 6 inches wide, 6 mils thick, have a minimum tensile strength 7,500 lbs/in², continuously inscribed with a description of the utility in permanent printing with caution striping, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; APWA color-coded as follows:
 - 1. Red: Electric
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect existing utilities, sidewalks, structures, pavements, and other facilities to remain free from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways in accordance with the Drawings.

3.2 DRAINAGE AND DEWATERING

- A. Prevent surface water and subsurface or groundwater from entering or flowing into excavations, from ponding on prepared subgrades, and from flooding the project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
- C. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

- A. Explosives: The use of explosives are prohibited on this Project.

3.4 FROST PROTECTION AND SNOW REMOVAL

- A. Keep earthwork operations clear and free of accumulations of snow as required to carry out the work.
- B. Protect the subgrade beneath structures and pipes from frost penetration when freezing temperatures are expected.

3.5 GENERAL EXCAVATION

- A. Excavate to depths and limits shown on the Drawings. Compact subgrade surface in accordance with Section 3.11.
- B. In all excavation areas, strip the surficial topsoil layer and underlying subsoil layer separate from underlying soils. In paved areas, first cut pavement as specified in Section 3.6 A of this specification, strip pavement and pavement subbase separately from underlying soils.
- C. All excavated materials shall be stockpiled separately from each other within the limits of work.
- D. Any soft or unstable material as characterized in the geotechnical report or by visual inspection of the geotechnical engineer shall be overexcavated and replaced by the contractor with compacted load bearing fill. Any areas of instability shall be overexcavated to a depth of at least 2 feet and replaced with structural fill in accordance with Section 3.11.
- E. Provide shoring and bracing as necessary.
- F. All footing excavation surfaces should be protected until the concrete and backfill is placed. Footing bearing surfaces should be cleaned of all material loosened by the excavation process and be recompacted using hand-operated compaction equipment prior to concrete placement. Should loose or soft materials be encountered or if the bearing materials become disturbed or softened, the disturbed materials should be removed and the footing should be lowered to undisturbed bearing materials or the undercut zone should be filled with lean concrete or compacted structural fill.

3.6 EXCAVATION FOR UTILITY TRENCHES

- A. Prior to excavation, trenches in pavement shall be the traveled way surface cut in a straight line by concrete saw or equivalent method, to the full depth of pavement. Excavation shall only be between these cuts. Excavation support shall be provided as required to avoid undermining of pavement. Cutting operations shall not be done by ripping equipment.
- B. Perform all dewatering requirements specified in Section 3.2 before performing trench excavations.
- C. Trenches shall be excavated to such depths as will permit pipe to be laid at the elevations, slopes, and depths of cover indicated on the Drawings. Trench widths shall be as shown on the drawings or as specified.
- D. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- E. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed.
- F. Clearance: 12 inches on each side of pipe or conduit or as indicated.
- G. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Remove projecting stones and sharp objects along trench subgrade.
 - 1. Provide bedding depth as indicated on the drawings.

2. Shape bedding to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
3. For pipes and conduit less than 6 inches in nominal diameter and flat-bottom, multiple-duct conduit units, hand-excavate trench bottom to accurate elevations and support pipe and conduit on an undisturbed subgrade.
4. For pipes and conduit 6 inches or larger in normal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with bedding material. At each pipe joint, dig bellholes to relieve pipe bell of loads and to ensure continuous bearing of pipe barrel on bearing surface.

3.7 EXCAVATION FOR FOUNDATIONS

- A. Excavations shall not be wider than required to set, brace, and remove forms for concrete, or perform other necessary work.
- B. After the excavation has been made, and before forms are set for footings, mats, slabs, or other structures, and before reinforcing is placed, all loose or disturbed material shall be removed from the subgrade. The bearing surface shall then be compacted to meet the requirements of this specification.
- C. If, in the opinion of the Engineer, the existing material at subgrade elevation is unsuitable for structural support; excavate and dispose of the unsuitable material to the required width and depth as directed by the Engineer. If, in the opinion of the Engineer, filter fabric is required; place filter fabric as approved by the Engineer and per the manufacturer's recommendations. Structural fill shall then be placed in lifts and compacted to required densities. Backfill shall be placed to the bottom of the proposed excavation.

3.8 EXCAVATION NEAR EXISTING STRUCTURES

- A. Attention is directed to the fact that there are pipes, manholes, drains, and other utilities in certain locations. An attempt has been made to locate all utilities on the drawings, but the completeness or accuracy of the given information is not guaranteed.
- B. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and excavation shall be done by means of hand tools, as required. Such manual excavation, when incidental to normal excavation, shall be included in the work to be done under items involving normal excavation.
- C. Where determination of the exact location of a pipe or other underground structure is necessary for properly performing the work, the Contractor shall excavate test pits to determine the locations.

3.9 UNAUTHORIZED EXCAVATION

- A. Unauthorized excavations shall be filled with satisfactory fill materials and compacted in accordance with the relevant paragraphs of this Section.
- B. The Contractor is responsible for furnishing all materials, labor, supervision, tools, and equipment associated with unauthorized excavations without additional compensation.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and excavated satisfactory materials sufficiently far away from the edge of excavations to preclude excavation instability. Stockpile soil materials without intermixing. Cover to prevent windblown dust.
- B. Install erosion control measures around stockpiles as required to comply with The Standards for Soil Erosion and Sediment Control in New York.

3.11 GENERAL BACKFILL

- A. Backfill shall not be placed on a subgrade which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all subgrade types, including the natural ground, all prepared subgrades (whether in an excavation or in a trench) and all layers of previously placed and compacted earth fill which become the subgrade for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Owner and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompact to the specified criteria before additional material is placed. The geotechnical engineer will determine when placement of fill shall cease due to cold weather.
- B. Prior to backfilling, compact the exposed natural subgrade to the densities as specified herein.
- C. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Inspecting and testing underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing temporary shoring, bracing, and sheeting unless directed to remain.
 - 6. Removing trash and debris.
 - 7. Place and compact materials to the specified density in continuous horizontal layers. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557, Method C. The minimum degree of compaction for fill placed shall be as follows:

LOCATION	PERCENT OF MAXIMUM DENSITY
Below pipe centerline	95
Above pipe centerline	92
Below pavement (upper 3 ft.)	95
Embankments	95

Below pipe in embankments	95
Adjacent to structures	92
Below structures	95

- D. The Engineer reserves the right to test backfill for conformance to the specification and the Contractor shall assist as required to obtain the information. Compaction testing will be performed by the Engineer or by an inspection laboratory designated or approved by the Engineer, engaged and paid for by the Contractor. If test results indicate work does not conform to specification requirements, the Contractor shall remove or correct the defective Work by recompacting where appropriate or replacing as necessary and approved by the Engineer, to bring the work into compliance, at no additional cost to the Owner. All backfilled materials under structures and buildings shall be field tested for compliance with the requirements of this specification.
- E. Where horizontal layers meet a rising slope, the Contractor shall key each layer by benching into the slope.
- F. If the material removed from the excavation is suitable for backfill with the exception that it contains stones larger than permitted, the Contractor has the option to remove the oversized stones and use the material for backfill or to provide replacement backfill at no additional cost to the Owner.
- G. The Contractor shall remove loam and topsoil, loose vegetation, stumps, large roots, etc., from areas upon which embankments will be built or areas where material will be placed for grading. The subgrade shall be shaped as indicated on the Drawings and shall be prepared by forking, furrowing, or plowing so that the first layer of the fill material placed on the subgrade will be well bonded to the subgrade.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies or ducts.
- B. Place and compact bedding material by hand shovel in 6-inch lifts to a height of 12 inches above and below the top of utility pipe or conduit. This area of backfill is considered the zone around the pipe and shall be thoroughly compacted before the remainder of the trench is backfilled.
 - 1. Carefully compact material under pipe haunches and bring backfill up evenly on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
 - 2. Place and compact materials to the specified density in continuous horizontal layers. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557, Method C.
- C. Coordinate backfilling with utilities testing.
- D. Fill voids with approved backfill or satisfactory soil materials as shoring, sheeting and bracing is removed. Place and compact final backfill of satisfactory soil material to final subgrade.

- E. Install warning and identification tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 BACKFILLING ADJACENT TO STRUCTURES

- A. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads to which they will be subjected. Excavated material approved by the Engineer may be used in backfilling around structures. Backfill material shall be thoroughly compacted to meet the requirements of this specification.
- B. Contractor shall use extra care when compacting adjacent to pipes and drainage structures. Backfill and compaction shall proceed along sides of drainage structures so that the difference in top of fill level on any side of the structure shall not exceed two feet (2') at any stage of construction.
- C. Where backfill is to be placed on only one side of a structural wall, only hand-operated roller or plate compactors shall be used within a lateral distance of five feet (5') of the wall for walls less than fifteen feet (15') high and within ten feet (10') of the wall for walls more than fifteen feet (15') high.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry satisfactory soil material that exceed optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.
 - 3. Construction during wet weather may also create unnecessary delays and undercutting of subgrades due to disturbance by construction traffic.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with the required grading surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and prevent ponding. Where paved, finish grades shall slope away from the building by a minimum 1/4" per foot for a distance of 8 feet unless otherwise indicated. In unpaved areas, finish grades shall slope away from the building by a minimum 1/2" per foot for a distance of 10 feet, unless otherwise indicated.
- C. Finish subgrades to required elevations within the following tolerances:

1. Lawn or unpaved areas: Plus or minus 1 inch.
2. Pavements: Plus or minus ½ inch.

3.16 SUBBASE AND BASE COURSES

- A. Under pavements and walks outside the right-of-way, place base course on prepared subgrade and as follows:
 1. Place base course material over prepared subgrade.
 2. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit density according to ASTM D 1557, as applicable.
 3. Shape base to required crown elevations and cross slope grades.
 4. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
 5. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.
 6. Place geogrid, geomembranes, and geotextiles where indicated on the Contract Drawings and per Section 310519 Geosynthetics for Earthwork.

3.17 FIELD QUALITY CONTROL

- A. The contractor shall coordinate all earthwork with the testing agency and geotechnical engineer to allow for inspection and testing. The geotechnical engineer shall provide full-time observation and testing of the compaction operations and provide documentation to the Owner.
- B. Allow geotechnical engineer to inspect and test each subgrade and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. The geotechnical engineer shall test compaction of soils in place according to ASTM D 1556, ASTM D 1557, ASTM D 2167, ASTM D 2922, ASTM D 2937, and ASTM D 4254 as applicable. Tests shall be performed at the following locations and frequencies:
 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2200 sq. ft. or less of paved areas or building slab, but in no case fewer than three tests.
 2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench, but no fewer than two tests.
 3. Structural Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench, but no fewer than two tests.

- D. When the geotechnical engineer reports that subgrades, fills or backfills have not achieved degree of compaction specified, recompact and retest until specified compaction is obtained.

3.18 PROTECTION

- A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by the Owner or the geotechnical engineer; reshape and recompact to the required density, at no additional cost to the Owner.
- C. Where settling occurs before the project correction period elapses, remove finished surfacing, backfill with additional approved material, compact, and reconstruct.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible at no additional cost to the Owner.
- D. Provide temporary underpinning, bracing, sheeting, and/or shoring as required to maintain the conditions of existing utilities or structures adjacent to excavation work. Prepare shop drawings of design details sealed by a professional engineer.
- E. Provide fencing, barricades, and/or protective barriers for all excavation.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off site to a regulated and permitted facility. Provide two copies of load manifest and permit from owner of the property where material is deposited.

3.20 EARTHWORK COMPUTATIONS AND VOLUMES

- A. All Earthwork shall be measured for payment via Surveyor methods which will obtain XYZ Data to be plotted by discipline. Also, where allowable, the Length, Width and Depth may be used in segments such as trenches, sub-bases and foundations while maintaining approximate site locations and project elevations.

END OF SECTION

SECTION 312323

EXCAVATION AND FILL FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfilling, and compacting utility trenches such as water, gas, irrigation, storm drain, sewer lines, concrete-encased conduits, and manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes and other utility appurtenances.

B. Related Requirements:

1. Section 02 4113 - Site Demolition.
2. Section 33 4000 - Storm Sewer Utilities.
3. Section 33 4600 - Subdrainage.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 SUBMITTALS

- A. Imported Soil: A geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain initial product Sample for testing in accordance with the terms of Article 3.05 of this section.

1.04 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works construction, current edition except as modified herein.

1.05 PROJECT CONDITIONS

- A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

- B. A copy of the foundation investigation and soils report is available for examination at the Architect's office during regular business hours of Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bedding material from trench bottom to one foot above the pipe:

1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.
2. Sand complying with the Specifications for cement concrete aggregates.

- B. Backfill Materials:

1. Excavated trench material to be installed for backfilling shall be clean, free of large clods, and stones larger than 2 ½-inch in any dimension.
2. Cement-sand slurry shall be provided with one sack of cement per cubic yard of the mixture.
3. Imported Fill Material: Imported fill material shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing a 200 mesh sieve. Material shall provide a coefficient of expansion of not more than two percent from air dry to optimum moisture content and not more than six percent from air dry to saturation. Imported materials shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

PART 3 - EXECUTION

3.01 GENERAL

- A. Before excavation, contact the NY One Call for information on buried public utilities and pipelines. For on-site utilities retain an underground locating service.
- B. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Section 01 5000 - Construction Facilities and Temporary Controls, and in accordance with OSHA standards and requirements.
- C. Saw-cut concrete or bituminous paving for trench installation.
- D. Trenches over 5 feet in depth shall conform to OSHA standards.
- E. Where indicated and required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

- F. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.
- G. Do not install piping lengthwise under concrete walks without review by the Architect.
- H. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of two horizontal to one vertical, from a line 9 inches above bottom of footings.
 - 1. Unless otherwise indicated on Drawings, depth of excavations outside the buildings shall allow for a minimum coverage above top of pipe, tank, or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finished grade
Copper Water Tube	18 inches below finished grade
Cast-Iron Pressure Pipe	36 inches below finished grade
Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structures	36 inches below finished grade
Soil, Sewer & Storm Drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. (Install polypropylene sewer pipe with at least 24 inches coverage)
 - 2. Trench width shall provide ample space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.
- I. Unless indicated otherwise, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.
- J. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.
- K. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and tanks.
- L. Do not install backfill until required inspections and testing is completed.
- M. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the Project Inspector.
- N. Install backfill materials in layers not exceeding 4 inches in thickness and compact to 90 percent of the maximum density.
- O. If materials excavated from the Project site are not permitted for trench backfill in paved areas,

backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.

- P. Install and compact sand bedding to provide a uniform full length bearing under piping and conduits.
- Q. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements.

A.02 IMPORT/EXPORT OF MATERIALS

- A. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- B. Imported fill materials shall be sampled by a geotechnical engineer, retained by the Owner as an Owner Consultant, for compliance with the requirements of Part 2 of this section.
- C. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall perform the tests by utilizing an independent approved testing laboratory.
- D. Initial sampling shall be performed by the geotechnical engineer, retained by the Owner as an Owner Consultant, before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory.
- E. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
- F. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the Project Inspector, Architect, OAR, DSA, Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, CBC and the DSA. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to the DSA as required by CBC.
- G. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.
- H. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.03 INSPECTION AND TESTING

A. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavations, sample material quality as required in Part 2, observe installation and compaction of fill materials.

B. Compaction test shall be performed in accordance with ASTM D1557, method "C."

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 320523

CONCRETE FOR EXTERIOR IMPROVEMENTS

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. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown on the Drawings. Construction shall include the following:
 - a. Curbs
 - b. Pedestrian Pavement: Walks, pedestrian crossings, wheelchair curb ramps, and steps.
 - c. Equipment Pads: Trash enclosure pad.

- B. Related Sections:

- 1. Contract Documents.
 - 2. Section 312000 Earthwork.

1.3 DEFINITIONS AND ABBREVIATIONS

- A. Definitions: None.

- B. Abbreviations: None.

1.4 REFERENCES

- A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- 1. American Association of State Highway and Transportation Officials (AASHTO).

- M147-65-UL Materials for Aggregate and Soil Aggregate Subbase, Base and Surface Courses (R 2004)

- M148-05-UL Liquid Membrane Forming Compounds for Curing Concrete (ASTM C309)

- M171-05-UL Sheet Materials for Curing Concrete (ASTM C171)

- M182-05-UL Burlap Cloth Made from Jute or Kenaf and Cotton Mats

- 2. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A82/A82M-07 Reinforcement	Standard Specification for Steel Wire, Plain, for Concrete
A185/185M-07	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
A615/A615M-12	Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
A653/A653M-11	Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
A706/A706M-09b	Standard Specification for Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A767/A767M-09	Standard Specification for Zinc Coated (Galvanized) Steel Bars for Concrete Reinforcement
A775/A775M-07b	Standard Specification for Epoxy Coated Reinforcing Steel Bars
A820/A820M-11	Standard Specification for Steel Fibers for Fiber Reinforced Concrete
C31/C31M-10	Standard Practice for Making and Curing Concrete Test Specimens in the field
C33/C33M-11a	Standard Specification for Concrete Aggregates
C39/C39M-12	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C94/C94M-12	Standard Specification for Ready Mixed Concrete
C143/C143M-10a	Standard Test Method for Slump of Hydraulic Cement Concrete
C150/C150M-12	Standard Specification for Portland Cement
C171-07	Standard Specification for Sheet Materials for Curing Concrete
C172/C172M-10	Standard Practice for Sampling Freshly Mixed Concrete
C173/C173M-10b...	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/C192M-07	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
C231/C231M-10	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C260/C260M-10a	Standard Specification for Air Entraining Admixtures for Concrete

C309-11 Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

C494/C494M-12 Standard Specification for Chemical Admixtures for Concrete

C618-12 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C666/C666M-03(2008) Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

D1751-04(2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

D4263-83(2012) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

D4397-10 Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

3. American Welding Society (AWS):

D1.4/D1.4M (2005) Structural Welding Code Reinforcing Steel

1.5 ACTION SUBMITTALS

A. General:

1. Make submittal in compliance with all provisions of Division 01 pertaining to submittals and quality assurance.
2. Render submittals and receive approval prior to delivery of installation.
3. Approval in writing by the Engineer of submitted products, samples, test reports, and certificates, does not constitute final acceptance.

B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.

1. Expansion Joint Filler.
2. Hot poured sealing compound.
3. Reinforcement.
4. Curing materials.

C. Jointing Plan for all concrete areas.

D. Concrete Mix Design.

E. Concrete Test Reports

F. Construction Staking Notes from Surveyor.

G. Data and Test Reports: Select subbase material.

1. Job mix formula.

2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.
3. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.
4. The Contractor shall retain a testing laboratory to design a select subbase material mixture and submit a job mix formula to the Resident Engineer, in writing, for approval. The formula shall include the source of materials, gradation, plasticity index, liquid limit, and laboratory compaction curves indicating maximum density at optimum moisture. Cost of the testing laboratory to be included in the Contractor's cost of project.

1.6 INFORMATION SUBMITTALS

- A. Qualification Data: For qualified installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of Owners' contact persons.

1.7 QUALITY ASSURANCE

- A. The Contractor shall engage the services of a geotechnical engineer and testing agency to perform quality control of the earthworks.

1.8 DELIVERY STORAGE AND HANDLING

- A. Follow industry guidelines for the timing and placement of concrete.

1.9 PROJECT CONDITIONS

- A. Weather Limitations

1. Hot Weather: Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

Cold Weather: Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

- B. Codes and Standards: Perform earthwork complying with federal, state, and local regulations including the Occupational Safety and Health Act of 1970 as amended.
- C. All applicable regulations regarding notification of utility companies.
- D. Any pumped water shall be discharged from the Site in accordance with federal, state and local codes and regulations. Comply with all local, county, and state permit requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Concrete Type: Concrete shall be as per Table 1 – Concrete Type, air entrained.

TABLE I – CONCRETE TYPE

	Concrete Strength		Non-Air-Entrained	Air-Entrained	
	Min. 28 Day Comp. Str. Psi (MPa)	Min. Cement lbs/c. yd (kg/m ³)	Max. Water Cement Ratio	Min. Cement lbs/c. yd (kg/m ³)	Max. Water Cement Ratio
Type A	5000 (35) ^{1,3}	630 (375)	0.45	650 (385)	0.40
Type B	4000 (30) ^{1,3}	550 (325)	0.55	570 (340)	0.50
Type C	3000 (25) ^{1,3}	470 (280)	0.65	490 (290)	0.55
Type D	3000 (25) ^{1,2}	500 (300)	*	520 (310)	*

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 1200 psi in excess of the compressed strength. For concrete strengths above 5000 psi, the proposed mix design shall achieve a compressive strength 1400 psi in excess of the compressed strength.
2. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

- B. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II – MAXIMUM SLUMP – INCHES (MM)

TYPE	MAXIMUM SLUMP*
Curb & Gutter	3 inches
Pedestrian Pavement	3 inches
Vehicular Pavement	2 inches (Machine Finished) 4 inches (Hand Finished)
Equipment Pad	3 to 4 inches
* For concrete to be vibrated: Slump as determined by ASTM C143. Tolerances as established by ASTM C94.	

2.2 REINFORCEMENT

- A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.

2.3 SELECT SUBBASE (WHERE REQUIRED)

- A. Subbase material shall consist of select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials conforming to AASHTO M147, as follows.

GRADE REQUIREMENTS FOR SOILS USED AS SUBBASE MATERIALS,
BASE COURSES AND SURFACES COURSES

AASHTO M147	Percentage Passing by Mass					
Size	Grades					
(in)	A	B	C	D	E	F
2	100	100				
1		75-95	100	100	100	100
3/8	30-65	40-75	50-85	60-100		
No. 4	25-55	30-60	35-65	50-85	55-100	70-100
No. 10	15-40	20-45	25-50	40-70	40-100	55-100
No. 40	8-20	15-30	15-30	25-45	20-50	30-70
No. 200	2-8	5-20	5-15	5-20	6-20	8-25

- B. Materials meeting other gradations than that noted will be acceptable whenever the gradations are within a tolerance of three to five percent, plus or minus, of the single gradation established by the job-mix formula, or as recommended by the geotechnical engineer and approved by the Resident Engineer.

1. Salvaged existing on-site asphalt material or dense graded aggregate, meeting requirements of this section, and approved for use by the Licensed Site Remediation Professional to be re-used where indicated on the Drawings.

- C. Subbase material shall produce a compacted, dense-graded course, meeting the density requirement specified herein.

2.4 FORMS

- A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.
- B. Do not use forms if they vary from a straight line more than 1/8 inch in any ten foot long section, in either a horizontal or vertical direction.
- C. Wood forms should be at least 2 inches thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

2.5 CONCRETE CURING MATERIALS

- A. Concrete curing materials shall conform to one of the following:

1. Burlap having a weight of seven ounces or more per yard when dry.
2. Impervious Sheeting conforming to ASTM C171.
3. Liquid Membrane Curing Compound conforming to ASTM C309, Type 1 and shall be free of paraffin or petroleum.

2.6 EXPANSION JOINT FILLERS

- A. Material shall conform to ASTM D1751-04.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

- A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTHWORK.
- B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE (WHERE REQUIRED)

- A. Mixing: Proportion the select subbase by weight or by volume in quantities so that the final approved job mixed formula gradation, liquid limit, and plasticity index requirements will be met after subbase course has been placed and compacted. Add water in approved quantities, measured by weight or volume, in such a manner to produce a uniform blend.
- B. Placing:
 1. Place the mixed material on the prepared subgrade in a uniform layer to the required contour and grades, and to a loose depth not to exceed 8 inches, and that when compacted, will produce a layer of the designated thickness.
 2. When the designated compacted thickness exceeds 6 inches, place the material in layers of equal thickness. Remove unsatisfactory areas and replace with satisfactory mixture, or mix the material in the area.
 3. In no case will the addition of thin layers of material be added to the top layer in order to meet grade.
 4. If the elevation of the top layer is 1/2 inch or more below the grade, excavate the top layer and replace with new material to a depth of at least 3 inches in compacted thickness.
- C. Compaction:
 1. Perform compaction with approved hand or mechanical equipment well suited to the material being compacted.
 2. Moisten or aerate the material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3. Compact each layer to at least 95 percent or 100 percent of maximum density as specified in Section 31 20 00, EARTHWORK.
- D. Smoothness Test and Thickness Control: Test the completed subbase for grade and cross section with a straight edge.
1. The surface of each layer shall not show any deviations in excess of 3/8 inch.
 2. The completed thickness shall be within 1/2 inch of the thickness as shown on the Drawings.
- E. Protection:
1. Maintain the finished subbase in a smooth and compacted condition until the concrete has been placed.
 2. When Contractor's subsequent operations or adverse weather disturbs the approved compacted subbase, excavate, and reconstruct it with new material meeting the requirements herein specified, at no additional cost to the Owner.
- 3.3 SETTING FORMS
- A. Base Support:
1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
 2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.
- B. Form Setting:
1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
 2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
 3. Forms shall conform to line and grade with an allowable tolerance of 1/8 inch (3 mm) when checked with a straightedge and shall not deviate from true line by more than 1/4 inch (6 mm) at any point.
 4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
 5. Clean and oil forms each time they are used.
 6. Make necessary corrections to forms immediately before placing concrete.
 7. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.

- C. The Contractor's Registered Professional Land Surveyor shall establish the control, alignment and the grade elevations of the forms or concrete slipforming machine operations. Staking notes shall be submitted for approval to the Resident Engineer prior to placement of concrete. If discrepancies exist between the field conditions and the Drawings, Contractor shall notify Resident Engineer immediately. No placement of concrete shall occur if a discrepancy greater than 1 inch is discovered.

3.4 EQUIPMENT

- A. The Resident Engineer shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.
- B. Maintain equipment and tools in satisfactory working condition at all times. newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

3.5 PLACING REINFORCEMENT

- A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement. All reinforcement shall be supported for proper placement within the concrete section.
- B. Before the concrete is placed, the Resident Engineer shall approve the reinforcement placement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown on the Drawings.

3.6 PLACING CONCRETE – GENERAL

- A. Obtain approval of the Resident Engineer before placing concrete.
- B. Remove debris and other foreign material from between the forms before placing concrete.
- C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.
- D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.
- E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.
- F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.
- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.
- H. Cracked or Chipped Concrete Surfaces and Bird Baths. Cracked or chipped concrete and bird baths will not be allowed. Concrete with cracks or chips and bird baths will be removed and replaced to the nearest joints, and as approved by the Resident Engineer, by the Contractor with no additional cost to the Owner.

- 3.7 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS
- A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
 - B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.
 - C. After the concrete has been placed in the forms, use a strike off guided by the side forms to bring the surface to the proper section to be compacted.
 - D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
 - E. Finish the surface to grade with a wood or metal float.
 - F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.
- 3.8 PLACEING CONCRETE FOR VEHICULAR PAVEMENT
- A. Deposit concrete into the forms as close as possible to its final position.
 - B. Place concrete rapidly and continuously between construction joints.
 - C. Strike off concrete and thoroughly consolidate by a finishing machine, vibrating screed, or by hand finishing.
 - D. Finish the surface to the elevation and crown as shown.
 - E. Deposit concrete as near the joints as possible without disturbing them but do not dump onto a joint assembly. Do not place adjacent lanes without approval by the Resident Engineer.
- 3.9 CONCRETE FINISHING – GENERAL
- A. The sequence of operations, unless otherwise indicated, shall be as follows:
 - 1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
 - 2. Maintain finishing equipment and tools in a clean and approved condition.
- 3.10 CONCRETE FINISHING - CURB AND GUTTER
- A. Round the edges of the gutter and top of the curb with an edging tool to a radius of 1/4 inch or as otherwise detailed.
 - B. Float the surfaces and finish with a smooth wood or metal float until true to grade and section and uniform in textures.
 - C. Finish the surfaces, while still wet, with a bristle type brush with longitudinal strokes.

- D. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the surface, while still wet, in the same manner as the gutter and curb top.
- E. Except at grade changes or curves, finished surfaces shall not vary more than 1/8 inch for gutter and 1/4 for top and face of curb, when tested with a 10 foot straightedge.
- F. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.
- G. Correct any depressions which will not drain. See Article 3.6, Paragraph H, above.
- H. Visible surfaces and edges of finished curb, gutter, and/or combination curb and gutter shall be free of blemishes, form marks, and tool marks, and shall be uniform in color, shape, and appearance.

3.11 CONCRETE FINISHING – PEDESTRIAN PAVEMENT

- A. Walks, Grade Slabs, and Wheelchair Curb Ramps:
 - 1. Finish the surfaces to grade and cross section with a metal float, troweled smooth and finished with a broom moistened with clear water.
 - 2. Brooming shall be transverse to the line of traffic.
 - 3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
 - 4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 1/16 inch in depth.
 - 5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 3/16 inch when tested with a 10 foot straightedge.
 - 6. The thickness of the pavement shall not vary more than 1/4 inch.
 - 7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints at no additional cost.
- B. Steps: The method of finishing the steps and the sidewalls is similar to above except as herein noted.
 - 1. Remove the riser forms one at a time, starting with the top riser.
 - 2. After removing the riser form, rub the face of the riser with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Use an outside edger to round the corner of the tread; use an inside edger to finish the corner at the bottom of the riser.

3. Give the risers and sidewall a final brush finish. The treads shall have a final finish with a stiff brush to provide a non-slip surface.
4. The texture of the completed steps shall present a neat and uniform appearance and shall not deviate from a straightedge test more than 3/16 inch.

3.12 CONCRETE FINISHING – EQUIPMENT PADS

- A. After the surface has been struck off and screeded to the proper elevation, provide a smooth dense float finish, free from depressions or irregularities.
- B. Carefully finish all slab edges with an edger having a radius as shown in the Drawings.
- C. After removing the forms, rub the faces of the pad with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The finish surface of the pad shall not vary more than 1/8 inch when tested with a 10 foot straightedge.
- D. Correct irregularities exceeding the above. See Article 3.6, Paragraph H, above.

3.13 JOINTS – GENERAL

- A. Place joints, where shown on the Shop Drawings and Drawings, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.
- B. Joints shall be straight and continuous from edge to edge of the pavement.

3.14 CONTRACTION JOINTS

- A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.
- B. Construct joints in curbs and gutters by inserting 1/8 inch steel plates conforming to the cross sections of the curb and gutter.
- C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.
- D. Finish edges of all joints with an edging tool having the radius as shown.
- E. Score pedestrian pavement with a standard grooving tool or jointer.

3.15 EXPANSION JOINTS

- A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.
- B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.
- C. Anchor with approved devices to prevent displacing during placing and finishing operations.
- D. Round the edges of joints with an edging tool.

E. Form expansion joints as follows:

1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.
2. Using joint filler of the type, thickness, and width as shown.
3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

3.16 CONSTRUCTION JOINTS

- A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown on the Shop Drawing jointing plan and Drawings.
- B. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.
- C. Use a butt type joint with dowels in curb and gutter if the joint occurs at the location of a planned joint.
- D. Use keyed joints with tiebars if the joint occurs in the middle third of the normal curb and gutter joint interval.

3.17 FORM REMOVAL

- A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.
- B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

3.18 CURING OF CONCRETE

- A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the Resident Engineer.
- B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 6 inches.
- C. Impervious Sheeting: Use waterproof paper, polyethylene coated burlap, or polyethylene sheeting. Polyethylene shall be at least 4 mils in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 12 inches. Securely anchor sheeting.
- D. Liquid Membrane Curing:

1. Apply pigmented membrane forming curing compound in two coats at right angles to each other at a rate of 200 square feet per gallon for both coats.
2. Do not allow the concrete to dry before the application of the membrane.
3. Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.
4. Immediately re-spray any area covered with curing compound and damaged during the curing period.

3.19 CLEANING

A. After completion of the curing period:

1. Remove the curing material (other than liquid membrane).
2. Sweep the concrete clean.
3. After removal of all foreign matter from the joints, seal joints as specified.
4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

3.20 PROTECTION

- #### A.
- The contractor shall protect the concrete against all damage prior to final acceptance by the Owner. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Resident Engineer, and at no additional cost to the Owner. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the Resident Engineer.

3.21 FINAL CLEAN-UP

- #### A.
- Remove all debris, rubbish and excess material from the Site.

END OF SECTION

SECTION 321216

ASPHALT PAVING

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 SECTION INCLUDES

- A. Work shall consist of the construction of all asphalt paving and related work, as indicated on the Contract Drawings and as specified herein. Limits of each type of pavement are shown on the Contract Drawings. Work shall include, but not be limited to the following:
 - 1. Subgrade preparation.
 - 2. Construction of subbase for driveways.
 - 3. Construction of bituminous stabilized base course.
 - 4. Construction of bituminous concrete surface course for driveways, parking areas and walkways.
 - 5. Pavement markings.

1.3 RELATED SECTIONS

- A. Section 310000 – Earthwork.

1.4 REFERENCES

- A. The current specifications of the New York State Department of Transportation, as amended and supplemented herein, shall be followed for all pavement work and materials.
- B. The compacted subgrade and subbase will be subject to testing by the ENGINEER to assure proper compaction as described in Section 02200.

1.5 SUBMITTALS

- A. Mix Formula: The Contractor shall supply to the OWNER, prior to construction, a State-approved mix formula for the type of bituminous concrete specified. The Contractor shall certify to the OWNER that the source of his bituminous concrete is a State-approved plant and that the bituminous concrete provided meets the state specifications.

PART 2 - MATERIALS

2.1 SUBGRADE MATERIAL

- A. Non-organic Soil and rock or rubble free of wood, metal or other deleterious materials obtained from on- or off-site sources. All materials shall be subject to approval by the Architect.

2.2 PAVEMENT MATERIALS

Driveway and Parking Areas:

- A. Subbase: Crushed stone Type 5A shall consist of quarry processed stone in conformance with the requirements of the NYSDOT Standard Specifications.
- B. Bituminous Stabilized Base Course: The bituminous stabilized base course material shall be bituminous concrete 25M64 in accordance with the requirements of NYSDOT Standard Specifications.
- C. Bituminous Concrete Surface Course: The bituminous concrete surface course material shall be bituminous concrete 9.5M64 in accordance with the requirements of NYSDOT Standard Specifications. Submit mix design to provide aggregates with high albedo (light reflecting) characteristics.

Pedestrian Trails:

- A. Subbase: Crushed stone Type 5A shall consist of quarry processed stone in conformance with the requirements of Section 901 of the NYSDOT Standard Specifications.
- B. Bituminous Concrete Surface Course: The bituminous concrete surface course material shall be bituminous concrete 9.5M64 in accordance with the requirements of NYSDOT Standard Specifications. Submit mix design to provide aggregates with high albedo (light reflecting) characteristics.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBGRADE

- A. The Contractor shall fine grade the subgrade to within 0.05 ft of the lines and grades shown on the Contract Drawings. The Contractor is alerted to the fact that special care must be taken in areas where utilities may be at a minimum cover.
- B. After the subgrade has been fine graded, the top 12 inches of the subgrade shall be compacted with a minimum of 4 passes using a minimum 5-ton static weight vibratory roller. The subgrade shall be compacted to not less than 95% of maximum dry density as determined by the Modified Proctor Test ASTM D1557. The water content of the top 12 inches shall be adjusted by adding water or drying to +/-2% of the optimum water content. All grading and compaction shall be done in such a manner as to produce a smooth, uniform subgrade surface. Any soils which exhibit weaving or pumping under the compactor or construction equipment shall be excavated and replaced with compacted fill.
- C. The subgrade shall be prepared after all utilities and other subsurface structures have been placed and the backfill has been properly placed and compacted.

- D. The subgrade shall not be prepared during freezing weather or when frozen, or when it is unstable because of excessive moisture.
- E. When completed, the subgrade shall be at the proper grade and contour, firm, even and free from depressions that may form water pockets, and shall be so maintained until the pavement is placed.

3.2 CONSTRUCTION OF SUBBASE

- A. Subbase shall not be constructed when the subgrade is frozen or when it is soft or unstable. Subbase shall not be constructed during rainy or freezing weather or with frozen material.
- B. The subbase shall be spread, compacted, and graded to within + 1/2 inch of the sections and grades shown on the Contract Drawings.
- C. The subbase shall be compacted with a minimum of 5 passes using a minimum 5-ton static weight vibratory compactor or other approved equipment and procedures. The subbase shall be compacted to not less than 95% of the maximum dry density as determined by the Modified Proctor Compaction Test, ASTM D1557.
- D. If, in the opinion of the ENGINEER, the moisture content is excessive or deficient, the Contractor shall make adjustments to the satisfaction of the ENGINEER and as required for the specified density.
- E. The Contractor shall be responsible for the protection of adjacent structures in or above the proposed subgrade to preclude any damages during placement or compaction.
- F. Should the subbase material become contaminated or for any reason become unsuitable prior to placement of the pavement, the Contractor shall correct or replace the subbase material with satisfactory subbase material at no additional expense.

3.3 BITUMINOUS STABILIZED BASE COURSE

- A. The base course shall be placed on the subbase in accordance with the requirements of NYSDOT Standard Specifications as soon as stable conditions are achieved. This shall be done so as not to interfere with existing and construction traffic patterns. Prior to placing the surface course, any failed areas in the base shall be patched by excavating both the bituminous base and subbase course and replaced with additional bituminous base to meet required elevations for stability.
- B. The thickness of the compacted asphaltic concrete shall not vary more than 1/8 inch from the thickness shown on the Contract Drawings.
- C. A tack coat is required between the base course and surface course. The surface shall be broom cleaned and a coat of tack coat shall be applied at a rate of 1/10 gal per square yard (or per manufacturers recommendations) immediately prior to placement of the surface course.

3.4 BITUMINOUS CONCRETE SURFACE COURSE

- A. The bituminous concrete shall be applied in a single course thickness with a self-propelled paving machine in accordance with NYSDOT Standard Specifications.
- B. The surface of the base course or existing pavement upon which the bituminous concrete pavement is to be placed shall be clean, dry and free from frost when the paving operations are about to start and shall be maintained in that condition. The ENGINEER may permit, in the case of a sudden rain, the placing of mixture in transit from the plant, if laid at proper temperature and if the roadbed is free of standing water.
- C. Bituminous concrete mixtures shall be laid when the combinations of laydown and base surface temperatures are within the limits shown in the following table.

<u>Minimum Laydown Temperature (Degrees F)</u>			
<u>Course Thickness</u>			
<u>Base Temp.</u>	<u>1"</u>	<u>2"</u>	<u>3" & Greater</u>
20 - 30	-	-	285
33 - 40	-	-	280
41 - 50	310	285	275
51 - 60	300	280	270
61 - 70	290	275	265
71 - 80	285	270	265
81 - 90	275	165	260
91 & over	270	260	265

- A. Contact surfaces of curbing, gutters, manholes, and other structures shall be painted with a thin uniform coating of cut-back asphalt, Grade RC-70 just prior to the placing of the bituminous concrete mixture against them.
- B. When bituminous concrete is laid on existing bituminous concrete or newly constructed bituminous concrete on which traffic has been maintained, the paved surface shall be given an application of tack coat material at the rate of 0.10 gallons per square yard as directed by the ENGINEER, prior to placing the new surface. Equipment for applying the tack coat shall be power operated pressure spraying or distributing equipment suitable for the materials to be applied. Bituminous pavements shall be thoroughly cleaned prior to application of tack coat material.
- F. The bituminous concrete shall be compacted at proper temperatures using a 10-ton steel-wheeled roller or other approved procedures.
- G. The thickness of the compacted asphaltic concrete shall not vary more than 1/4 inch from the thickness shown on the Contract Drawings.
- H. The finished pavement shall have a smoothness such that no point varies more than 1/4 inch under a 20-ft straight edge applied parallel to the flow line of the pavement. Low spots or "bird baths" which hold water will be repaired by the Contractor by patching.

3.5 PAVEMENT MARKING

- A. Prior to any pavement marking, the surface of the pavement shall be thoroughly cleaned and all dust, dirt, and other foreign materials removed.
- B. The markings or striping shall be completed as shown on the Contract Drawings.
- C. No markings shall be done until the surface of the pavement has been in place for a minimum of 2 weeks.
- D. The Contractor shall be responsible for protecting the work until the paint has sufficiently dried.
- E. The Contractor shall be responsible for removing tracking marks, spilled paint or paint not meeting the requirements of the Specifications at no additional cost to the OWNER.

PART 4 – MEASUREMENT & PAYMENT

- A. The Driveway Asphalt Sections as indicated on the Contract Drawings shall be measured in price per square yard and will include the 2" HMA 9.5 M64 Surface course, 4" HMA 25 M64 Base course, 6" dense graded aggregate, and subgrade under one item.
- B. The Pedestrian Asphalt Trail Sections as indicated on the Contract Drawings shall be measured in price per square yard and will include the 2" HMA 9.5 M64 Surface course, 6" dense graded aggregate, and subgrade under one item.

END OF SECTION

SECTION 334000

STORM SEWER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. Section Includes:

- 1. This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

B. Related Sections:

- 1. Section 312000 Earthwork.
- 2. Section 334600 Subdrainage.

1.3 DEFINITIONS AND ABBREVIATIONS

A. Definitions: None.

B. Abbreviations:

HDPE: High-density polyethylene.

PE: Polyethylene.

PVC: Poly Vinyl Chloride.

1.4 REFERENCES

- A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- a. C139-10 – Concrete Masonry Units for Construction of Catch Basins and Manholes
- b. C150/C150M-11 - Portland Cement
- c. C443-10 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- d. C478-09 - Precast Reinforced Concrete Manhole Sections
- e. C857-07 - Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
- f. C891-09 - Installation of Underground Precast Concrete Utility Structures
- g. C913-08 - Precast Concrete Water and Wastewater Structures

- h. C923-08 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
 - i. C990-09 - Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
 - j. C1173-08 - Flexible Transition Couplings for Underground Piping Systems
 - k. C1433-10 - Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
 - l. C1479-10 - Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
 - m. D448-08 - Sizes of Aggregate for Road and Bridge Construction
 - n. D698-07e1 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))
 - o. D2751-05 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
 - p. D3350-10 - Polyethylene Plastics Pipe and Fittings Materials
 - q. F894-07 - Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
 - r. F949-10 - Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
 - s. F1417-11 - Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
 - t. F1668-08 - Construction Procedures for Buried Plastic Pipe
- 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M198-10 – Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
 - b. M252-09 – Corrugated Polyethylene Drainage Pipe
 - c. M294-10 – Corrugated Polyethylene Pipe, 12 to 60 In. (300 to 1500 mm) Diameter
 - 3. American Concrete Institute (ACI):
 - a. 318-05 – Structural Commentary
 - b. 350/350M-06 – Environmental Engineering Concrete Structures and Commentary
 - 4. National Stone, Sand, and Gravel Association (NSSGA): Quarried Stone for Erosion and Sediment Control

1.5 ACTION SUBMITTALS

A. General:

- 1. Make submittal in compliance with all provisions of Division 01 pertaining to submittals and quality assurance.
- 2. Render submittals and receive approval prior to delivery of installation.
- 3. Approval in writing by the Engineer of submitted products, samples, test reports, and certificates, does not constitute final acceptance.

- B. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.
- C. Shop Drawings:
 - 1. Cleanouts and Drains. Include plans, elevations, sections, details, frames, covers, grates, outlet control structures, weir walls, dome risers, infiltration trenches, and all connections to existing drainage infrastructure.

1.6 INFORMATION SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Qualification Data: For qualified installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of Owners' contact persons.

1.7 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 - 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of two years from final acceptance. Further, the Contractor will furnish all manufacturers' and suppliers' written guarantees and warranties covering materials and equipment furnished under this Contract.

1.8 DELIVERY STORAGE AND HANDLING

- A. Do not store plastic pipe, and fittings in direct sunlight.
- B. Handle manholes, structures, catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.9 PROJECT CONDITIONS

- A. Existing Conditions
 - 1. Carefully examine the site before submitting a bid. Be informed as to the nature and location of the Work, general and local conditions including climate, adjacent properties and utilities, conformation of the ground, the nature of subsurface conditions, the character of equipment and facilities needed prior to and during execution of the Work.

2. Should the Contractor, in the course of Work, find any discrepancies between Drawings and physical conditions or any omissions or errors in Drawings, or in layout as furnished by the Engineer, it will be his duty to inform the Engineer immediately in writing for clarification. Work done after such discovery, unless authorized by the Engineer, shall be done at the Contractor's risk.
- B. Field Measurements: Verify actual grade elevations, service and utility locations, structural components, and dimensions of footings, walls, pavement areas, subbase materials and construction contiguous with storm sewer utilities by field measurements before proceeding with work.
 - C. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
 1. Notify the Construction Manager and Owner no fewer than three days in advance of proposed interruption of each service or utility.
 2. Do not proceed with interruption of services or utilities without the Owner's written permission.
 - D. Weather Limitations: Proceed with work only when existing and forecasted weather conditions permit the work to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 FACTORY ASSEMBLED PRODUCTS

- A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.2 HDPE PIPE AND FITTINGS

- A. Corrugated HDPE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
- B. Water-tight Couplings: AASHTO D3212, corrugated, matching tube and fittings.
- C. Water-tight flexible connections at manholes and other concrete structures: Rubber corrugated pipe adapter and flexible boot-type connector meeting or exceeding ASTM 2510, ASTM C 1478, ASTM D 2321.
 1. Adapter: ADS Pipe Adapter as manufactured by Press-Seal Corporation, Fort Wayne, Indiana, or approved equal.
 2. Flexible Boot-Type Connector: PSX: Direct Drive as manufactured by Press-Seal Corporation, Fort Wayne, Indiana, or approved equal.

3. Finished connections shall provide sealing to 10.8 psi minimum.
4. Finished connection shall accommodate angular deflection of the pipe to 7 degrees (minimum) and diametric deflection of 5% minimum with no loss of seal.
5. Testing of installed adapters and connectors shall be conducted in strict conformance with the requirements of the adapter and connector manufacturer.

2.3 PE PIPE AND FITTINGS

- A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.
 1. Water-tight Couplings: AASHTO D3212, corrugated, matching tube and fittings.
- B. PVC Pipe And Fittings
 1. PVC Cellular-Core Pipe And Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
 2. Fittings: ASTM D3034, SDR 35, PVC socket-type fittings.

2.4 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure 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 plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
 2. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.5 EXPANSION JOINTS AND DEFLECTION FITTINGS (NOT USED)

2.6 CLEANOUTS

- A. General: Provide cleanouts per the locations and extents indicated on the Drawings.

- B. Plastic Cleanouts shall have PVC body with PVC threaded plug. Pipe fitting and riser to cleanout shall be of same material as main line pipe.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or approved equal:
 - a. Canplas LLC.
 - b. IPS Corporation.
 - c. NDS Inc.
 - d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.
- C. Lid Manufacturers: Subject to compliance with requirements, the basis of design is the following or approved equal:
 - 1. East Jordan Iron Works Product #41610102.

2.7 OBSERVATION WELLS

- A. General: Provide cleanouts per the locations and extents indicated on the Drawings.
- B. Plastic observation wells shall have PVC body with PVC threaded plug.
 - 1. Slotted well screen: 0.01 slot size.
 - 2. Atlantic Screen and Manufacturing Inc. Item #OES40400 or approved equal.
 - 3. Observation Well Cover: Gray iron frame
 - a. East Jordan Iron Works product #00157024 or approved equal.

2.8 DRAINS

- A. Plastic Polymer Concrete Trench Drains: ASME A112.6.3, rectangular body with anchor flange or other anchoring device, and rectangular grate. Include units of total length indicated and quantity of bottom outlets with inside call or spigot connections, of sizes indicated.
 - 1. Top-Loading Classification(s): Load Class F
 - 2. Grate openings shall be ADA compliant.
 - 3. Grate Material: 16 Gauge, Grade 304 Stainless Steel or approved equal
 - 4. Manufacturers: Subject to compliance with requirements, the basis of design is the following or approved equal:
 - a. ACO, Inc.: S300K Trench Drain System.
 - b. 8" nominal size.
 - c. Ductile Iron Grate – Heavy Duty Ductile Iron Slotted Grate Part NO. 93502
 - d. Catch Basin – K2-902G Series.
- B. Nyloplast In-Line Drain

1. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a water tight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals.
2. The flexible elastomeric seals shall conform to ASTM F477.
3. The pipe bell spigot shall be joined to the inline drain body by use of a swage mechanical joint.
4. The inline drain body and pipe stubs of the surface drainage inlets shall conform to ASTM D178 cell class 12454.
5. The grates furnished for all surface drainage inlets shall be ductile iron grates and shall be made specifically for each fitting so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet.
6. Grates for inline drains shall be capable of supporting H-20 wheel loading for traffic areas or H-10 loading for pedestrian areas.
7. 12" and 15" square grate will be hinged to the frame using pins.
8. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 10-50-05 for ductile iron.

2.9 WATER QUALITY INSERTS FOR CATCH BASINS, STORMWATER INLETS, AND OUTLET CONTROL STRUCTURES

- A. General: Permanent water quality filtration screen provided in inlets and outlet control structures where shown on the Drawings.
 1. Manufacturers: Subject to compliance with requirements, the basis of design is the following or approved equal:
 - a. Advanced Drainage Systems, Inc.: Flexstorm Pure Permanent Inlet Protection.
 - b. Suntree Technologies, Inc.: Grate Inlet Skimmer Box or High Capacity Curb-inlet Box.

2.10 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS

- A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets, and shall conform to ASTM C923.

2.11 WARNING TAPE

- A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

PART 3 - EXECUTION

3.1 PIPE BEDDING

- A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

3.2 PIPING INSTALLATION

- A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping with 48 inch minimum cover or as shown on the Drawings.
- C. 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.
 - 1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
 - 2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
 - 3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
 - 4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
 - 5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
 - 6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches over the crown of the pipe.
 - 7. Warning tape shall be continuously placed 12 inches above storm sewer piping.

- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. 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.
- F. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
 - 3. Install PE corrugated sewer piping according to ASTM D2321 with gasketed joints.
 - 4. Install PVC cellular-core piping, PVC sewer piping, and PVC profile gravity sewer piping, according to ASTM D2321 and ASTM F1668.

3.3 REGRADING

- A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.4 CONNECTIONS TO EXISTING PUBLIC UTILITY MANHOLES

- A. Comply with all rules and regulations of the public utility.
- B. Cleanout Installation
 - 1. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast iron soil pipe fittings in sewer pipes at branches for cleanouts and cast iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 2. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 - 3. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
 - 4. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

5. Set cleanout frames and covers in earth in cast in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.
6. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 IDENTIFICATION

- A. Install green warning tape directly over piping and at outside edge of underground structures.

3.6 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record of all piping from the building to the City connection to show the lines are free from obstructions, properly sloped and joined.
 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. Damage: 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.

3.7 TESTING OF STORM SEWERS

- A. Submit separate report for each test.
- 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 requirements of 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. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.

C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.8 CLEANING

A. Clean Interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION

SECTION 334600

SUBDRAINAGE

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. Perforated-wall pipe and fittings.
 - 2. Drainage conduits.
 - 3. Geotextile filter fabrics.
- B. Related Sections:
 - 1. Section 312000 Earthwork.
 - 2. Section 334000 Storm Sewer Utilities.

1.3 DEFINITIONS AND ABBREVIATIONS

NPS: Nominal Pipe Size.

PVC: Polyvinyl Chloride.

HDPE: High Density Polyethylene.

PE: Polyethylene.

SDR: Standard Dimension Ratio.

MARV: Minimum Average Roll Value.

1.4 REFERENCES

- A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
 - 1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
 - a. F 667 Standard specification for 3 through 24 inch corrugated polyethylene pipe and fittings.
 - b. D 2729 Standard specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - c. D 3350 Standard specification for polyethylene plastics pipe and fittings materials.

- d. D 4716 Standard test method for determining the (in-plane) flow rate per unit width and hydraulic transmissivity of a geosynthetic using a constant head.
 - e. D 4491 Standard test methods for water permeability of geotextiles by permittivity.
 - f. D 4632 Standard test method for grab breaking load and elongation of geotextiles
 - g. D 4633 Standard test method for energy measurement for dynamic penetrometers
 - h. D 4533 Standard test method for trapezoid tearing strength of geotextiles
 - i. D 3786 Standard test method for bursting strength of textile fabrics – diaphragm bursting strength tester method.
 - j. D 4491 Standard test methods for water permeability of geotextiles by permittivity.
 - k. D 4751 Standard test method for determining apparent opening size of geotextile
 - l. D 4355 Standard test method for deterioration of geotextiles by exposure to light, moisture and heat in a xenon arc-type apparatus.
2. American Association of State Highway and Transportation Officials (AASHTO)
- a. M 288 Class 2 Geotextiles.
 - b. M 252 Standard specification for corrugated polyethylene drainage pipe.
 - c. M 294 Standard specification for corrugated polyethylene pipe (12 to 60 inches) diameter.

1.5 ACTION SUBMITTALS

A. General:

- 1. Make submittal in compliance with all provisions of Division 01 pertaining to submittals and quality assurance.
- 2. Render submittals and receive approval prior to delivery of installation.
- 3. Approval in writing by the Engineer of submitted products, samples, test reports, and certificates, does not constitute final acceptance.

B. Product Data:

- 1. Drainage conduits, including rated capacities.
- 2. Drainage panels, including rated capacities.
- 3. Geotextile filter fabrics.

C. Samples for Verification:

- 1. Drainage conduits: 12 inch length.
- 2. Geotextile filter fabrics: 12 by 12 inches.

1.6 INFORMATIONAL SUBMITTALS

A. None.

1.7 QUALITY ASSURANCE

A. Products Criteria:

- 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
- 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall

be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.8 DELIVERY STORAGE AND HANDLING

- A. Product labels shall clearly show the manufacturer of supplier name, style name, and product number.
- B. Each product shall be wrapped with material that will protect the product from damage due to shipment, water, sunlight, and contaminants.
- C. Store products in a manner that prevents excessive mud, wet concrete, epoxy, or other deleterious materials from coming in contact with and affixing to the material. Store materials above -20°F (-29°C) and avoid handling below 14°F (-10°C).
- D. During storage, materials shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical property values of the geosynthetic.

1.9 PROJECT CONDITIONS

- A. Existing Conditions
 - 1. Carefully examine the site before submitting a bid. Be informed as to the nature and location of the Work, general and local conditions including climate, adjacent properties and utilities, conformation of the ground, the nature of subsurface conditions, the character of equipment and facilities needed prior to and during execution of the Work.
 - 2. Should the Contractor, in the course of Work, find any discrepancies between Drawings and physical conditions or any omissions or errors in Drawings, or in layout as furnished by the Engineer, it will be his duty to inform the Engineer immediately in writing for clarification. Work done after such discovery, unless authorized by the Engineer, shall be done at the Contractor's risk.
- B. Field Measurements: Verify actual grade elevations, service and utility locations, structural components, and dimensions of footings, walls, pavement areas, subbase materials and construction contiguous with subdrainage elements by field measurements before proceeding with work.
- C. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
 - 1. Notify the Construction Manager and Owner no fewer than three days in advance of proposed interruption of each service or utility.
 - 2. Do not proceed with interruption of services or utilities without the Owner's written permission.

- D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit the work to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 DRAINAGE CONDUITS

- A. Single-Pipe Drainage Conduits: Prefabricated geocomposite with perforated corrugated core molded from HDPE complying with ASTM D 3350 and wrapped in geotextile filter fabric.

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, or approved equal:
2. Basis-of-Design Product: Subject to compliance with requirements, product or comparable product by one of the following, or approved equal:

a. Advanced Drainage Systems, Inc.; N-12 T IB Dual Wall – HDPE Pipe

- 1) Shall have a smooth interior and annular exterior corrugations.
- 2) 4- through 10-inch pipe shall meet AASHTO M252, Type S or SP.
- 3) Joint Performance: Pipe shall be joined using a bell & spigot joint meeting the requirements of AASHTO M252, AASHTO M294, or ASTM F2306. The joint shall be soil-tight and gaskets for diameters 12- through 60-inch, shall meet the requirements of ASTM F477. For diameters 4- through 10-inch, the joint shall be soil-tight using an engaging dimple connection. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
- 4) Fittings: Fittings shall conform to AASHTO M252, AASHTO M294, or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of AASHTO M252, AASHTO M294, or ASTM F2306.
- 5) Material Properties: Material for pipe and fitting production shall be high density polyethylene conforming with the minimum requirements of cell classification 424420C for 4- through 10-inch (100 to 250 mm) diameters, and 435400C for 12- through 60-inch (300 to 1500 mm) diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12- through 60-inch (300 to 1500 mm) pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 9.5 and 5.1 of AASHTO M294 and ASTM F2306, respectively.
- 6) Minimum In-Plane Flow: 30 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

3. Filter Fabric: PP geotextile.

4. Fittings: HDPE with combination NPS 4 and NPS 6 outlet connection.

5. Couplings: Corrugated HDPE band.

B. Slow release orifice: To be set in inlet or outlet structures as noted on the Drawings.

1. Assembly:

- a. Dual Wall Cleanout – Nyoplast Dwg. #0874Ag or as required for pipe sizes, or approved equal.
- b. End Plug with gasket and recessed handle – ADS Product #0833AA, or approved equal.
- c. Drilled orifice opening, diameter per the Drawings.

2.2 DRAINAGE PANELS (NOT USED)

2.3 SOIL MATERIALS

A. Soil materials are specified in Section 312000 "Earth Moving."

2.4 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.

1. Survivability: AASHTO M 288 Class 2.

2. Styles: Flat and sock.

C. Geotextile Filter Fabrics

1. Provide Mirafi 180N 8oz Non-Woven fabric, or approved equal, at locations of reinforced subgrade below manholes as indicated on the Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing utilities, sidewalks, structures, pavements, and other facilities to remain free from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Foundation soil shall be excavated to the line and grades as shown on the construction drawings or as directed by the Engineer. Over-excavated areas shall be filled with compacted backfill material as per project specifications or as directed by the Engineer. As a minimum, the foundation soil shall be proof rolled prior to backfill and geosynthetic placement.

C. Clear, grub, and excavate to the design subgrade elevation, stripping topsoil, deleterious debris and unsuitable material from the site.

D. Smooth grade and compact the soils using appropriate compaction equipment. Very soft soils (CBR < 0.5) may be difficult to compact. In these instances, create a surface that is as uniformly smooth as possible.

- E. Drainage and dewatering, excavation, grading, subbase and base course coordination shall be per Section 312000 – Earthwork.

3.2 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.
- C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.4 FOUNDATION DRAINAGE INSTALLATION (NOT USED)

3.5 UNDERSLAB DRAINAGE INSTALLATION (NOT USED)

3.6 LANDSCAPING DRAINAGE INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.7 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 12 inches unless otherwise indicated.
 - 2. Landscaping Subdrainage: Install piping level with a minimum cover as indicated on the Drawings
 - 3. Lay perforated pipe with perforations down.
 - 4. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install thermoplastic piping according to ASTM D 2321.

3.8 GEOSYNTHETIC INSTALLATION

- A. Geosynthetic shall be laid at the proper elevation and orientation as shown on the construction drawings or as directed by the Engineer. Correct orientation of the geosynthetic shall be verified by Contractor.
- B. Geosynthetic may be temporarily secured in-place with staples, pins, sand bags or backfill as required by fill properties, fill placement procedure or weather condition, or as directed by the Engineer.
- C. Unroll the geosynthetic in the direction of travel so that the long axis of the roll is parallel with channelized traffic patterns. For very soft subgrades (CBR < 0.5), unrolling geogrid transversely or perpendicular to the roadway embankment alignment, may be preferred, particularly if lateral spreading and separation of overlaps is a concern.
- D. Overlap geosynthetics in accordance with manufacturer's recommendations.
- E. Cut and overlap geogrid to accommodate curves. Cutting may be done with sharp shears, a knife-like implement or handheld power (i.e., "cutoff") saws. Cut grid to conform to manhole covers and other immovable protrusions.
- F. Geomembranes to conform to protrusions per details provided in the Drawings.

3.9 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.

- B. Join perforated PVC sewer pipe and fittings according to ASTM D 3212 with loose bell-and-spigot, push-on joints.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.10 CLEANOUT INSTALLATION

- A. Comply with requirements for cleanouts specified in Section 334100 "Storm Utility Drainage Piping."
- B. Cleanouts for Landscaping Subdrainage:
 - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.
 - 3. In nonvehicular-traffic areas, use NPS 4 PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout 1 inch above grade.
 - 4. Comply with requirements for concrete specified in Section 033000 "Cast-in-Place Concrete."

3.11 CONNECTIONS

- A. Comply with requirements for piping specified in Section 334100 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.12 IDENTIFICATION

- A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 312000 "Earth Moving."
 - 1. Install PE warning tape or detectable warning tape over ferrous piping.
 - 2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.13 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.

2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.14 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600

SECTION 32 92 00 – TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fine grading and preparing seeded areas.
 - 2. Applying topsoil.
 - 3. Furnishing and applying soil amendments.
 - 4. Furnishing and applying fertilizers.
 - 5. Seeding & sod installation
 - 6. Reseeding and sod installation at unsatisfactory or damaged areas.
 - 7. Mulch applications.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, and as described below.
 - 1. Label each submittal with the Specification number and line-item number(s).
 - 2. Do not combine submittals from different Sections.
- B. Turf and Grasses Submittals Tracking List: Spreadsheet indicating each submittal required by this Section, labeled by name and Specification and line-item number, with columns for each submittal indicating dates of submittals, reviews, and completion of reviews/revisions process.
 - 1. Submit to University Representative no later than three months after project start date, or two months prior to planting, whichever is earlier.
 - 2. Update and submit monthly during months of preparation, purchasing, planting, maintenance, and close-out.
 - 3. Provide copies of each correspondence to University Landscape Architect and Project Landscape Architect, ThinkGreen LLC.
- C. Samples of each of the following:
 - 1. Mulch.
- D. Certification of seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 1. Seed must be Blue Tagged Certified Seed and must contain requirements indicated herein. Submit seed breakdown tags to the Owners Representative for approval. Tags must

show percentage of seed varieties, weed seed, inert matter, and date of "Germination Test" done within a nine-month period prior to sale of the seed.

- E. Certification by product manufacturer that the following products supplied comply with requirements:
 - 1. Soil amendments.
 - 2. Fertilizers.
- F. Identify nursery source and availability of seed mixes within 30 days of the award of contract. Submit to Owners Representative for approval before ordering materials.
- G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.
- H. At least 30 days prior to intended use, provide the following samples and submittals for approval in conformance with the requirements of the Section. Do not order materials until the Owners Representative provides acceptance of samples, certifications or test results have been obtained.
- I. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.
 - 1. Analysis of existing topsoil (representative sample from stockpile).
 - 2. Analysis of imported topsoil.
- J. Seeding and sod installation schedule: Submit proposed seeding and sod installation schedule during normal seasons for such work in area of site. Perform seeding and mulching upon completion of planting. Coordinate seeding schedules with planting schedules. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.
- K. Submit verification that hydro mulch applicators are certified to operate equipment.
- L. Submit letter notifying the Owners Representative of completion seeding and sod installation, including maintenance instructions for Owner's use, and requesting inspection to determine acceptability for Substantial Completion and beginning of warranty period.
- M. Submit letter to the Owners Representative requesting a final inspection of seeding and sod for Final Acceptance at end of warranty period.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful grass establishment.
- B. Qualification of Foreman or Crew Leader: Each item of Work of this section shall be supervised by a foreman or crew leader who is a certified landscape professional.
 - 1. Landscape professional shall be a Pennsylvania Certified Horticulturist or Landscape Technician certified by the Pennsylvania Landscape and Nursery Association.
 - 2. Certification shall be current.

- C. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated and make recommendations without delaying the Work.
1. Qualified independent soil-testing laboratories include, but are not limited to:
 - a. Earth Works, Martins Creek, Pennsylvania; phone: 800-732-TURF.
- D. Topsoil Analysis: Furnish an agronomic profile of the topsoil made by a qualified independent soil-testing laboratory stating percentages of organic matter and inorganic matter (silt, clay, and sand); pH, total exchange capacity, mineral and plant-nutrient content, base saturation percentages and deleterious material.
1. Report suitability of topsoil for growth of proposed seed and plant material as specified in Section 32 9300-Planting. State deficits and recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil that complies with the following percentage of base saturation:

BASE SATURATION

<u>Element</u>	<u>% range desired</u>	<u>ideal %</u>
Ca	60-70%	68%
Mg	10-20%	12%
K	2-5%	5%
Na	0.5-3%	0.75%
Other Bases (variable)	2-4%	3.75%
Exchangeable Hydrogen	10-15%	10.50%
pH	6.2-6.7	6.5

- E. Provide the Owners Representative with copies of soil test results a minimum of 30 days prior to any grading, seeding or sodding.
 - F. Submit a Percolation Rate Test prior to the commencing of any seeding or planting activity as outlined in Earth Moving, or if not specified therein, as required by Penn State University Standards. This test is intended to determine the rate of percolation of the existing subgrade.
 - G. The seed producer shall specialize in grass seed production with a minimum of 5 years' experience and shall be certified by the Pennsylvania Department of Agriculture as outline in Title 3 (Agriculture) of the Pennsylvania Consolidated Statutes.
 - H. Seed must comply with all commonwealth of Pennsylvania seed certifications.
 - I. Pre-installation Conference: Conduct conference at Project site to comply with Section General Requirements, "Project Meetings."
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1. Each seed container shall be in sealed 50# bags labeled by manufacturer and/or grower and indicating weight and analysis
 2. Seed shall be accompanied with delivery tickets specifying percentage of germination, purity, and noxious weed content.
- B. Deliver and store fertilizer, lime and seed in original unopened packages. Keep dry, and unopened until needed for use.
1. Keep away from contaminants, insects and rodents.
- C. Sod: Sod shall be reviewed by the Owners Representative at the job site prior to installation. The Owners Representative reserves the right to reject any sod they deem unacceptable.
1. All sod delivered from the supplier shall be installed on the same day as delivery.
 2. Each palette, flat, or specified group of sod shall be labeled by the grower or manufacturer as separate items.
 3. During delivery and storage, sod materials shall be protected from any drying or contamination by detrimental material.
 4. Sod shall not be dropped or dumped from vehicles

1.6 COORDINATION AND SCHEDULING

- A. Planting Season: Sow seed and place sod during following planting seasons for type of work required. Correlate seeding with specified maintenance periods to provide required maintenance from date of Substantial Completion.
1. Lawn Seeding: April 1 to May 15 or August 15 to September 30, further restricted as specified below.
- C. Weather Limitations: Proceed with seeding only when existing and forecast weather conditions are suitable for work.
- D. No seeding or sodding is to be done when the ground is frozen or during days of extreme heat (≥ 85 degrees).
- E. No seed or sod shall be installed before April 1st or a minimum of 3 consecutive days of 55 degree soil temperatures.
- F. If work must be performed outside of these parameters, the Owners Representative must be contacted.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Warrant seed and sod areas as follows except for incidents that are beyond the Contractor's control:
1. Seeding & Sodding: Warrant areas for a period of 90 days after date of Substantial Completion. Grass areas shall be vigorous and thriving, free of objectionable quantities of weeds and other undesirable growth. Seeded lawn coverage shall exceed 90% over

- any ten-foot square area, and each bare spot shall not be larger than 2" x 2". Sod shall be vigorous, well-rooted, and with no more than 5% dead or browning, with no gaps.
2. When full warranty period has not elapsed before end of normal growing season, or if vegetation is not fully established at that time, continue warranty during next normal growing season.
- C. In seeded areas, reseed bare spots larger than those allowed with seed and mulch with same materials specified for respective areas.
 - D. At end of warranty period and after final inspection, remove site protections, and seed, mulch and sod with same materials specified for respective areas.
 - E. Exclusions from the Warranty: Where evidence exists of damage that is beyond the Contractor's control, advise the Owners Representative in writing, stating location and nature of damage. The Owners Representative, upon receipt of such notice, may order the Contractor to correct the damage at the Owner's expense, or exclude the damaged areas from the warranty provisions and correct the damage by any arrangement deemed appropriate by the Owners Representative.

1.8 SEED AND SOD AREA MAINTENANCE

- A. Begin maintenance of areas immediately after each area is installed and continue until acceptable vegetative cover is established, but for not less than the warranty period.
 1. Seed & Sod Areas Areas: 90 days from date of Substantial Completion, or until Final Acceptance by Owners Representative, whichever is longer.
 2. When full maintenance period has not elapsed before end of planting season or if lawn is not fully established, continue maintenance during next planting season
- B. Maintain and establish areas by watering, weeding, reseeding, re-sodding, controlling pests and diseases, and other operations. Roll, regrade, and reseed/re-sod bare or eroded areas and remulch seeded areas to produce a uniformly smooth vegetative cover.
 1. Reseed/Re-sod bare areas with same materials specified for respective grasses.
 2. Add new mulch in seeded areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.
 3. All areas and spots which do not show a prompt catch of grass or signs of browning shall then be reseeded or re-sodded as required until complete coverage is obtained.
- C. Watering: Provide and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep area uniformly moist to a depth of 4 inches.
 1. Lay out temporary turf-watering system and arrange watering schedule to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly seeded, plugged, or sprigged areas.
 2. Water or supplement natural rainfall to provide a minimum rate of 1 inch per week.
 3. All lawn areas shall be kept moist to maximize germination and root establishment. Water shall be applied frequently enough to keep the grass and soil from drying out. The University shall provide the water source. The contractor is responsible for hoses, sprinklers or other watering devices and he/she shall ensure proper backflow protection on the water source.
 4. To protect pedestrians any hoses that cross a sidewalk, walkway, or other pedestrian route must be bridged using a cable tray or other similar device in a manner that is ADA compliant

- D. When the average height of the grass is 3 to 4 inches, grass shall be cut to 2 to 3 inches or 1/3 of the grass blade. Any depressions or irregularities in the lawn surface shall be leveled off and reseeded or re-sodded.

1.9 ACCEPTANCE

- A. Conditions at end of Maintenance Period: lawn areas shall be free of insect, pest and disease damage.
- B. Lawn Areas. At the end of the maintenance period, a healthy, uniform, close stand of grass will have been established, free of weeds, invasive species and surface irregularities, with seeded lawn coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 2 by 2 inches.
- C. If lawn areas are deficient, the Contractor's responsibility for maintenance of all areas shall be extended until deficiencies are corrected. Areas to be corrected shall be prepared and reinstalled in accordance with the requirements of this Section. Owners Representative's inspection shall determine whether maintenance shall continue in any part.
- D. Following the correction of all punch list deficiencies, the Contractor shall request in writing that the Owners Representative formally inspect the work. If installation and workmanship are acceptable, the Owners Representative will issue a written acceptance and date of Substantial Completion.

1.10 CHEMICAL SPRAYING PROGRAM

- A. Chemical Spraying Program: No spraying of herbicides, insecticides, fungicides, nematocides, fumigants, or other chemicals shall be done without first submitting a spray program to the Owners Representative. Application of herbicides will only be permitted by licensed applicators. Applicators shall follow notification requirements of the University and consult any Chemical Hypersensitivity Registries for the area.

PART 2 - PRODUCTS

2.1 SEED

- A. Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.
 - 1. Seed Mixture: Provide seed of species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as required by PADOT seed mixes.
- B. Shall be clean and fresh, packed in sealed bags showing net weight, composition of mix, date of germination tests and supplier's name.
- C. Seed must be Blue Tagged Certified and must not contain more than 0.1% by weight weed seed, no more than 1.5% inert matter, no more than 0.2% other crop seed and no noxious weed seed or undesirable grass species.
- D. Lawn Seed shall be PADOT Formulas as indicated on Drawings

2.2 SOD

- A. The sod producer shall specialize in grass seed production with a minimum of 5 years' experience and shall be certified by the Pennsylvania Department of Agriculture as outlined in Title 3 (Agriculture) of the Pennsylvania Consolidated Statutes.
- B. Sod shall be a minimum of 18 months in age with root development that will support its own weight without tearing when suspended vertically by holding two adjacent corners.
- C. Composition of seed blend shall be a minimum of 3 different turf type tall fescue varieties, with a blended ratio of 20% to 40% of each variety for a total of 100%. Varieties shall represent the top 1/3 of performers in the most recent final or current year National Turfgrass Evaluation Program (www.ntep.org) for the Northeast USA. In addition, one of the varieties may be a rhizomatous type as advertised by the seed marketer. Seed mixture must be approved by the Owners Representative prior to purchase for seeding.
- D. The Owners Representative may request or allow a composition of seed blend with 3 different turf type tall fescue varieties and also a maximum of 10 % perennial ryegrass. The perennial ryegrass must follow the same specifications as other seeds mentioned in these specifications.
- E. The Owners Representative may request or allow compositions to include 10% bluegrass for stability purposes.
- F. Sod shall be field grown in same climatic conditions as that of the project site.
- G. Sod shall be strongly rooted, not less than 18 months old, free of weeds and undesirable native grasses. Sod must be capable of growth and development when planted.
- H. Sod shall be free of pests.
- I. Sod shall be installed within 24 hours from the time it is cut.

2.3 TOPSOIL

- A. Topsoil: ASTM D-5268, pH range of 6.2 to 6.7, 4 to 6 percent organic material (by weight), free of stones 1 inch or larger in any dimension, and other extraneous materials harmful to plant growth.
 - 1. Topsoil Source: Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil, if needed, that is equal to amended stockpiled topsoil when quantities are insufficient, to meet project requirements, at no additional cost to Owner. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
- G. Do not export excess existing topsoil. Transport to University property as directed by Owners Representative.
- H. Topsoil shall not be muddy or frozen at time of grading as determined by the Owners Representative

2.4 SOIL AMENDMENTS

- A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve.
 - 1. Provide lime in the form of natural dolomitic and/or calcitic limestone.
- B. Aluminum Sulfate: Commercial grade, unadulterated.
- C. Herbicides: EPA registered and approved, of type recommended by manufacturer.
- D. Water: Potable.

- F. Organic Matter: Fully composted and stable, per Section 329300 Plants.

2.5 FERTILIZER

- A. As recommended in the topsoil analysis.
1. Each container of fertilizer and/or lime shall be labeled by manufacturer as separate items indicating weight and analysis of the container.

2.6 MULCHES

- A. Wood-Cellulose Mulch (Hydromulch): Specially prepared mixture of biodegradable, air-dried wood fiber manufactured from wood chips or bark, and shredded paper particles, comprised of recycled newsprint or other recycled cellulose fiber combined with a surfactant and nontoxic, green-dye; manufactured to be applied with hydraulic seeding equipment and meet the following requirements:

Wood Fiber	45% to 55%
Recycled Cellulose Fiber	45% to 55%
Moisture content	21% Maximum
Organic matter (oven-dried basis)	97% Minimum
Ash content	0% to 1.6%
Water holding capacity (grams H ₂ O per 100 grams fiber)	1000% minimum

1. No straw or hay mulch will be accepted.
2. In areas with slopes >3:1 erosion control matting shall be used as approved by the Owners Representative
3. Mulch shall consist of especially prepared wood cellulose processed into a uniform fibrous physical state.
4. Mulch shall be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry.
5. Mulch shall contain no germination or growth inhibiting factors.
6. Mulch shall be manufactured and processed in a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with other additives to form a homogeneous slurry.
7. Mulch shall form a blotter-like groundcover, on application, having moisture absorption and percolation properties and shall cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.
8. Mulch shall not contain elements or compounds at concentration levels that will be phytotoxic.
9. Mulch must conform to the following physical requirements and as listed above.
 - a. Fiber length to approximately 10 mm. Diameter approximately 1 mm.
 - b. pH range of 4.0-8.5
 - c. Ash content of 1.6% maximum

2.7 WATERING

- A. The Contractor shall be responsible for watering seeded and sodded areas during the maintenance period. Work that is injured or damaged due to the lack of water, or the use of too much water, shall be Contractor's responsibility to correct.

2.8 MEADOW SEEDING – as indicated on Drawings

2.9 FABRICS – as indicated on Drawings

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive turf and grass for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 1. Areas shall be free of waste or debris developed by other trades. Any discrepancy from such conditions shall be reported to the Owners Representative before beginning any installation.
 - 2. Prior to commencing any finished grading the Contractor shall notify the Owners Representative allowing enough time for a thorough inspection of the subgrade.
 - 3. Prior to any work the Contractor shall have all utilities located by calling PA One-Call at (800)242-1776.

3.2 GRADING

- A. Refer to Section 312000 Earth Moving for additional requirements.
- B. Prior to grading, apply Round-Up or other approved herbicide as per the manufacturer's directions to eliminate any existing weeds. Allow sufficient time for the herbicide to take effect.
- C. Perform finished grading necessary to bring site to required finished elevations indicated on the grading plan.
- D. If the general area is hard pan, the sub-grade shall first be rototilled or chisel plowed at least 12 inches deep to permit proper loosening, drainage, and preparation of the ground. The sub-grade shall be loosened and graded by harrowing, discing, or dragging, as dictated by the condition of the sub-grade. The entire sub-grade shall then be raked and stones over 1 ½ inches, grade stakes, rubbish, and general debris removed.
- E. A final inspection of the sub-grade by the Owners Representative is required before topsoil is spread.

3.3 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by seeding operations.
 - 1. Protect adjacent and adjoining areas from hydroseed overspray.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.4 PLANTING SOIL PREPARATION

- A. Limit subgrade preparation to areas that will be seeded in the immediate future.
 - 1. The Contractor shall grade turf areas indicated on the drawings. In the event there are discrepancies between the construction drawings and on-site conditions, the Contractor shall notify the Owners Representative before beginning any installation.
- B. Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter.
- C. Mix soil amendments and fertilizers with topsoil at rates indicated in the topsoil analysis. Delay mixing fertilizer if seeding does not follow placing of soil within a few days. Either mix soil before spreading or apply soil amendments on surface of spread topsoil and mix thoroughly into top 4 inches of topsoil before seeding and sod installation.
 - 1. Mix lime with dry soil before mixing fertilizer.
 - 2. Apply fertilizers and mix soil amendments as per soil test recommendations
 - 3. Immediately after lime and fertilizer application go over the entire area with a rototiller, or other approved piece of equipment and loosen surface at least 4 inches deep and then hand rake to a smooth even surface.
 - 4. Spread starter fertilizer uniformly at the rate determined by the soil test for new lawns.
- D. Spread planting mix to depth required to meet grades, and elevations shown, after light rolling and natural settlement. Do not spread if soil or subgrade is frozen.
- E. Preparation of Unchanged Grades (for areas of existing topsoil to remain undisturbed): Where areas are to be seeded or sodded in areas unaltered or undisturbed by excavating, grading, and surface soil stripping operations, prepare soil as follows:
 - 1. Till surface soil to a depth of at least 6 inches. Apply required soil amendments thoroughly into top 6 inches of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.
 - a. Do not till at roots of existing trees to remain; rake amendments in lightly to top 1" of soil.
 - 2. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 3. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.
- F. Grade to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be seeded in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches in any dimension, and other objects that may interfere with seeding or maintenance operations.
- G. Moisten prepared areas before seeding and sodding when soil is dry. Water thoroughly and allow surface to dry before seeding and sodding. Do not create muddy soil.
- H. Restore prepared areas if eroded or otherwise disturbed after fine grading and before seeding.
- I. Re-loosen soil in areas to be seeded and sodded if left for more than seven days to a depth of 4 inches.

3.5 SEEDING LAWN AREAS

- A. As soon as the ground has been properly prepared and approved for seed by the Owners Representative, sow seed, in two operations at right angles to each other, using a suitable mechanical seeder or sowing by hand for small area. Do not broadcast or drop seed when

wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.

- B. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
- D. Sow seed at rates as required by PADOT for PADOT seed mixes specified on Drawings. Refer to Soil Erosion and Sediment Control Drawings and Specifications for additional information. For other mixes required or allowed by Owners Representative, seed at rate as approved by Owners Representative.
 - 1. PADOT Formula B: 44 lbs / 1,000 SY, unless a higher seeding rate is specified on Drawings.
 - 2. PADOT Formula L: 48 lbs / 1,000 SY, unless a higher seeding rate is specified on Drawings.
- E. Unless the seeder covers the seed with soil as it sows, rake to obtain a light covering of soil over the seed after sowing, then roll very lightly with an empty water roller.
- F. Do no seeding in adverse weather or in wet conditions.
- G. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray.

3.6 MULCHING

- A. General: Apply mulch to 100 percent of the areas requiring treatment as indicated on the Drawings. Mulch immediately after seeding or within 48 hours after completion of seeding. Contractor may mulch seeded areas.
- B. Do not apply mulch within 24 hours of forecast rainfall. Re-treat at the originally specified rates any mulched areas damaged by rain before materials have dried.
- C. Re-treat, at the same rate, any mulched areas damaged before acceptance at the Contractor's expense. If seed bed is destroyed, reseed at originally specified rates.

3.7 WOOD-CELLULOSE MULCH (HYDROMULCH)

- A. After seed application, wood cellulose fiber mulch shall be applied at a net dry weight of 1,500-2,000 lbs. per acre. The wood cellulose fiber mulch shall be mixed with water, and the mixture shall contain a maximum of 50 lbs of wood cellulose fiber per 100 gallons of water. In areas where erosion may be a problem, use an organic tackifier, erosion fabric, or approved equal in accordance with the manufacturer's instructions.
- B. Hydraulically apply wood-cellulose mulch with equipment approved by the mulch manufacturer.
- C. Avoid unnecessary spraying of adjacent surfaces and features, including plant stems and foliage. Remove mulch from pavement surfaces at the end of each work day.

3.8 SOD INSTALLATION

- A. Lay sod on the same day as delivery to prevent dehydration.
- B. Lay sod tight with no open joints visible, and no overlapping. Stagger end joints 12 inches minimum. Do not stretch sod pieces.
- C. Lay smooth and align with adjoining grass areas. Place top elevation of sod even with or slightly above adjoining edging, paving, or curbs to allow for settling.
 - 1. At interface with existing grass areas, apply lawn seed to disturbed and bare portions of the existing lawn to a 2-foot maximum wide area.

- D. On slopes exceeding 2 horizontal to 1 vertical (and as specified below), lay sod perpendicular to the slope and secure every row with biodegradable staples at maximum of 2 feet on center. Drive staples flush with soil portion of the sod.

- 1. Use same stapling pattern for sod on this project, regardless of slope.

- E. Water sodded areas immediately after installation with enough moisture to ensure the entire rootmass and thatch areas are completely saturated.

- F. After sod and soil have dried, roll sodded areas to ensure a good bond between sod and soil and to remove minor depressions and irregularities.

3.9 FINAL INSPECTION AND ACCEPTANCE:

- A. Give 10 days' notice prior to Final Inspection. Final acceptance shall be granted provided grass areas are properly established and free of washouts, depressions, bare spots, weeds and large off-color areas. Silt socks or other erosion control devices shall be removed and their areas restored. Lawn area under this contract that is not in satisfactory condition, as determined by the Owners Representative, shall be reworked as soon as conditions permit. Reworked lawn areas shall be maintained as previously specified until final inspection and acceptance occurs.

3.10 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas.
- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period until turf is established.

3.11 MEADOW SEEDING

- A. Follow recommendations of Ernst Seed Company unless stricter recommendations and higher seeding rates are indicated on Drawings and herein.

END OF SECTION 32 92 00

SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Trees.
2. Shrubs.
3. Ground Cover.
4. Plants & Plant Plugs.
5. Edgings.
6. Mineral Mulch.
7. Geotextile Fabric.
8. Planting & Mulching.
9. Maintenance & Warranties.

- B. Related Sections:

1. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
2. Division 1 Section "Temporary Soil Erosion and Sedimentation"
3. Division 33 Section "Stormwater Structures" for below-grade drainage of landscaped areas, paved areas and wall perimeters.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than sizes indicated and or diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated and or diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed

from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

- F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- H. Finish Grade: Elevation of finished surface of planting soil.
- I. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- J. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- K. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- L. Planting Area: Areas to be planted.
- M. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- N. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- O. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- P. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- Q. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- R. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- S. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS - GENERAL

- A. General: Provide each submittal according to the Conditions of the Contract and Division 1 Specification Sections, and as described below.
 - 1. Label each submittal with the Specification number and line-item number(s).
 - 2. Do not combine submittals from different Sections.
- B. Planting Submittals Tracking List: Submit spreadsheet indicating each submittal required by this Section, labeled by name and Specification line-item number, with columns for each submittal indicating dates of submittals, reviews, and completion of reviews/revisions process.
 - 1. Submit to Owners Representative no later than three months after project start date, or two months prior to planting, whichever is earlier.
 - 2. Update and submit monthly during months of preparation, purchasing, planting, maintenance, and close-out.
 - 3. Provide copies of each correspondence to Project Landscape Architect, ThinkGreen LLC.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
 - 2. Plant Photographs: Include color photographs in 3- by 5-inch print or as high quality digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
- B. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis for standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Samples: For each of the following:
 - 1. 2 lb of topsoil and planting soil mixes for each soil type tested, in labeled plastic bags.
 - 2. Organic amendment: duplicate samples of 1 quart.
 - 3. 2 lb of organic mulch for each color and texture required, in labeled plastic bags.
 - 4. Mineral mulch: Eight stones of 3 inch diameter and larger sizes, and one-half gallon bag of smaller stones, for each type of mineral mulch, in labeled plastic bags, including full range of color and size.
- D. Qualification Data: For Landscape Installer.
- E. Material Test Reports: For existing surface soil, AND imported topsoil, AND planting soil mixes.
 - 1. Existing Source Soil: 1 material test report for each topsoil type.
 - 2. Imported Topsoil and Planting Soil Mixes: 1 material test report for each 100 cubic yards of material from random samples.

- F. Planting Schedule: Indicating anticipated planting dates for exterior plants, in each area of the site.
 - 1. Submit no later than two months prior to planting.
 - 2. Submit update one week prior to completion of planting markouts.
 - 3. Submit update one week prior to start of planting.
 - 4. Provide copies directly to Project Landscape Architect, ThinkGreen LLC.
- G. Plant Sources: Indicating nursery locations and list of plants supplied by each nursery.
 - 1. Submit, in writing, a plant list outlining the source for all plants, their estimated delivery date, and length of time plants are to be stored at an off-site location.
 - 2. Provide a copy directly to Project Landscape Architect, ThinkGreen LLC.
- H. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.
- I. Plant Substitutions Requests: Plant substitutions will be permitted only upon written approval by the Owners Rep and/or their designee, using input from Project Landscape Architect.
 - 1. Submit no later than one month prior to anticipated purchasing.
 - 2. Provide a copy directly to Project Landscape Architect, ThinkGreen LLC.

1.6 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network, the American Nursery and Landscape Association and or have landscape installation credentials to be reviewed by Owners Representative.
 - 2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
 - a. Certified Landscape Technician - Exterior, with installation, maintenance and irrigation specialty area(s), designated CLT-Exterior.
 - b. Certified Landscape Technician - Interior, designated CLT-Interior.
 - c. Certified Ornamental Landscape Professional, designated COLP.
 - 5. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

- C. **Certificates:** Provide certificates required by authorities having jurisdiction, including any composted materials containing sewage sludge. Approval as EPA Type 1 “exceptional quality” is required as well as well standards for application of composted organic materials by the Commonwealth of New Jersey.
- D. **Sources for Soil Components and Planting Soil Mixes:** Submit information identifying sources for all soil components and the contractor responsible for mixing of planting soil mixes.
1. Owner or Owners Representative shall have the right to reject any soil supplier.
 2. Soil mix supplier shall have a minimum of five years experience at supplying custom planting soil mixes.
 3. Submit supplier name, address, telephone and fax numbers and contact name. the soil scientist can assist in locating acceptable suppliers within the area.
 4. Submit certification that the accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project. Indicate quantity and type of material from each supplier.
- E. **Soil Analysis:** For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.
1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
 2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
 3. Report suitability of tested soil for plant growth.
 - a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
 4. Refer to Section 329200 Turf and Grasses for additional requirements.
- F. **Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1., “American Standard for Nursery Stock.”**
1. Selection of plants will be made by the Owners Representative, who will tag plants at their place of growth before they are prepared for transplanting.
- G. **Measurements:** Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. **Trees and Shrub Measurements:** Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 2. **Other Plants:** Measure with stems, petioles, and foliage in their normal position.

- H. Plant Material Observation: Owners Representative may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
 - 1. Tree tagging with Owners Representative at Nursery locations is required with three days notice minimum.
 - 2. Notify Owners Representative of sources of planting materials seven days in advance of delivery to site.
- I. Preinstallation Conference: Conduct conference at project site to review planting intent with Owners Representative.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall contact the Owners Representative 24 hours prior to the delivery of any plant material.
- B. The Contractor is responsible for having the planting plan, grading plan, plant list, and all applicable installation details on site at all times so that it can be reviewed by the Owners Representative.
- C. Plant material shall be inspected by the Owners Representative at the job site upon delivery. Only plants approved by the Owners Representative shall be stored or planted. The Owners Representative reserves the right to refuse plant material they deem unacceptable. Rejected plant materials shall be removed from the job site on the day of rejection.
- D. Each tree, shrub, groundcover flat, container of fertilizer or other construction material shall be labeled by grower or manufacturer as separate items.
 - 1. Plant identification labels shall be durable and waterproof. Labels shall be securely attached to plants, bundlers, or containers of plants and shall state the correct botanical plant name and size. Labels shall not be removed from the plants until final acceptance.
- E. Bulk deliveries of mulch, topsoil, and inert material shall be accompanied with delivery tickets showing weight, origin, and composition and stored in such a manner as to prevent the inclusion of foreign materials.
- F. Plant Storage: Trees, shrubs, and groundcovers not installed on the day of delivery to the site shall be stored and protected.
 - 1. No plants shall be stored on the site for a period greater than 5 business days.
 - 2. Storage locations shall be continually shaded and protected from the wind.
 - 3. Plants stored on the project site shall be protected from drying at all times by covering the balls or roots with moist woodchips, shredded bark, peat moss or other suitable heel-in material.
 - 4. If planting is delayed more than six hours after delivery, protect from weather and mechanical damage, and keep roots moist.

5. Do not remove container-grown stock from containers before time of planting.
 6. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.
- G. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- H. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.
- I. Deliver plants freshly dug.
- J. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- K. Handle planting stock by root ball.
- L. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

1.9 PROJECT CONDITIONS

- A. Planting areas shall be free of waste or debris developed by other trades. Any discrepancy from such conditions shall be reported to the Owners Representative before beginning any installation.
- B. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- C. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
1. Notify Architect no fewer than five days in advance of proposed interruption of each service or utility.
 2. Do not proceed with interruption of services or utilities without Architect's/Owners written permission.
- D. No plants are to be planted when the ground is frozen or during days of extreme heat (≥ 80 degrees). No plants shall be installed before March 1st or after the ground freezes.

1. If work must be performed outside of these parameters, the Owners Representative must be contacted.
- E. Planting Restrictions: Within the limitations stated above, plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
1. Trees and Shrubs:
 - a. Spring Planting: March 1 to May 1
 - b. Fall Planting: September 1 to November 1
 2. Plugs
 - a. Spring Planting: March 1 to May 1
 - b. Fall Planting: September 1 to October 15
 3. Bulbs
 - a. Fall Planting: September 1 to October 15
 4. Contractor shall schedule tree selection and digging operations so as to comply with nursery industry recognition of 'Spring Dig Only' or 'Fall Hazard' plant materials. No substitutions of plant materials will be allowed for fall planting based on unavailability due to 'Spring Dig Only' or 'Fall Hazard' restrictions.
- F. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- G. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.
- 1.10 ACCEPTANCE
- A. Conditions at end of Maintenance Period: If plant material is reviewed when it is in full leaf, leaves shall be plump with water with a shape indicative of the species and shall be free of insect, pest and disease damage. Twigs shall have living cambium for their full length. Twigs and branches shall have a full bud set for their full length, including terminal buds. Trunks and branches shall be free of frost cracks, sunscald, damage due to insect, pests and disease, structural defects, and damage resulting from machinery or tools. Plant materials inspected and reviewed when the plants are not in full leaf shall have twigs, branches and trunks meeting the above requirements. All plants regardless of the season of review shall have a minimum of 75 percent healthy, balanced branching structure with a healthy terminal leader(s) with viable terminal bud(s).
- B. If any number of plants do not meet these Acceptance Standards at the time of inspection, or if in the Owners Representative's opinion, workmanship is unacceptable, written notice will be given by the Owners Representative to the Contractor in the form of a punch list, which itemizes necessary planting replacements and/or other deficiencies to be remedied. The Contractor's responsibility for maintenance of all plants shall be extended until replacements are made or other deficiencies are corrected. Plants that do meet these Acceptance Standards shall be removed from the project within seven days of receipt of punch list. Replacements shall conform in all respects to the Specifications for new plants and shall be planted in the same manner.

- C. Following the correction of all punch list deficiencies, the Contractor shall request in writing that the Owners Representative formally inspect the planting work. If plant materials and workmanship are acceptable, the Owners Representative will issue a written acceptance and date of Substantial Completion.

1.11 WARRANTY

- A. Special Warranty: Installer agrees to warrant, repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Periods begin from Date of Substantial Completion:
 - a. Refer to Establishment Period article in this Specification.
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.
 - 4. Exclusions from Warranty: Where evidence exists of damage that is beyond the control of the Landscape Contractor, advise Owners Representative in writing, stating location and nature of Damage. The Owners Representative, upon receipt of such notice, may order the Landscape Contractor to correct the damage at Owner's expense, or exclude the damaged areas from the warranty and correct the damage by any arrangement deemed appropriate by the owner.

1.12 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - 1. Maintenance Period: up to the end of the Establishment Period.
- B. Ground Cover and Plants: Maintain for the following maintenance period by watering, weeding the plants, fertilizing, and other operations required to establish healthy, viable plantings.
 - 1. Maintenance Period: up to the end of the Establishment Period.

- C. Watering: Review watering needs, temporary establishment irrigation system operations, and weather conditions with Owner.
- D. During the Maintenance Period, any decline in the condition of plantings shall require the contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall engage professional arborists and/or horticulturists to inspect plant materials, identify problems, and recommend corrective measures. The Owners Representative shall be notified immediately of such actions.
- E. If Owner chooses to perform all or part of the maintenance during the warranty period, submit maintenance instructions to be performed by the owner and set up a schedule for regular on-site review to assure compliance. Submit instructions and schedule before date of Substantial Completion.
 - 1. Owner's performance of maintenance during the warranty period shall not limit Contractor's obligations under provisions of the warranty.

1.13 CHEMICAL SPRAYING PROGRAM

- A. Follow requirements as specified in Section 329200 Turf and Grasses.

PART 2 - PRODUCTS

2.3 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
 - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

- E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

2.4 SHADE AND FLOWERING TREES

- A. Shade Trees: Single-Stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1
 - 1. Provide balled and burlapped trees.
- B. Small Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as follows:
 - 1. Stem Form: Single stem or, as indicated, multistem, with multiple stems.
 - 2. Provide balled and burlapped trees.
- C. Multistem Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as follows:
 - 1. Stem Form: Clump and shrub.
 - 2. Provide balled and burlapped trees.

2.5 DECIDUOUS SHRUBS & EVERGREEN SHRUBS

- A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.
 - 1. Provide balled and burlapped or, if indicated or allowed, container-grown shrubs.

2.6 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.7 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 25 -55% percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.8 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight. Follow soil test requirements.
 - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
 - 1. Size: 5-gram tablets.
 - 2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.
- F. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

2.9 PLANTING SOILS

- A. Planting Soil, Use local, native planting soil: ASTM D 5268 topsoil, with pH range of 5.5 to 8, a minimum of 10 percent organic material content (by weight) and a maximum of 20 percent; free of stones 1/2 inch or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D 5268 topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil as recommended by required soil tests.
 - 1. Ratio of Loose Compost to Topsoil by Volume: per required soil tests and recommendations.
 - 2. Weight of Bonemeal per required soil tests and recommendations.
 - 3. Weight of Superphosphate per required soil tests and recommendations.
 - 4. Weight of Commercial Fertilizer per required soil tests and recommendations.
 - 5. Weight of Slow-Release Fertilizer per required soil tests and recommendations.

2.10 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, subject to approval of Owners Representative, consisting of the following:
 - 1. Type: Triple Shredded hardwood.
 - 2. Size Range: 3 inches maximum, 1/2 inch minimum.
 - 3. Color: Natural.
- B. Mineral Mulch (Riverstone): Free from deleterious materials, consisting of the following:
 - 1. Color: as indicated on Drawings.
 - 2. Size Ranges: as indicated on Drawings.
 - 3. Product: as indicated on Drawings.

2.11 Staking and Guying:

- A. Tree stakes shall be two 2"x2" stakes, a minimum of 6 feet long with 2 feet in ground. Guying shall consist of nylon straps wrapped loosely around the trunk.

2.12 Non-woven Geotextile Fabric: Mirafi 140N or approved equal.

PART 3 - EXECUTION

3.3 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.4 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

- C. Lay out individual tree, shrub, plant locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owners Representative's acceptance of layout before excavating or planting. Make minor adjustments as required. Notify Owners Representative three days prior to layout and staking.
- D. Lay out plants at locations directed by Owners Representative. Stake locations of individual trees and shrubs and outline areas for multiple plantings. Notify Owners Representative three days prior to layout and staking.

3.5 PLANTING AREA ESTABLISHMENT

- A. Prior to commencing any finished grading, the Contractor shall notify the Owners Representative allowing enough time for a thorough inspection of the subgrade.
- B. Perform all finished grading necessary to bring site to required finished elevations indicated on the grading plan and to allow for positive drainage.
- C. Use topsoil stockpiled on the site during earthwork operations and provide any additional topsoil required. Refer to Section 329200 Turf and Grasses for additional requirements.
- D. Topsoil shall not be placed when the subgrade is frozen, excessively wet, or extremely dry, and no topsoil shall be handled when in a frozen or muddy condition.
- E. Loosen subgrade of planting areas to a minimum depth of 12 inches. Remove stones larger than 1/2 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply fertilizer as directed or required by soil tests directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer as directed or required by soil tests on surface, and thoroughly blend planting soil.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - 3. Spread planting soil to a depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 8 inches of subgrade. Spread remainder of planting soil.
- F. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- G. After completion of topsoil placing and approval of finish grading by the Owners Representative, remove any excess topsoil from the site and deliver to location determined by the Owners Representative.
- H. Leave finish graded area clean, well raked, and ready for planting.
- I. Before planting, restore planting areas if eroded or otherwise disturbed after finish grading.

3.6 PLANTING LAYOUT:

- A. Layout of plants prior to planting shall be verified by the Owners Representative. Any alterations to the planned planting layout must be approved by the Owners Representative and/or their designee.

3.7 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 1. Excavate approximately three times as wide as ball diameter for balled and burlapped, balled and potted, container-grown stock.
 - 2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - 4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 - 5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - 6. Maintain supervision of excavations during working hours.
 - 7. Keep excavations covered or otherwise protected overnight, after working hours and when unattended by Installer's personnel.
 - 8. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- B. Subsoil and topsoil removed from excavations may be used as planting soil if it meets the requirements recommended by the soil tests.
- C. Obstructions: Notify Owners Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations, or if hardpan is encountered.
- D. If an impervious, hard pan layer remains in the bottom of the pit after excavation the Owners Representative shall be notified prior to any additional planting activities to inspect the excavation and develop an alternate course of action. The Owners Representative may recommend the following action in item 1 below:
 - 1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet , whichever is less, and backfill with free-draining material.
 - 2. Refer to Section 329200 Turf and Grasses for 3.2.D for required treatment in hardpan areas that is also required in planting areas if the general area is hard pan.
- E. Drainage: Notify Owners Representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- F. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.8 TREE AND SHRUB PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.
 - 1. Use local, native planting soil that meet the soil test requirements in planting areas shown on landscape plans for backfill.
 - 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 3 inches from root tips; do not place tablets in bottom of the hole.
 - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Set balled, potted and container-grown stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.
 - 1. Use local, native planting soil that meets the soil test requirements for backfill.
 - 2. Carefully remove root ball from container without damaging root ball or plant.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 3 inches from root tips; do not place tablets in bottom of the hole.
 - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.9 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Landscape Plans & Details. Notify Owners Representative three days prior to layout and staking.
- B. Use local, native planting soil that meet the soil test requirements for backfill.
- C. Dig holes large enough to allow spreading of roots.

- D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.10 STAKING AND GUYING:

- A. Staking and guying shall be done immediately after trees are planted using specified staking materials.
- B. Trees shall stand plumb prior to staking.

3.11 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 2-inch to 3-inch average settled thickness, with 36-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
 - 2. Organic Mulch in Planting Areas: Apply 2-inch to 3-inch average settled thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.12 PLANT MAINTENANCE

- A. The Contractor shall be responsible for providing the following maintenance on all newly planted trees, shrubs, groundcovers, and herbaceous perennials.
 - 1. Watering: During any 7 day period that yields less than 1/2 inch of rainfall - as measured by a nearby Weather Service station - the contractor shall water all plant material to maintain a constant suitable moisture level for adequate plant growth. The Contractor shall be responsible for providing all watering hoses, watering devices or other water delivery methods including tankers. The Owner will provide the water source.
 - 2. Insect, Disease, and Weed Control: Weed control shall be by mechanical or hand weeding. The use of herbicides, insecticides, fungicides, nematicides, fumigants or other chemicals are only acceptable upon approval by the Owner under the provisions of a Chemical Spraying Program approved by the Owners Representative.
- B. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- C. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

- D. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.13 ESTABLISHMENT PERIOD

- A. The Establishment Period will begin upon notice of substantial completion by the Contractor and inspection by the Owners Representative and will last for a total of 120 days during the growing season. The growing season is defined as the period between April 1st and November 1st. If planting occurs in the autumn, the Establishment Period will carry over to the next growing season until a total of 120 days have been established.
- B. Plants shall be guaranteed during the Establishment Period and shall be alive and in satisfactory growth at the end of that period. Plants which die within the establishment period will be removed by the Contractor within five (5) business days of notice or the Owner will remove the plants and bill the Contractor accordingly. Replacement plants may be installed during the next appropriate planting season for the species specified. All replacements shall be plants of the same species and size specified in the plant list. They shall be furnished and planted according to all previous specifications noted and shall be guaranteed through an additional 120 day Establishment Period, as outlined above. The cost of replacement shall be borne by the Contractor, except for possible replacements resulting from removal, loss or damage due to vandalism, or act of neglect on the part of others.
- C. The Contractor is responsible for all maintenance activities, including watering, weeding, insect and disease control or other methods required to insure the overall health of the plants during the Establishment Period.

3.14 FINAL INSPECTION AND ACCEPTANCE:

- A. At the end of the Establishment Period, an inspection will be made by the Owners Representative and the Contractor. Any plant determined to be of insufficient quality or unsatisfactory growth, as determined the Owners Representative, shall be removed from the site and replaced at the Contractor's expense.

3.15 RIVERSTONE, METAL EDGE RESTRAINT, AND FABRIC INSTALLATION AT DRIP STRIPS

- A. Verify finish grades and review with Architect on site.
- B. Excavate to depth required.
- C. Compact soil under the drip strip.
- D. Install metal edge restraint according to manufacturer's instructions.
 - 1. Tolerance: maximum 1/4" horizontal variance in 20 linear feet, and 1/2" in 50 linear feet.
 - 2. Utilize full-length pieces wherever possible.
- E. Install nonwoven geotextile fabric per manufacturer's instructions.
 - 1. Overlap fabric 12" minimum: lay uphill fabric over downhill fabric and install one u-shaped stake at each overlap.
 - 2. Wrap fabric up the face of edging and wall, trim cleanly 1 inch below top of edge restraint and below top of riverstone.

- F. Place riverstone and rake riverstone to settle small stones into larger stones, to meet settled depth indicated on Drawings.

3.16 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.17 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally recycle or dispose of them off Owner's property.

END OF SECTION 329300