

Specifications for City of South Lebanon River Corridor Public Sanitary Sewer Extension

OWNER:

City of South Lebanon
10 North High Street
South Lebanon, Ohio 45065
(513) 494-2296

ARCHITECT:

McGill Smith Punshon, Inc.
3700 Park 42 Drive – Suite 190 B
Cincinnati, Ohio 45241
(513) 759-0004

SURVEYOR & CIVIL ENGINEER:

McGill Smith Punshon, Inc.
3700 Park 42 Drive – Suite 190 B
Cincinnati, Ohio 45241
(513) 759-0004

STRUCTURAL ENGINEER:

Pinnacle Engineering
8180 Corporate Park Drive – Suite 235
Cincinnati, Ohio 45242
(513) 984-1663

MEP ENGINEER:

HAWA Incorporated
570 Polaris Parkway, Suite 410
Westerville, Ohio 43082
(614)-451-1711

PUMP STATION DESIGNER:

Beckman Environmental Services Co, Inc.
4259 Armstrong BLVD
Batavia, Ohio 45103
(513) 752-3570

BID / PERMIT ISSUE

08/15/2025

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APPENDIX I

	Geotechnical Report

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**SUBSURFACE INVESTIGATION &
FOUNDATION RECOMMENDATIONS**

**RIVER CORRIDOR PUBLIC SEWER EXTENSION
SOUTH LEBANON, OHIO**

Prepared for:

**MCGILL SMITH PUNSHON
CINCINNATI, OHIO 45241**

Prepared by:

**ALT & WITZIG ENGINEERING, INC.
WEST CHESTER, OHIO**

JUNE 15, 2020

PROJECT NO.: 20CN0086



Alt & Witzig Engineering, Inc.

6205 Schumacher Park Drive • West Chester, Ohio 45069

Phone: (513) 777-9890 • www.altwitzig.com

June 15, 2020

McGill Smith Punshon
3700 Park 42 Drive, Suite 190 B
Cincinnati, Ohio 45241
ATTN: Mr. Rich Arnold

RE: Subsurface Investigation &
Geotechnical Recommendations
River Corridor Public Sewer Extension
Loveland Bike Trail
South Lebanon, Ohio
Alt & Witzig File: 20CN0086

Dear Mr. Arnold:

In compliance with your request, Alt & Witzig Engineering has completed a subsurface investigation and evaluation for the above referenced project. The purpose of our investigation was to provide information for use with designing and installing the proposed sewer extension and pump station for the River Corridor Public sewer.

Site/Project Description

The site of the proposed sewer extension is located in South Lebanon, Ohio. Specifically, the location of the proposed sewer extension is as followed:

- Begins at the Wastewater Treatment Plant located off Mason Morrow Millgrove Road
- Sanitary Force Main heads southeast along the Lebanon Countryside Trail until it intersects with the Little Miami Scenic Trail
- Sanitary Force Main heads east at the intersection along the Little Miami Scenic Trail (Approximate Mile Marker 34.5)
- Sanitary Force Main continues east until the Pump Station located at the dead end of Browning Drive (Approximate Mile Marker 33.5)
- From the Pump Station, Gravity Sewer Main continues east along Browning Drive to intersection with S. Main Street
- From S. Main Street, the Gravity Sewer Main goes south until it intersects with the Little Miami Scenic Trail.
- From the Little Miami Scenic Trail, the Gravity Sewer Main continues east along the Little Miami Scenic Trail (Approximate Mile Markers 33.5 to 32.0)

The approximate sewer location is shown in Figure 1 below and a more detailed boring location plan can be viewed in the Appendix of this report.

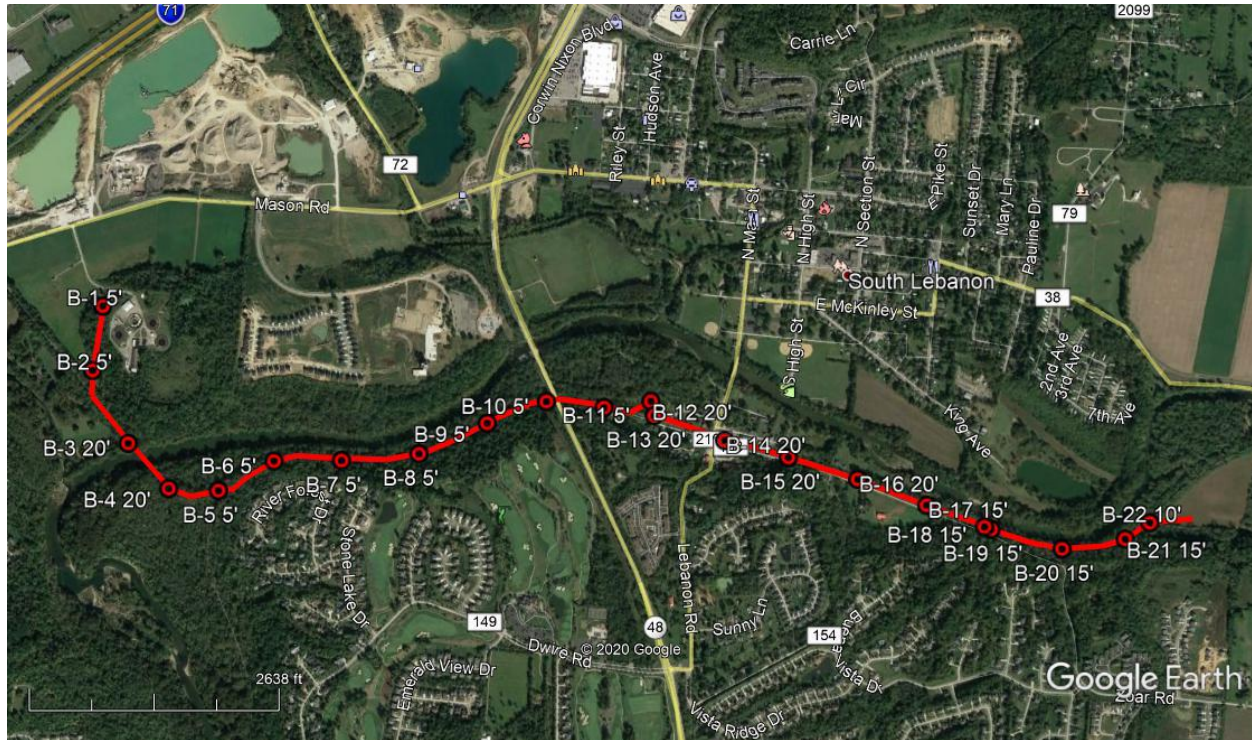


Figure 1: Sewer Extension Location

Field Services

Field investigations to determine the engineering characteristics of the subsurface materials included a reconnaissance of the project site drilling 19 soil borings as shown on the Figure 1. However, borings B-1, B-2, and B-4 were eliminated due to utility conflicts and accessibility at the time of drilling operations. Standard Penetration tests with soil samples retained in the standard split-spoon sampler was also performed during drilling operations. The apparent groundwater level at each boring location was also determined.

The soil borings were performed with a conventional drilling rig equipped with a rotary head. Conventional hollow-stem augers were used to advance the holes. Representative samples were obtained employing split-spoon sampling procedures in accordance with ASTM Procedure D-1586.

During the sampling procedure, Standard Penetration Tests were performed at regular intervals to obtain the Standard Penetration Test value of the soil. The Standard Penetration Test value is defined as the number of blows of a 140-pound hammer, falling 30 inches, required to advance the split-spoon sampler 1 foot into the soil. The results of the Standard Penetration Tests indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

Laboratory Testing

In addition to the field investigations, a supplemental laboratory investigation was conducted to ascertain additional pertinent engineering characteristics of the subsurface materials necessary in analyzing the behavior of the new printing presses. All phases of the laboratory investigation were conducted in general accordance with applicable ASTM Specifications.

Samples of the cohesive soil from the split-spoon sampling device were frequently tested in unconfined compression by use of a calibrated spring testing machine. In addition, a calibrated soil penetrometer was used as an aid in determining the strength of the soil. The values of the unconfined compressive strength as determined on soil samples from the split-spoon sampling must be considered, recognizing the manner in which they were obtained since the split-spoon sampling techniques provide a representative but somewhat disturbed soil sample.

Subsurface Condition

Existing fill soils were generally encountered at all borings within the upper 6.0 feet with exception to borings B-12, B-13 and B-20 through B-22 which encountered existing fill soils within the upper 8.0 to 20.0 feet. Borings B-5 through B-9 and B-11 terminated in existing fill soils. The existing fill soils consisted of sandy silty clay, clay, and fine to coarse sand with varying amounts of construction debris (asphalt, concrete, brick), limestone cobble, gravel and organics. However, boring B-3 did not encounter any existing fill soils. Native soils consisted of brown/gray clay, sandy clay, and fine sand with varying amounts of gravel and limestone cobble. The native soils were generally medium stiff to stiff in consistency. Groundwater was not encountered in any of the borings.

Design and Construction Recommendations for the Sewer Line

Based on the proposed invert elevations of the proposed sewer line, the sewer line will be placed within existing fills and native soils. The sewer line in the location of borings B-5 through B-9, B-11, B-12, and B-21 are anticipated to bear within existing fill soils and borings B-10, B-14 through B-20, and B-22 are anticipated to bear within native soils. Additional undercuts may be required for portions of the sewer line that bear on existing fill soils to create more stable conditions for support of the new sewer. Excavation below invert elevation should be re-established with controlled density fill (CDF) or a well graded sand and gravel. For placement of sand and gravel, the material should be placed in 6 to 8 inches lifts compacted to 98% of maximum dry density (according to ASTM D698) with a vibratory plate compactor. Given the relatively large spacing between borings, varying soil conditions could be encountered along the sewer alignment. The following table provides the utility excavation recommendations regarding the different soil types:

Soil Type	OSHA Type	Recommend Temporary Slope
Native Cohesive Soils	B	1H:1V or flatter
Native Non-Cohesive Soils	C	1.5H:1V or flatter
Existing Fill Soils	C	1.5H:V or flatter
All excavation slopes should be monitored for changes due to weather conditions and water seepage. Flattening of the slopes should be performed as necessary for safety purposes.		

Any excavated trenches in structural areas should be backfilled with a granular material compacted with a vibratory plate compactor until a point in which a sheepsfoot compactor can safely enter the trench excavation. Once a sheepsfoot can be utilized for compaction, transition from granular backfill to clay backfill can be performed. All trench compaction methods should be reviewed with Alt & Witzig Engineering before proceeding. Proper compaction techniques and densities should be followed as recommended in the specifications for compacted fills and backfills section in the appendix.

Many factors influence the performance of excavations during construction. Soil type, excavation slopes, weather conditions, groundwater level, and construction procedures are the most influential of these factors. Excavated spoil materials should be placed far enough away as to not influence the excavation slope. Alt & Witzig Engineering recommends the excavation spoils be placed a minimum distance away from the top of the excavation equal to the depth of the excavation. Thus, if the depth of the excavation is 10 feet, spoils should be placed a minimum of 10 feet away from the top of the slope. Excavations should be designed to prevent damage to the line, to adjacent structures, utilities, pavements or walks, and to prevent injury to workmen or others. Applicable OSHA guidelines should always be followed.

Corrosion Potential

Boring	Material	pH	Sulfates	Moisture Content	Condition
B-14	Sand	7.6	40 ppm	N/A	High Drainage
B-17	Clay	7.6	N/A	23.7 %	Low Drainage
B-19	Clay	7.9	27 ppm	N/A	Low Drainage
B-20	Clay	7.8	60 ppm	15.9 %	Low Drainage

Based on the borings and the sewer plan, the sewer lines will be placed within non-cohesive soils and cohesive soils. Based on the laboratory tests conducted, the potential for corrosion is low. pH tests ranged from 7.6 through 7.9 and sulfates ranged from 27 ppm to 60 ppm which is considered low.

Pump Station and Control Building Recommendations

Borings B-12 and B-13 were drilled in the locations of the Pump Station and Control Building. Boring B-12 (Pump Station) encountered 20.0 feet of existing fill soils underlain by stiff clay. Boring B-13 (Control Building) encountered 10.0 feet of fill underlain by silty fine to coarse sand. Note that each of these borings were offset due to concrete slabs/obstructions encountered.

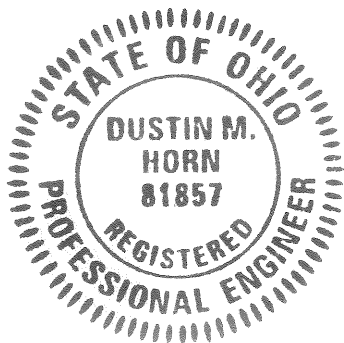
From the River Corridor Public Sanitary Sewer Extension plans developed by McGill Smith Punshon, the pump station will be excavated approximately 25 feet below the existing ground surface. Therefore, the pump station will bear on native clay soils. Plans for the control building have not been provided at this time, however, Alt & Witzig Engineering anticipates the control building will have a finished floor elevation near/at current grades. Therefore, approximately 10 feet of fill will remain beneath the proposed finished floor elevation of the control building. These existing fill soils are unsuitable for bearing and should be undercut and replaced with suitable structural fill or lean concrete. These existing fill soils along with the concrete obstructions should be undercut and replaced during mass earthwork operations or alternatively during footing excavations. In the vicinity of the pump station, equipment capable of removing buried concrete should be utilized.

Conventional footings can be used to support each of the structures provided the existing fill soils are addressed. A net allowable bearing pressure of 2,500 psf is recommended to design the conventional footings. The above recommended bearing pressure assumes the footings will be founded on stiff native clay, dense silty fine to coarse sand, or suitable structural fill.

The above recommended bearing pressure is a "net allowable soil pressure". In utilizing this net allowable pressure for dimensioning footings, it is necessary to consider only those loads applied above the finished floor elevations. The undercut footing areas should be re-established with either lean clay, granular soils, or lean concrete. All exterior foundations should be founded a minimum of 30-inches or greater below the final grade to reduce frost action.

All foundation excavations should be inspected by Alt & Witzig Engineering to verify that adequate bearing soils exist in the base of all footings. At the time of footing inspections, Housel Penetration Tests or other approved tests can be performed on these foundation soils.

This report is based on our understanding of the proposed construction. If variable soil conditions are encountered, Alt & Witzig should be contacted to provide further recommendations. If we can give further service in these matters, please contact us at your convenience.



Respectfully Submitted,

ALT & WITZIG ENGINEERING, INC.

Kyle Spoelker

Kyle Spoelker, E.I
Project Engineer

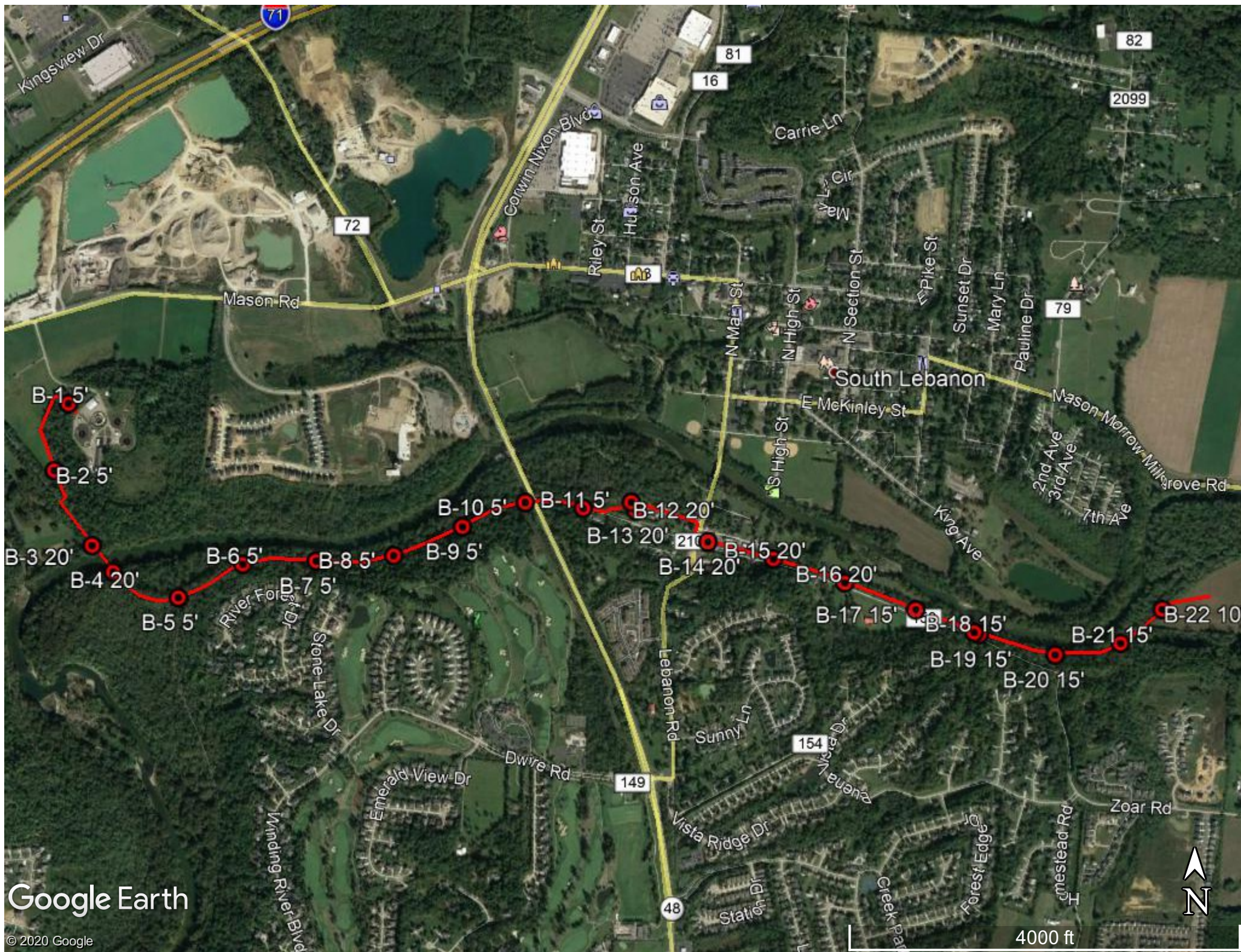
Dustin Horn

Dustin M. Horn, P.E
Senior Project Engineer

APPENDIX

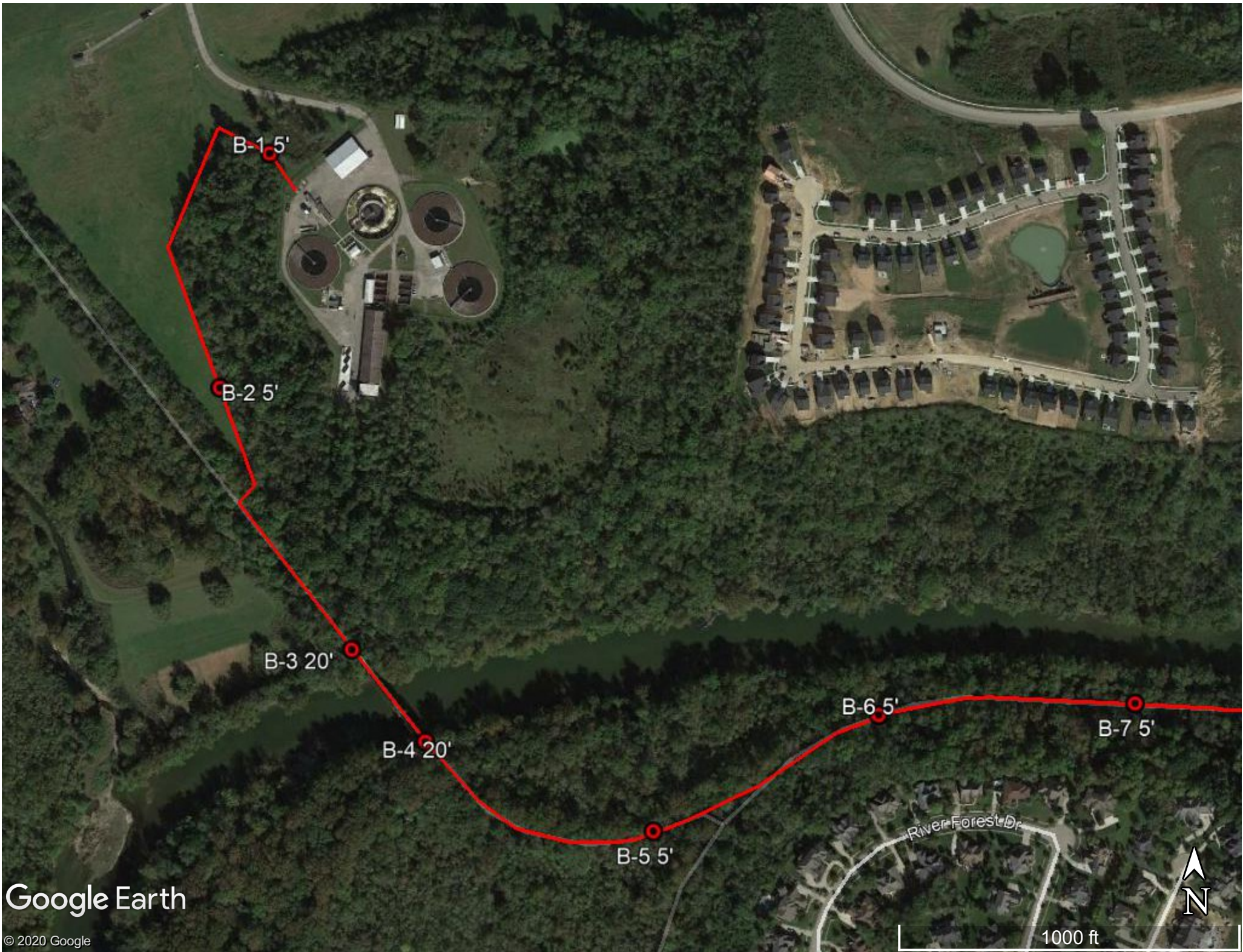
RECOMMENDED SPECIFICATIONS FOR COMPACTED FILLS AND BACKFILLS

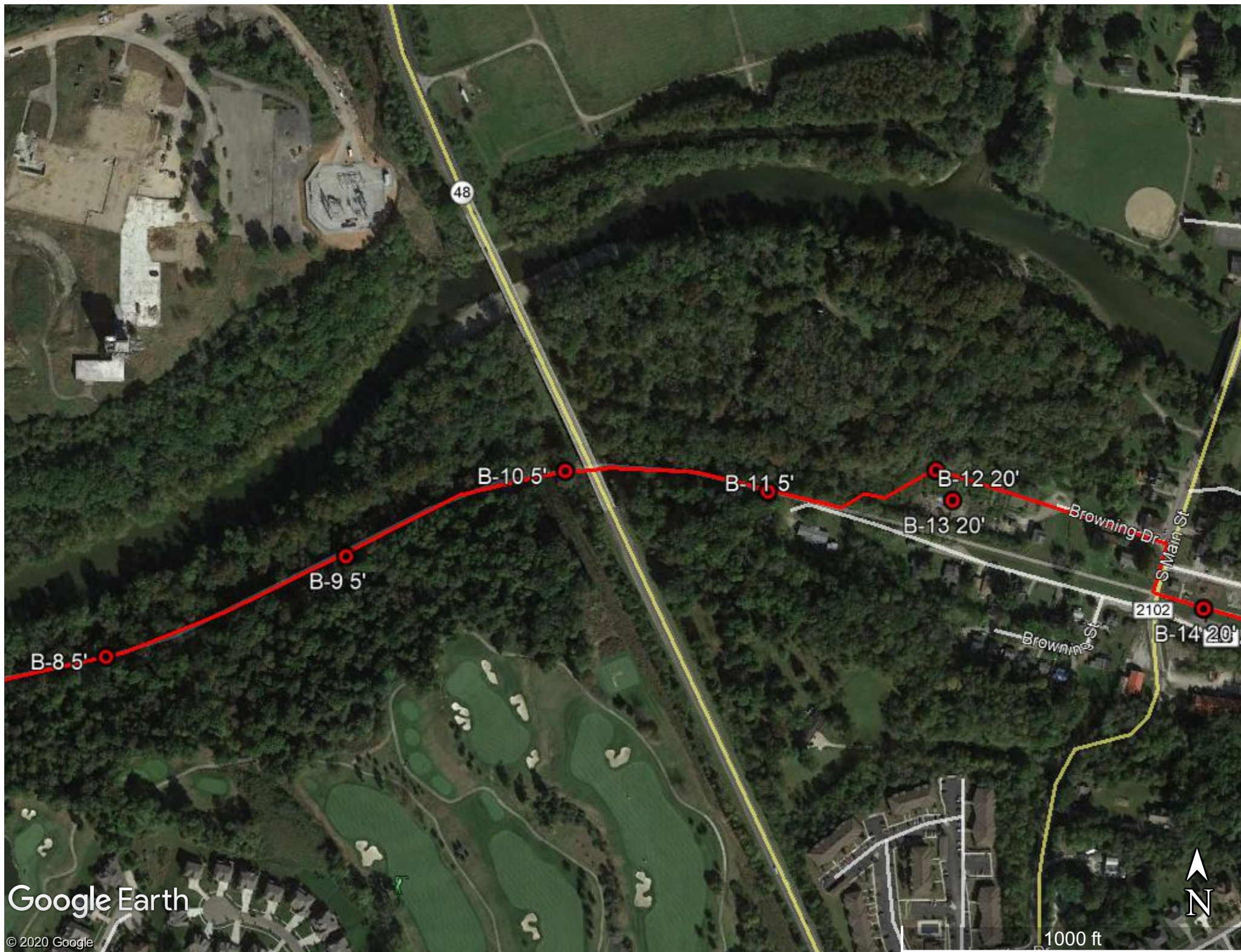
All fill shall be formed from material free of vegetable matter, rubbish, large rock, and other deleterious material. Prior to placement of fill, a sample of the proposed fill material should be submitted to the soil engineer for his approval. The fill material should be placed in layers not to exceed eight (8) inches in loose thickness and should be sprinkled with water as required to secure specified compactions. Six (6) inch lift could be required for smaller compaction equipment. Each layer should be uniformly compacted by means of suitable equipment of the type required by the materials composing the fill. Under no circumstances should a bulldozer or similar tracked vehicles be used as compacting equipment. Material containing an excess of water so the specified compaction limits cannot be attained should be spread and dried to a moisture content that will permit proper compaction. All structural fill should be compacted to 98% of the maximum density obtained in accordance with ASTM Standard Proctor Test D698. Should the results of the in-place density tests indicate that the specified compaction limits are not obtained, the areas represented by such tests should be reworked and retested as required until the specified limits are reached.

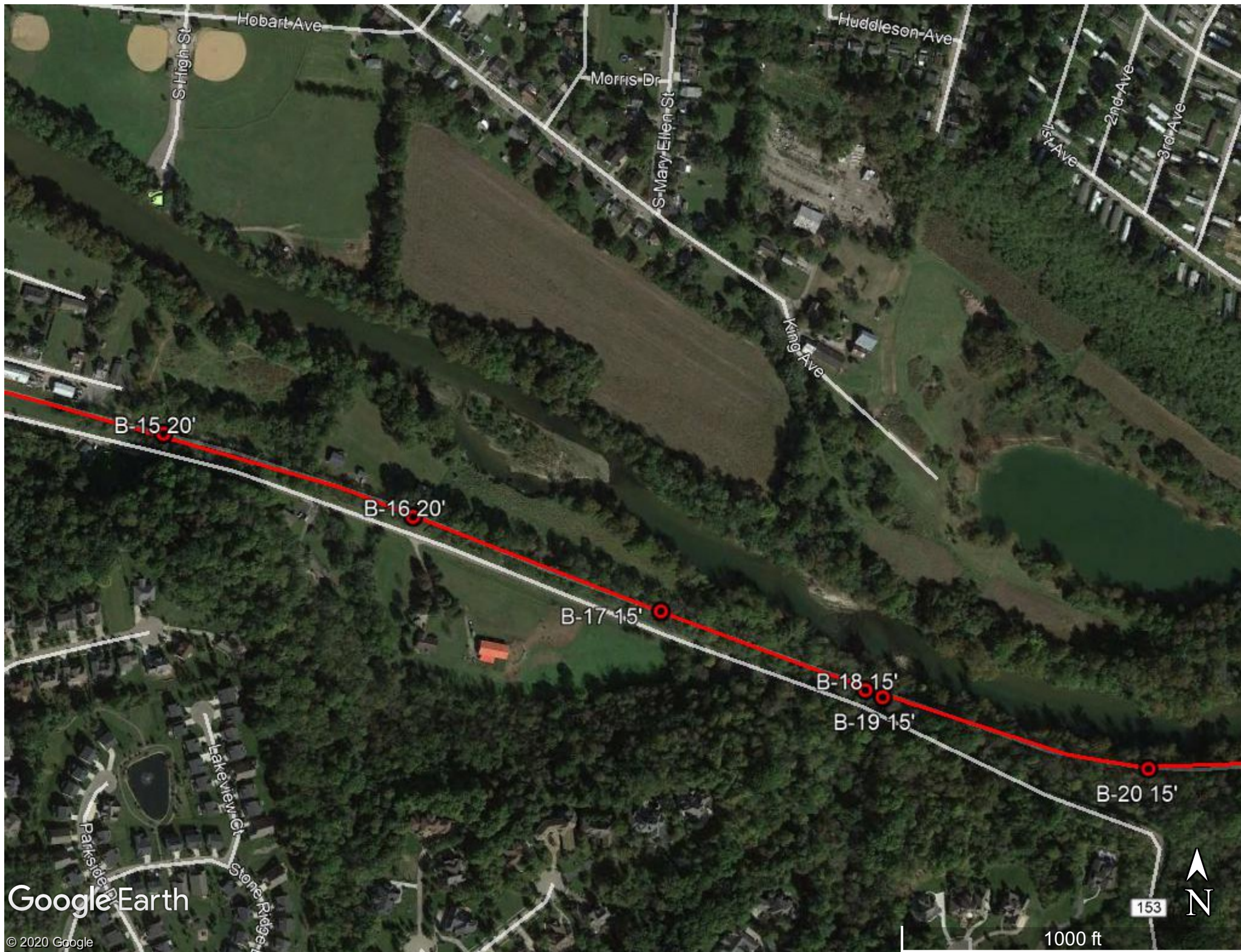


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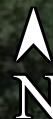


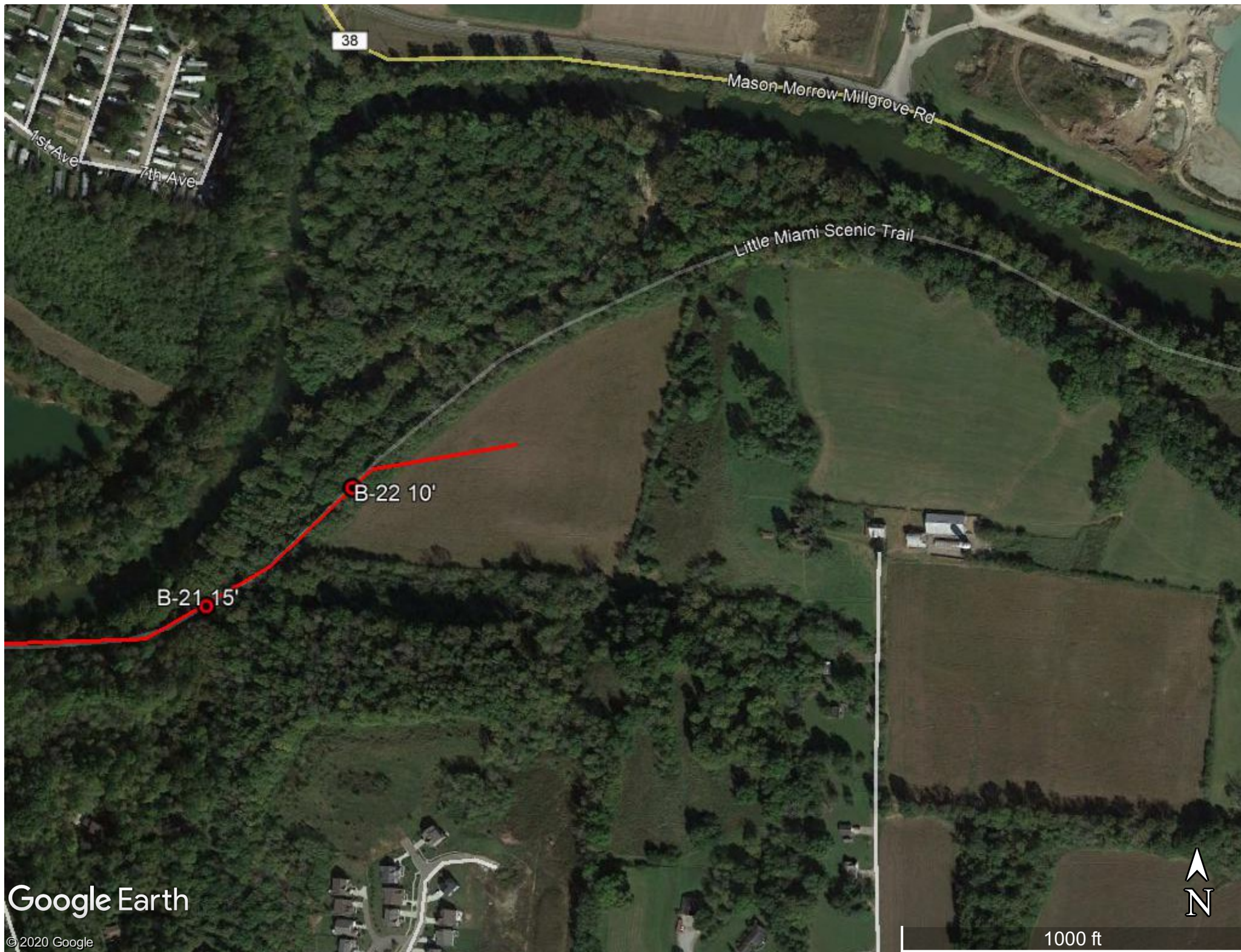
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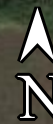
1000 ft





Google Earth

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1000 ft



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-03 Force Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 27.5 Offset 0.0ft

Date Started 6/9/20 Hammer Wt. 140 lbs.
Date Completed 6/9/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Track ATV

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type Sampler Graphics Recovery Graphics Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
	SURFACE ELEVATION 632.0									
631.5	TOPSOIL 6"	0.5								
	Brown Silty CLAY			1	SS	10		2.0	19.3	
			5	2	SS	10		1.5	21.1	
624.5	Brown, Moist Silty CLAY with Sand	7.5		3	SS	5		1.0	22.5	
			10	4	SS	20		1.0	20.4	
619.0	Brown, Dry Fine SAND with Limestone Cobble	13.0								
617.0		15.0	15	5	SS	68				
	Auger Refusal @ 15' End of Boring at 15 feet									

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
▽ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-05 Force Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 41.75 Offset 0.0ft

Date Started 4/13/20 Hammer Wt. 140 lbs.
Date Completed 4/13/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION		Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Grain Recovery Graphic	Ground Water	Standard Penetration Test, N - blows	Qu-tsf Unconfined Compressive	PP-tsf Pocket Penetrometer	Moisture Content Dry Unit Weight	Remarks
	SURFACE ELEVATION 628.0												
627.9	TOPSOIL 1"		0.1										
	Brown/Black Silty Fine to Coarse Sand with Gravel (FILL)				1	SS			18				
623.5			4.5										
622.0	Brown/Dark Brown Silty Sandy CLAY with Trace Gravel (FILL)		6.0	5	2	SS			10		2.3	22.7	
	End of Boring at 6 feet												

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
▼ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-06 Force Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 48.5 Offset 0.0ft

Date Started 4/13/20 Hammer Wt. 140 lbs.
Date Completed 4/13/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
628.9	TOPSOIL 1"	0.1										
625.5	Brown/Gray Silty SAND with Gravel, Cobble, and Slag (FILL)	3.5		1	SS			52				
	End of Boring at 3.5 feet			2	SS			50/1				No Recovery

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
▼ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
 PROJECT NAME River Corridor Public Sewer Expansion
 PROJECT LOCATION Loveland, Ohio

BORING # B-07 Force Main
 ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 55.5 Offset 0.0ft

Date Started 4/13/20 Hammer Wt. 140 lbs.
 Date Completed 4/13/20 Hammer Drop 30 in.
 Boring Method HSA Spoon Sampler OD 2 in.
 Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION		Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content Dry Unit Weight	Remarks
	SURFACE ELEVATION 626.0												
625.9		TOPSOIL 1"	0.1										
		Black Silty SAND with Gravel and Cobble (FILL)			1	SS			16				
622.5		Auger Refusal @ 3.5' End of Boring at 3.5 feet	3.5										

Sample Type

SS - Driven Split Spoon
 ST - Pressed Shelby Tube
 CA - Continuous Flight Auger
 RC - Rock Core
 CU - Cuttings
 CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
 ▼ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
 CFA - Continuous Flight Augers
 DC - Driving Casing
 MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-08 Force Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 64 Offset 0.0ft

Date Started 4/13/20 Hammer Wt. 140 lbs.
Date Completed 4/13/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION		Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Grain Recovery Gr.	Ground Water	Standard Pen Test, N - blow	Qu-tsf Unconf Compressive	PP-tsf Pocket Penet	Moisture Con Dry Unit We	Remarks
	SURFACE ELEVATION 628.0												
627.9	TOPSOIL 1"		0.1										
	Brown Silty CLAY with Black Sand and Trace Gravel (FILL)				1	SS			7				
					2	SS			5				
622.0	End of Boring at 6 feet		6.0										

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
▼ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-09 Force Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 72 Offset 0.0ft

Date Started 4/13/20 Hammer Wt. 140 lbs.
Date Completed 4/13/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION		Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Grain Recovery Grain	Ground Water	Standard Penetration Test, N - blows	Qu-tsf Unconfined Compressive	PP-tsf Pocket Penetrometer	Moisture Content Dry Unit Weight	Remarks
	SURFACE ELEVATION 626.0												
625.9	TOPSOIL 1"		0.1										
	Brown/Dark Brown Silty Sandy CLAY with Gravel and Cobble (FILL)				1	SS			4			29.0	
					2	SS			5		0.3	29.5	
620.0	End of Boring at 6 feet		6.0										

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
⚡ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **McGill Smith Punshon**
PROJECT NAME **River Corridor Public Sewer Expansion**
PROJECT LOCATION **Loveland, Ohio**

BORING # **B-10 Force Main**
ALT & WITZIG FILE # **20CN0086**

DRILLING and SAMPLING INFORMATION

Station 78.75 Offset 0.0ft

Date Started **4/13/20** Hammer Wt. **140** lbs.
Date Completed **4/13/20** Hammer Drop **30** in.
Boring Method **HSA** Spoon Sampler OD **2** in.
Driller **J. Roark** Rig Type **D-50 Truck**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION		Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Grain Recovery Grain	Ground Water	Standard Pen Test, N - blow	Qu-tsf Unconf Compressive	PP-tsf Pocket Penet	Moisture Con Dry Unit Weig	Remarks
	SURFACE ELEVATION 630.0												
629.9	TOPSOIL 1"		0.1										
	Gray Silty Fine to Coarse Sand with Gravel (FILL)				1	SS			10				
625.5			4.5										
	Brown/Gray CLAY			5	2	SS			10		2.8	15.7	
624.0	End of Boring at 6 feet		6.0										

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
▼ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-11 Force Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 85 Offset 0.0ft

Date Started 4/9/20 Hammer Wt. 140 lbs.
Date Completed 4/9/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION		Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/ft	Qu-tsf Unconfined Compressive	PP-tsf Pocket Penetration	Moisture Content <i>Dry Unit Weight</i>	Remarks
	SURFACE ELEVATION 628.0												
626.5		Brown CLAY <i>(FILL)</i>	1.5										
624.5		Brown Silty Sandy CLAY with Gravel, Wood, and Brick <i>(FILL)</i>	3.5		1	SS			11		0.8	21.1	
	End of Boring at 3.5 feet												

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
▼ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-12 Pump Station
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Date Started 4/20/20 Hammer Wt. 140 lbs.
Date Completed 4/20/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
624.2	Gravel 10"	0.8										
	Brown/Gray CLAY with Cobble and Asphalt (FILL)			1	SS			60		1.3	25.4	No Recovery
			5	2	SS			7				
618.0		7.0		3	SS			10		0.3	25.7	
615.5	Brown CLAY with Cobble (FILL)	9.5		4	SS			5		1.0	26.6	
	Brown/Gray CLAY with Trace Organics (FILL)											
610.5		14.5		5	SS			4		1.0	26.5	PH = 7.4 , LOI = 3.9%
	Dark Gray, Moist CLAY with Trace Organics (FILL)											
605.0		20.0		6	SS			12		0.3	9.5	
604.0	Brown/Gray, Moist CLAY with Sand and Cobble	21.0										
	End of Boring at 21 feet											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
⚡ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **McGill Smith Punshon**

BORING # B-13 Control Building

PROJECT NAME **River Corridor Public Sewer Expansion**

ALT & WITZIG FILE # **20CN0086**

PROJECT LOCATION **Loveland, Ohio**

DRILLING and SAMPLING INFORMATION

Date Started 4/8/20 Hammer Wt. 140 lbs.

Date Completed 4/8/20 Hammer Drop 30 in.

Boring Method HSA Spoon Sampler OD 2 in.

Driller **J. Roark** Rig Type **D-50 Truck**

TEST DATA

[illegible]

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling	<u>Dry ft.</u>
▽ At Completion	<u>Dry ft.</u>

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **McGill Smith Punshon**
PROJECT NAME **River Corridor Public Sewer Expansion**
PROJECT LOCATION **Loveland, Ohio**

BORING # **B-14 Gravity Main**
ALT & WITZIG FILE # **20CN0086**

DRILLING and SAMPLING INFORMATION

Station 10 Offset 0.0ft

Date Started **4/20/20** Hammer Wt. **140** lbs.
Date Completed **4/20/20** Hammer Drop **30** in.
Boring Method **HSA** Spoon Sampler OD **2** in.
Driller **J. Roark** Rig Type **D-50 Truck**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
629.9	TOPSOIL 1"	0.1										
	Dark Brown, Moist Fine SAND with Limestone Cobble (FILL)			1	SS			10				
625.5		4.5	5	2	SS			9		2.5	23.5	
	Brown/Gray CLAY			3	SS			7		2.3	24.5	
			10	4	SS			11		2.5	24.8	
615.5		14.5	15	5	SS			7				PH = 7.6, Sulfates 40 ppm
	Brown, Moist Silty Fine Sand											
609.0		21.0	20	6	SS			6				
	End of Boring at 21 feet											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
▽ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-15 Gravity Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 16.75 Offset 0.0ft

Date Started 4/16/20 Hammer Wt. 140 lbs.
Date Completed 4/16/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
629.9	TOPSOIL 2"	0.1										
	Black, Moist Fine SAND with Cobble and Asphalt (FILL)			1	SS			19				
625.5		4.5	5	2	SS			6		1.0	26.9	
				3	SS			5		0.5	25.0	
	Brown, Moist CLAY		10	4	SS			5		2.0	23.0	
615.0		15.0	15	5	SS			6				
	Brown, Moist Fine SAND											
609.0		21.0	20	6	SS			10				
	End of Boring at 21 feet											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
▽ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **McGill Smith Punshon**

PROJECT NAME **River Corridor Public Sewer Expansion**

PROJECT LOCATION **Loveland, Ohio**

BORING # **B-16**
ALT & WITZIG FILE # **20CN0086**

DRILLING and SAMPLING INFORMATION

Station 24.5 Offset 0.0ft

Date Started	<u>4/16/20</u>	Hammer Wt.	<u>140</u>	lbs.
Date Completed	<u>4/16/20</u>	Hammer Drop	<u>30</u>	in.
Boring Method	<u>HSA</u>	Spoon Sampler OD	<u>2</u>	in.
Driller	<u>J. Roark</u>	Rig Type	<u>D-50 Truck</u>	

TEST DATA

[illegible]

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling	<u>Dry ft.</u>
▽ At Completion	<u>Dry ft.</u>

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-17 Gravity Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 32.25 Offset 0.0ft

Date Started 4/16/20 Hammer Wt. 140 lbs.
Date Completed 4/16/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
626.9	TOPSOIL 1"	0.1										
	Dark Brown, Moist Fine SAND with Gravel and Asphalt (FILL)			1	SS			10				
622.5		4.5	5	2	SS			7		1.5	22.8	
	Brown Sandy CLAY with Cobble			3	SS			7				Auger Sample
			10	4	SS			10		1.5	22.1	
612.5		14.5	15	5	SS			11		0.8	23.7	PH= 7.6
611.0	Brown CLAY	16.0										
	End of Boring at 16 feet											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
⚡ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-18
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 39 Offset 0.0ft

Date Started 4/16/20 Hammer Wt. 140 lbs.
Date Completed 4/16/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
629.9	TOPSOIL 1"	0.1										
	Dark Brown Sandy CLAY with Cobble (FILL)			1	SS			12				
625.5		4.5	5	2	SS			14		4.0	20.0	
	Brown CLAY with Cobble											
623.0	Auger Refusal @ 7.0 End of Boring at 7 feet	7.0		3	SS			50/0				

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
▼ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-19 Gravity Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 40 Offset 0.0ft

Date Started 4/20/20 Hammer Wt. 140 lbs.
Date Completed 4/20/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
629.9	TOPSOIL 2"	0.1										
	Dark Brown SAND with Cobble (FILL)			1	SS	X		5				No Recovery
625.0		5.0	5	2	SS	X		10		2.5	20.2	
623.0	Brown CLAY	7.0		3	SS	X		66		4.5	17.1	
	Brown CLAY with Cobble		10	4	SS	X		21		2.0	19.0	
				5	SS	X		38		4.5		PH= 7.9 , Sulfates = 27 ppm
615.0	End of Boring at 15 feet	15.0	15									

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
⚡ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-20 Gravity Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 47.5 Offset 0.0ft

Date Started 4/20/20 Hammer Wt. 140 lbs.
Date Completed 4/20/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION		Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows	Qu-tsf Unconfined Compressive	PP-tsf Pocket Penetrometer	Moisture Content Dry Unit Weight	Remarks
	SURFACE ELEVATION 630.0												
629.9	TOPSOIL 2"		0.1										No Recovery
	Gray, Moist SAND with Cobble (FILL)				1	SS		7					
				5	2	SS		6					
622.0			8.0		3	SS		11	1.8	20.6			
	Brown CLAY with Cobble			10	4	SS		17			19.0		
616.5			13.5		5	SS		33	4.5	15.9	PH = 7.8 , Sulfates 60 ppm		
615.0	Brown CLAY		15.0	15									
	End of Boring at 15 feet												

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
⚡ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-21 Gravity Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 54.25 Offset 0.0ft

Date Started 4/20/20 Hammer Wt. 140 lbs.
Date Completed 4/20/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
626.9	TOPSOIL 1"	0.1										
	Dark Brown, Moist Fine SAND with Gravel (FILL)			1	SS			10				
622.0		5.0	5	2	SS			6				
620.0	Brown CLAY with Brick and Sand (FILL)	7.0		3	SS			10				Auger Sample
	Brown CLAY with Cobble (FILL)		10	4	SS			10				Auger Sample
612.5		14.5										
611.0	Dark Brown CLAY	16.0	15	5	SS			6			25.6	
	End of Boring at 16 feet											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
⚡ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT McGill Smith Punshon
PROJECT NAME River Corridor Public Sewer Expansion
PROJECT LOCATION Loveland, Ohio

BORING # B-22 Gravity Main
ALT & WITZIG FILE # 20CN0086

DRILLING and SAMPLING INFORMATION

Station 57.5 Offset 0.0ft

Date Started 4/20/20 Hammer Wt. 140 lbs.
Date Completed 4/20/20 Hammer Drop 30 in.
Boring Method HSA Spoon Sampler OD 2 in.
Driller J. Roark Rig Type D-50 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % Dry Unit Weight (pcf)	Remarks
625.9	TOPSOIL 2"	0.1										
	Dark Brown Silty CLAY with Topsoil and Organics (FILL)			1	SS			8				
621.0		5.0	5	2	SS			8				No Recovery
	Dark Brown CLAY with Trace Gravel (FILL)			3	SS			11		2.0	22.5	
616.5		9.5										
615.0	Dark Brown, Moist Sandy CLAY	11.0	10	4	SS			12		0.3	16.9	
	End of Boring at 11 feet											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling Dry ft.
⚡ At Completion Dry ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

- N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split-spoon.
- Qu: Unconfined compressive strength, TSF
- Qp: Penetrometer value, unconfined compressive strength, TSF
- Mc: Water content, %
- LL: Liquid limit, %
- PL: Plastic limit, %
- Dd: Natural dry density, PCF
- : Apparent groundwater level at time noted after completion

DRILLING AND SAMPLING SYMBOLS

- SS: Split-spoon - 1 3/8" I.D., 2" O.D., except where noted
- ST: Shelby tube - 3" O.D., except where noted
- AU: Auger sample
- DB: Diamond bit
- CB: Carbide bit
- WS: Washed sample

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

<u>TERM (NON-COHESIVE SOILS)</u>	<u>BLOWS PER FOOT</u>
Very loose	0 - 4
Loose	5 - 10
Firm	11 - 30
Dense	31 - 50
Very Dense	Over 50

<u>TERM (COHESIVE SOILS)</u>	<u>Qu (TSF)</u>
Very soft	0 - 0.25
Soft	0.25 - 0.50
Medium	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.(+)	Coarse Sand	5 mm-0.6 mm	Silt	0.075 mm - 0.005 mm
Cobbles	8 in. - 3 in.	Medium Sand	0.6mm-0.2 mm	Clay	0.005mm(-)
Gravel	3 in. - 5 mm	Fine Sand	0.2mm-0.075 mm		

SECTION 00 11 16
INVITATION TO BID

1.1 BID INFORMATION

- A. Project: River Corridor Public Sanitary Sewer Extension.
- B. Owner: City of South Lebanon.
- C. Architect/Engineer of Record: McGill Smith Punshon, Inc.
- D. **Bid Due Date: Tuesday, November 18, 2025 at 10:00 AM**
- E. ANNOUNCEMENT
- F. City of South Lebanon is inviting General Contractors to submit a Bid for the construction of a public sanitary sewer extension project located at 397 Main Street, South Lebanon Ohio 45065. The Owner will receive sealed Bids at their administration office located at 10 North High Street, South Lebanon Ohio 45065 until 10:00 AM EST on the 18th day of November 2025, at which time the Bids will be publicly opened and read aloud. Bids received after the indicated time will not be opened and returned to the party submitting the bid.
- G. Project Description: Work of this Project involves the construction of a public sanitary sewer and a public force main that is located primarily along the Little Miami Scenic Trail. It includes approximately 5,000 LF of public gravity sanitary sewer, 8,000 LF of public force main and a Control Building and site improvements where the gravity sewer becomes a force main sewer.
- H. General Contractors are required to prequalify to the requirements as described in Document 00 21 13 - Instructions to Bidders.
- I. Bid Documents may be obtained at the Contractor's cost from ARC Document Solutions, 4219 Malsbury Drive, Cincinnati Ohio 45242 – (513) 326-2600.
- J. Questions regarding the Bid Documents should be directed to office of the Architect/Engineer attention Rich Arnold at 513-759-3247 (direct) or via email at rarnold@mspdesign.com.
- K. Bidders may view the Bid Documents at the following locations:
 - 1. ARC Document Solutions
4219 Malsbury Drive, Cincinnati Ohio 45242 – (513) 326-2300
 - 2. Allied Construction Industries
3 Kovach Drive, Cincinnati, Ohio 45215 – (513) 221-8020
 - 3. Builders Exchange, Inc.
4350 Glendale Milford Road, Blue Ash, Ohio 45242 – (513) 769-4800

- L. Refer to other Bidding requirements as described in Document 00 21 13 - Instructions to Bidders.
- M. Submit your Bid on the Bid Form provided.
- N. Your Bid will be required to be submitted under a condition of irrevocability for a period of 30 days after submission.
- O. A Prebid Meeting will be held for Bidders at 9:00 AM EST on the 20th day of October, at the future Control Building site located at 397 Main Street, South Lebanon Ohio 45065. Park at the end of Browning Street. General Contractors and major subcontractors are encouraged to attend.
- P. Owner reserves the right to waive irregularities and to accept or reject any or all Bids.

END OF DOCUMENT 00 11 16

SECTION 00 21 13

1.1 SUMMARY

A. Document Includes:

1. Instructions to Bidders.
2. Site Examination.
3. Prebid Meeting.
4. Substitutions.
5. Contract Time

B. Related Documents:

1. Section 00 11 16 - Invitation to Bid.
2. Section 00 41 00 - Bid Form.
3. Section 00 43 00 - Procurement Form Supplements.
4. Section 00 73 13 - Supplementary Conditions
5. Section 01 10 00 - Summary.
6. Section 01 60 00 - Product Requirements.

1.2 INSTRUCTIONS TO BIDDERS

- A.** These Instructions to Bidders amend or supplement AIA A701 - Instructions to Bidders (specific reference indicated in parentheses) and other provisions of Bidding Documents and Contract Documents.
- B.** This project will use Davis-Bacon Wage Rate Requirements – see the WPCLF & WSRLA information.

1.3 SITE EXAMINATION

- A.** Examine Project Site before submitting Bid.
- B.** Contact Owner at following address and telephone number to arrange date and time to visit Project Site other than the Pre-bid meeting:
1. Address: 10 north High Street – South Lebanon, Ohio 45065.
 2. Telephone: (513) 494-2296

1.4 PREBID MEETING

- A.** A Prebid meeting is scheduled for 9:00 AM EST on the 20th day of October, 2025, at the project site at 397 Main Street, South Lebanon Ohio 45065. Drive to the end of Browning Street and park.
- B.** General Contractors and major subcontractors are invited to attend.

- C. Representatives of Architect/Engineer and Owner will attend.
- D. Minutes:
 - 1. Summarized minutes of this meeting will be circulated to attendees, known Bidders and plan holders via addendum.
 - 2. These minutes will not form part of Contract Documents.
- E. Information relevant to Bidding Documents will be issued by Addendum.

1.5 SUBSTITUTIONS

- A. Where Bidding Documents stipulate particular products, substitution requests will be considered by Architect/Engineer up to 7 business days before receipt of Bids.
- B. With each substitution request, provide sufficient information for Architect/Engineer to determine acceptability of proposed products; comply with substitution request submittal requirements as specified in Section 01 25 00 - Substitution Request Form.

1.6 CONTRACT TIME

- A. Time is of Essence:
 - 1. Owner requests Work of this Contract be completed as quickly as possible.
 - 2. Consideration will be given to the time of completion when reviewing submitted Bids.
 - 3. General Contractor shall include a preliminary project schedule identifying proposed start date, key milestones, substantial completion and completion date in order for their Bid to be considered complete.

END OF DOCUMENT 00 21 13

DOCUMENT 00 41 00

BID FORM

DATE _____, 20____

PROJECT River Corridor Public Sanitary Sewer Extension
397 Main Street, South Lebanon Ohio 45065

PROPOSAL OF _____
hereinafter called "Bidder", a (corporation) (partnership) (sole proprietorship) (Bidder
strike out inapplicable terms)

TO City of South Lebanon, (hereinafter called "Owner")

The undersigned, in compliance with your Advertisement for Bids, submits the following Bid.

1.1 REPRESENTATIONS

- A. Bidder will accept the provisions of the Bidding Documents.
- B. Bidder will enter into and execute a contract with the Owner within 10 days after notification of the acceptance of this Bid.
- C. Bidder will accomplish the Work in accordance with the Bidding Documents prepared by McGill Smith Punshon, Inc.
- D. See specification 00 43 00 Bid Form Supplements for additional information to include with Bid Form.

1.2 TIME OF COMPLETION

- A. Contractor will attain Substantial Completion and/or Certificate of Occupancy on or before April 1, 2027.

1.3 BID AMOUNTS

- A. Base Bid Amount: Bidder proposes to construct this project for the stipulated sum of:
_____ Dollars (_____)

The above base bid amount includes the following allowances:

Owner Contingency: _____ Dollars (_____)

1.4 ADDENDA

A. Bidder acknowledges receipt of the following Addenda:

No. _____ Dated _____, 20____

No. _____ Dated _____, 20____

No. _____ Dated _____, 20____

No. _____ Dated _____, 20____

Respectfully Submitted,

Firm Name

By

Street Address

Signature

City, State and Zip Code

Title

Telephone

Corporations: Affix Corporate Seal

State in which incorporated

END OF DOCUMENT

DOCUMENT 00 43 00

BID FORM SUPPLEMENTS

DATE: _____, 2025

PROJECT: River Corridor Public Sanitary Sewer Extension
397 Main Street, South Lebanon, Ohio 45065

**SUPPLEMENT TO
PROPOSAL OF:** _____

TO: City of South Lebanon (hereinafter called "Owner")
10 North High Street
South Lebanon, Ohio 45065

The undersigned, in compliance with your Advertisement for Bids, submits the Supplements to the Bid Form listed below. The information provided shall be considered as an integral part of the Bid Form previously submitted.

These Appendices are as follows:

1. Proposed Subcontractors: Includes the names of Subcontractors and the portions of the Work they will perform.
2. Base Bid Amount Breakdown: Identifies the cost breakdown of the previously submitted Base Bid amount into the portions of the Work requested.

Respectfully submitted,

Firm Name

Name of Officer

Signature of Officer

PROPOSED SUBCONTRACTORS

Bidder proposes to use the following Subcontractors for the portions of the Work indicated.

DESCRIPTION	SUBCONTRACTOR
<u>Demolition Work – 02 41 16</u>	
<u>Concrete Work – 03 30 00</u>	
<u>Masonry – 04 20 00</u>	
<u>Metal Fabrications – 05 50 00</u>	
<u>Rough Carpentry – 06 10 00</u>	
<u>Thermal & Moisture Protection – 07 20 00</u>	
<u>Roofing & Flashings – 07 61 00</u>	
<u>Doors, Frames & Hardware – 08 10 00 / 08 33 00 / 08 70 00</u>	
<u>Ceilings – 09 21 00</u>	
<u>Painting – 09 90 00</u>	
<u>Interior Specialties – 10 20 00</u>	
<u>Plumbing – Division 22</u>	
<u>HVAC – Division 23</u>	
<u>Electrical – Division 26</u>	
<u>Site & Infrastructure – Division 31</u>	

Exterior Improvements – Division 32

Site Utilities – Division 33

Other

Other

Other

Other

Other

BASE BID BREAKDOWN

The following is a breakdown of the Base Bid Amount into amounts attributable to the portions of the Work indicated. Contractor's overhead and profit shall be included in the value for each item of work.

<u>ITEM OF WORK</u>	<u>VALUE</u>
Demolition	\$ _____
Concrete Foundations	\$ _____
Masonry (CMU, Brick & Accessories)	\$ _____
Misc. Metals, Stairs, Guards & Railings	\$ _____
Wood Framing, wood trusses & blocking	\$ _____
Plastics & Composites	\$ _____
Thermal & Moisture Protection (Insulation, sealants, roofing etc)	\$ _____
Doors, windows & Door Hardware	\$ _____
Finishes (GWB, paint, tile, ceilings, etc)	\$ _____
Specialties	\$ _____
Site Improvements	\$ _____
Site Utilities	\$ _____
Plumbing (Fixtures, piping & accessories, etc)	\$ _____
HVAC (Equipment, ductwork, HVAC accessories)	\$ _____
Electrical (Electric Gear, lighting, wiring & accessories)	\$ _____
Gravity Sewer (Complete)	\$ _____
Force Main Sewer (Complete)	\$ _____
Pump Station (Complete)	\$ _____
Other (Define) _____	\$ _____
Other (Define) _____	\$ _____
Other (Define) _____	\$ _____
Owner Contingency / Allowance (See 01 21 00)	\$ _____ 750,000
TOTAL (BASE BID AMOUNT)	\$ _____

DOCUMENT 00 72 00

GENERAL CONDITIONS

1.1 SUMMARY

- A. Related Documents:
 - 1. Document 00 73 00 - Supplementary Conditions.
 - 2. Division 01 - General Requirements.

1.3 DOCUMENT

- A. American Institute of Architects (AIA) Document A201-2007, General Conditions of the Contract for Construction, forms a part of this Contract and by reference is incorporated herein as fully as if repeated at length.
- B. AIA Documents can be purchased at www.aiaaincinnati.org/contracts; Please call the AIA Executive Director at 513.421.4661 for more information.

END OF DOCUMENT

DRAFT AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

River Corridor
Public Sanitary Sewer Extension
397 Main Street
South Lebanon, Ohio 45065

THE OWNER:

(Name, legal status and address)

City of South Lebanon
10 North High Street
South Lebanon, Ohio 45065

THE ARCHITECT:

(Name, legal status and address)

McGill Smith Punshon, Inc
3700 Park 42 Drive, Suite 190B
Cincinnati, Ohio 45241

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14	TERMINATION OR SUSPENSION OF THE CONTRACT
15	CLAIMS AND DISPUTES

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.

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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 requirements.

§ 1.1.2 THE CONTRACT

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

§ 1.1.3 THE WORK

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

§ 1.1.4 THE PROJECT

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

§ 1.1.5 THE DRAWINGS

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

§ 1.1.6 THE SPECIFICATIONS

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

§ 1.1.7 INSTRUMENTS OF SERVICE

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

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

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

§ 1.2.2 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 will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment 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 this 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 material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them 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 material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect’s consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

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 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner’s obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner’s ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 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.

§ 2.2.3 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.

§ 2.2.4 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.

§ 2.2.5 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.

§ 2.3 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.

§ 2.4 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 written 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 deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor 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. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

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 obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make 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 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, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and 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 written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required 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 authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

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

§ 3.5 WARRANTY

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

§ 3.6 TAXES

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

§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

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

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

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

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 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 an equitable adjustment 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 in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed 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 furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply 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 SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be 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, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

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

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be 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 the way by which 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 requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing 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 written 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. 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 cause such services or certifications to be provided by a properly 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, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, 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. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 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, and 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 and patching shall be restored to the condition existing prior to the cutting, fitting and 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 such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's 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 or 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 Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect 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 such 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 the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such 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 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.

§ 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.

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

§ 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, except as provided in Section 3.3.1.

§ 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 report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) 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 FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 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 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 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, unless otherwise specifically stated by the Architect, 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 authorize 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 duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 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 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 or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply 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 previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, 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, which the Contractor, by these 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 in writing; 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 such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 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 other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the 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, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor 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 report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report 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, except as to defects not then reasonably discoverable.

§ 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 the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors 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, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

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

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

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

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

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

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

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 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.

§ 7.3.6 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.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and 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 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .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 related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 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 has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

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, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be

furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

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

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

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

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

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.

§ 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's 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. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material 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 material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the

Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part 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 comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. 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. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. 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 material 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 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 the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 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 material or equipment suppliers 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 Architect will reflect such payment on the next Certificate 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 material and equipment 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 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, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment 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 and 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, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written 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 shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

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

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

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall 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 such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such 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 as required under Section 11.3.1.5 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 written 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 and, 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 terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial 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 and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, 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. If such lien 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 such lien, 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 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 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; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material 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 or the Contractor's Subcontractors or Sub-subcontractors; 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 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 owners and users of adjacent sites and utilities.

§ 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, except damage or loss 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, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. 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 report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written 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 such material or substance or who are to perform the task of removal or safe containment of such 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 in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

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

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

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

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify 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 LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's

risk “all-risk” or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an “all-risk” or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect’s and Contractor’s services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner’s option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner’s property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner’s property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 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, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 WAIVERS OF SUBROGATION

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, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, 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 covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance 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 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 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.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, 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 an 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 written 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 2.4.

§ 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, whether completed or partially completed, of the Owner or separate contractors 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 except that, 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 such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 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.

§ 13.4.2 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 there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 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 (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 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 13.5.1, 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 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 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.

§ 13.5.5 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.

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

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may 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.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time 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 13.7.

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 or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, 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 promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, 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' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor 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' written 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 for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .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 above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, 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' written 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 as described in 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 written 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 Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

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, 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.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written 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 must 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 CONTINUING CONTRACT PERFORMANCE

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. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

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

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein 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.

§ 15.1.5.2 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.

§ 15.1.6 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 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, 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 arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no 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 such 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 an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, 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 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 ARBITRATION

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The

party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

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

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

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

§ 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

SECTION 00 73 13
SUPPLEMENTARY CONDITIONS

1.1 SUMMARY

A. Document Includes:

1. Supplementary Conditions.

B. Related Documents:

1. Document 00 41 13 - Bid Form - Stipulated Sum (Single-Prime Contract).
2. Document 00 43 00 - Bid Form Supplements: Appendices A and B.
3. Document 00 52 13.11 - Agreement Form - AIA Stipulated Sum (Single-Prime Contract).
4. Document 00 72 13.11 - General Conditions - AIA Stipulated Sum (Single-Prime Contract).

1.2 SUPPLEMENTARY CONDITIONS

A. Modifications:

1. These Supplementary Conditions modify AIA A201 - General Conditions of the Contract for Construction and other provisions of the Contract Documents as indicated below.
2. All provisions not modified remain in full force.
3. The terms used in these Supplementary Conditions, which are defined in AIA A201, have the meanings assigned to them in the General Conditions.

1.3 (ARTICLE 1) GENERAL PROVISIONS

A. (Subparagraph 1.1) Basic Definitions:

1. Add following Subparagraphs:
 - a. (Subparagraph 1.1.8) Products: New material, machinery, components, equipment, fixtures, and systems forming the Work, not including machinery and equipment used for preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials or components required for reuse.
 - b. (Subparagraph 1.1.9) Furnish: To supply, deliver, unload, and inspect for damage.
 - c. (Subparagraph 1.1.10) Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, and make ready for use.
 - d. (Subparagraph 1.1.11) Provide: To furnish and install.

B. (Subparagraph 1.2) Correlation and Intent of the Contract Documents:

1. Add following Subparagraph:
 - a. (Subparagraph 1.2.4): Sections of Division 01 govern the execution of the Work of all Sections of the Specifications.

1.4 (ARTICLE 3) CONTRACTOR

A. (Subparagraph 3.6) Taxes:

1. Add following Subparagraph:

- a. (Subparagraph 3.6.2): Owner will obtain an exemption certificate for Contractor for taxes on certain products or items, for purchasing products or items for the Work.

1.5 (ARTICLE 7) CHANGES IN THE WORK

A. (Subparagraph 7.3) Construction Change Directives:

1. Add following Subparagraphs:

- a. (Subparagraph 7.1.4): Following fees apply to changes in the Work:
- b. (Subparagraph 7.1.4.1): 10 percent overhead and profit on the net cost of Work performed by Contractor.
- c. (Subparagraph 7.1.4.2): 10 percent overhead and profit on the cost of Work performed by any Subcontractor.
- d. (Subparagraph 7.1.4.3): On Work deleted from the Contract, credit to Owner shall be Architect/Engineer-approved net cost plus 1/2 of the overhead and profit percentage noted above.

1.6 (ARTICLE 8) TIME

A. Contract Time:

1. Add following Subparagraph:

- a. (Subparagraph 8.1.5): Contract Time is identified in Document 00 21 13.11 - Instructions to Bidders - AIA.

1.7 (ARTICLE 9) PAYMENTS AND COMPLETION

A. (Subparagraph 9.3) Applications for Payment:

1. Add following Subparagraph to Subparagraph 9.3.1:

- a. (Subparagraph 9.3.1.3): Until Substantial Completion, Owner shall pay 90 percent of the amount due Contractor on account of progress payments.

1.8 (ARTICLE 11) INSURANCE AND BONDS

A. (Subparagraph 11.1) Contractor's Liability Insurance.

B. (Subparagraph 11.5) Performance Bond:

1. Add following Subparagraphs:
 - a. (Subparagraph 11.5.3): Contractor shall furnish bonds to Owner in the following amounts:
 - b. (Subparagraph 11.5.3.1): Furnish a 100 percent performance bond on AIA A312.

END OF DOCUMENT 00 73 13

Contract Document Provisions

- The following contract requirements and forms are to be included in the construction contract documents. Completed copies of the forms are to be submitted to Ohio EPA within one week after bids are received, or sooner, dependent on your individual project schedule. Bid packages for WPCLF projects should be submitted to DEFA in the central office while bid packages for WSRLA projects should be submitted to the appropriate DDAGW district office.

Equal Employment Opportunity (EEO) Requirements

The Contractor's EEO Certification Form must be (1) included in the contract documents and (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.

NOTE: If the loan applicant has its own EEO requirements, local procedures and forms may be substituted for the EPA form.

Debarment

The Certification Regarding Debarment, Suspension, and Other Responsibility Matters must be (1) included in the contract documents and (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.

Disadvantaged Business Enterprises (DBE) Utilization

The DBE Specification language and instructions to the bidders and Forms 6100-3, 6100-4 and 6100-2 must be (1) included in the contract documents and (2) referenced in the Instructions to Bidders, informing bidders that the forms must be completed and submitted with their bid.

NOTE: If the loan applicant has its own DBE requirements or if other funding programs with potentially competing DBE requirements are participating in the project funding, please contact Ohio EPA – DEFA for specific instructions regarding the DBE requirements.

Davis-Bacon wage rate requirements

The contract documents must include language that requires contractors and subcontractors to pay wages at rates not less than those prevailing on similar projects within the area as determined by the US Secretary of Labor. In addition, the loan recipient will be required to conduct wage interviews and monitor payroll for compliance.

Build America, Buy America (Lead Service Line, Emerging Contaminant, Equivalency Projects)

Build America Buy America Act (BABA) requirements apply to Lead Service Line, Emerging Contaminants and equivalency projects funded by a WPCLF assistance agreement and/or a WSRLA assistance agreement. Equivalency projects are those receiving funding from federal capitalization grants that support the WPCLF and WSRLA programs. The acknowledgement form must be included in the contract documents. The acknowledgement form should be signed by the contractor and submitted with the final bid package. It is recommended that the BABA guidance document and questions and answers document be included in the contract documents.

American Iron and Steel

All treatment works projects funded by a WPCLF assistance agreement and all public water system projects funded by a WSRLA assistance agreement are required to comply with American Iron and Steel (AIS) requirements. The acknowledgement form must be included in the contract documents. The acknowledgement form should be signed by the contractor and submitted with the final bid package. It is recommended that the AIS guidance document and questions and answers document be included in the contract documents.

- The following contract requirements are to be included in the construction contract documents but are not required to be submitted to Ohio EPA for contract endorsement.

Violating Facilities Clause

Language prohibiting this use of equipment or services from anyone on the EPA List of Violating Facilities must be included in the contract documents.

Small Businesses in Rural Areas (SBRA)

Language encouraging the participation of small businesses in rural areas should be included in the contract documents.

Prohibition on Telecommunications and Video Surveillance

Restrictions to loan recipients and subrecipients on certain telecommunications and video surveillance services or equipment due to Public Law 115-232.

Insurance Provisions

Section 3.5 of the WPCLF/WSRLA Loan Agreement contains specific requirements regarding insurance for all contractors and all subcontractors for the life of the contract. These insurance requirements must be reflected in the contract documents. Adjust the language as needed to meet the specifics of the construction project while still meeting the provisions of the Loan Agreement.

Materials Testing

In addition to the details included with specific equipment testing in the specifications, there should be an overall statement regarding testing for the project. Adjust the language as needed to meet the specifics of the construction project.

Continuous Treatment Provisions

It is important that construction activities not result in any temporary violations of Drinking Water or NPDES permit requirements (for permitted facilities). Construction activities should interrupt wastewater service to the individual resident as little as possible. For drinking water projects, it is important that construction activities not result in any disruption of service. The example language is intended for construction work occurring at an existing drinking water plant or a WWTP and must be adjusted to meet the specifics of the construction project.

WPCLF/WSRLA Change Order Form

All change orders for the construction project must be executed on the WPCLF/WSRLA change order form. The form must be (1) included in the contract documents and (2) the instructions referenced in the Contract Documents.

- The following contract requirements are provided in Ohio Revised Code (ORC). Some loan applicants have local requirements that supersede ORC provisions for competitive bidding, and these local requirements can be applied instead of ORC, except for those requirements specified in the WPCLF/WSRLA loan agreements.

Bid Guarantee

The requirements for a bid guarantee (which can be a bond or a certified check, cashier's check, or letter of credit) are covered in ORC 153.54.

Payment and Performance Bonds

The requirements for a Payment and Performance Bond are covered in ORC 153.54 and Section 3.4 of the WPCLF/WSRLA Loan Agreements.

Payment Retention

The requirement for payment retainage is provided in ORC 153.12. Details on how the escrow account that holds the retainage are provided in ORC 153.13. Further details on how and when to pay for materials delivered and installed are provided in ORC 153.14.

Completion Time

The contract documents must state the length of the contract time per ORC 153.19. The dates for Initiation of Operation and Project Completion are specified in the WPCLF/WSRLA Loan Agreements and need to coincide with the specified contract time.

- The following are contract provisions to consider but are not required. The language provided for each are samples only and must be adjusted to reflect the specifics of the project and local needs.

Local Protest Procedure

Some statement as to when a valid protest must be filed, in what form it must be filed and who it must be filed with should be included. ORC 153.12 has some default procedures for handling disputes. If the owner wants more control than provided in ORC, a procedure needs to be spelled out in the Contract Documents.

[Basis and Method for Award](#)

The contract documents should include some language that clearly states what the Owner will consider when determining the successful bidder and to provide a clear basis for the Owner when they have a need to reject the low bidder and go with a different bidder.

[Payment Methods](#)

To minimize uncertainty and arguments that can slow down the progress of construction it is useful to provide language stating how and when the Contractor will get paid. In addition to ORC and other local requirements, the involvement of public funding Agencies such as the WPCLF, WSRLA, Ohio Public Works Commission and Community Development Block Grant impact the process and timing for payments.

Contract Documents Review (pre-advertising)

Whenever possible, all the provisions listed above must be included in the contract documents for the project prior to advertisement for bids. Ohio EPA's review for these contract provisions will occur as part of our normal detail plans and specifications review. The bidding documents are to be submitted to Ohio EPA for review regardless of whether a Permit to Install or a Plan Approval is required for the project.

After bidding has started:

In those cases when WPCLF or WSRLA funding is being requested after advertisement for bids has started, add all missing contract provisions, forms, and requirements via addendum.

After bids have been opened but before contracts have been signed:

If the bid advertisement period is over and bids have been opened, but the construction contract have not been signed yet, provide a draft contract change order which would be used to incorporate all missing contract provisions, forms, and requirements into the contract. This should be done in consultation with local legal counsel to address any potential bid protest concerns.

Construction contracts have already been signed:

If the construction contract has already been signed, a contract change order must be executed incorporating all missing contract provisions, forms, and requirements into the contract.

A [Contract Documents Review checklist](#) is provided here to help ensure that all requirements are included and to help expedite Ohio EPA's review of your documents.

Bid Package Submittals (post-advertising)

Certain documents must be submitted to Ohio EPA within one week after bids are received, or sooner dependent on your individual project schedule. Please [look here for a complete list](#) of the required submittals.

NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.

Equal Employment Opportunity (EEO) Requirements
(Required Contract Provision)

The Contractor's EEO Certification Form provided on the following page must be:

- (1) included in the contract documents and
- (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.

NOTE: If the loan applicant has its own EEO requirements, local procedures and forms may be substituted for the EPA form.

/

Contractor Equal Employment Opportunity Certification

During the performance of this contract, the undersigned agrees as follows:

1. The undersigned will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The undersigned will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The undersigned agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this equal opportunity (federally assisted construction) clause.
2. The undersigned will, in all solicitations or advertisements for employees placed by or on behalf of the undersigned, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.
3. The undersigned will send to each labor union or representative of workers, with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representative of the undersigned's commitment under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. The undersigned will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
5. The undersigned will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and relevant orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the administering agency of the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
6. In the event of the undersigned's non-compliance with the equal opportunity (federally assisted construction) clause of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part, and the undersigned may be declared ineligible for further Government contracts of federally assisted construction contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rules, regulations, or order of the Secretary of Labor, or as provided by law.
7. The undersigned will include this equal opportunity (federally assisted construction) clause in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order No. 11246 of September 24, 1965, so that such provision will be binding upon each subcontract or vendor. The undersigned will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for non compliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor, as a result of such direction by the administering agency the undersigned may request the United States to enter into such litigation to protect the interest of the United States.

(Signature)

(Date)

(Name and Title of Signer, Please type)

(Firm Name)

Debarment Requirements

(Required Contract Provision)

The Certification Regarding Debarment, Suspension, and Other Responsibility Matters form included on the following page must be:

- (1) included in the contract documents and
- (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.

Certification Regarding Debarment, Suspension, and Other Responsibility Matters

INSTRUCTIONS

Under Executive Order 12549 an individual or organization debarred or excluded from participation in Federal assistance or benefit programs may not receive any assistance award under a Federal program or a subagreement thereunder for \$25,000 or more.

Accordingly, each prospective recipient of an EPA grant, loan, or cooperative agreement and any contract or subagreement participant thereunder must complete the attached certification provide an explanation why they cannot. For further details, see the regulation 40 CFR 32.510, Participants' responsibilities.

Go to <https://sam.gov/content/exclusions> to search for excluded parties. The record includes information regarding entities debarred, suspended, proposed for debarment, excluded or disqualified under the nonprocurement common rule, or otherwise declared ineligible from receiving Federal contracts, certain subcontracts, and certain Federal assistance and benefits. This information may include names, addresses, DUNS numbers, Social Security Numbers, Employer Identification Numbers or other Taxpayer Identification Numbers, if available and deemed appropriate and permissible to publish by the agency taking the action.

Where To Submit

The prospective EPA grant, loan, or cooperative agreement recipient must return the signed certification or explanation with its application to Ohio EPA.

A prospective prime contractor must submit a complete certification or explanation to the individual or organization awarding the contract.

Each prospective subcontractor must submit a complete certification or explanation to the prime contractor for the project.

Applicants may reproduce these materials as needed and provide them to their prospective prime contractor, who, in turn, may reproduce and provide them to prospective subcontractors.

Additional copies / assistance may be requested from:

Ohio EPA
Division of Environmental and Financial Assistance
P.O. Box 1049
Columbus, Ohio 43216-1049
(614) 644-2798
www.epa.ohio.gov/defa/

Certification Regarding Debarment, Suspension, and Other Responsibility Matters

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (b) of this certification;
- (d) Have not within a three year period preceding this application / proposal had one or more public transactions (Federal, State, or local) terminated for cause or default; and
- (e) Will not utilize a subcontractor or supplier who is unable to certify (a) through (d) above.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to \$10,000 or imprisonment for up to 5 years, or both.

Type Name & Title of Authorized Representative

Signature of Authorized Representative

Date

☐ I am unable to certify to the above statements. My explanation is attached.

Disadvantaged Business Enterprises (DBE) Utilization

(Required Contract Provision)

USEPA has a program to encourage the participation of disadvantaged businesses in the construction activities funded by the Clean Water and Drinking Water SRF's. "DBE" is an all-inclusive term that includes Minority Business Enterprises (MBE), Women Business Enterprises (WBE), Small Business Enterprises (SBE), Small Business in Rural Areas (SBRA), HUBZone Small Business, Labor Surplus Area Firms (LSAF), and other entities defined as socially and/or economically disadvantaged. While the WPCLF and WSRLA strongly encourage participation by all disadvantaged groups, specific participation goals are negotiated with USEPA only for Minority Business Enterprises and Women's Business Enterprises.

Goals

As a condition of receiving capitalization grants from U.S. EPA for the Water Pollution Control Loan Fund (WPCLF) and the Water Supply Revolving Loan Account (WSRLA), the Ohio EPA negotiates "fair share" Disadvantaged Business Enterprises (DBE) objectives with U.S. EPA. **The current negotiated goal for construction related activities is 5.4% (the total goal is based on 3.1% of MBEs and 2.3% of WBEs participation).**

DBE Certification

Under the DBE program, qualified DBE's are those that have been certified as an MBE or WBE. Certifications can be obtained from a federal agency such as the Small Business Administration or the Department of Transportation or by an approved State agency. The Unified Certification Program (UCP) administered by the Ohio Department of Transportation (ODOT) can provide the necessary DBE certifications. Information on the UCP can be found at www.ohioucp.org as well as the ODOT website <https://www.transportation.ohio.gov/programs/business-economic-opportunity/dbe>. The Department of Development operates the Encouraging Diversity Growth and Equity Program (EDGE), the other state approved DBE certification program. Information on EDGE can be found at <https://development.ohio.gov/business/minority-business/business-certifications/encouraging-diversity-growth-and-equity-program>.

DBE Qualifications

To qualify for MBE certification, businesses must be 51 percent owned and controlled by a U.S. citizen and Ohio resident belonging to an African American, Native American, Hispanic, or Asian American ethnic group. In addition, the business must be in operation for at least one year prior to submitting an application. For DBE status, a business must be at least 51 percent owned by a socially and economically disadvantaged person who participates in the daily operations of the business. This person must be a woman or of African-American, Hispanic, Native American, Asian American ethnicity.

Program Requirements

To comply with DBE program requirements the WPCLF/WSRLA loan recipient must do the following:

1. Create and maintain a bidder's list (see description below)

2. Include contract conditions applicable to the DBE program in all procurement contracts entered into by the Borrower for all WPCLF and WSRLA projects. These conditions are listed below.
3. Follow, document, and maintain documentation of good faith efforts on the part of prime contractors to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project.
4. Review the Form 6100-3 and 6100-4 submittals provided by bidders on the project for completeness and obtain any additional information necessary to verify the certification status of all proposed subcontractors.
5. Obtain documentation of the good faith efforts of the prime contractor if the prime contractor does not meet the MBE or WBE goal.
6. Obtain a written confirmation from any prime contractor states that they will not meet the MBE and WBE goals because they will not be entering into any agreements for goods or services with any company, firm, joint venture, or individual.
7. Submit the following to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined:
 - Form 6100-3 from each subcontractor
 - Form 6100-4 from each prime contractor
 - a copy of the Good Faith Efforts documentation from any prime contractors that will not meet the MBE and WBE goals,
 - if any of the prime contractors will not meet the MBE and WBE goals because they will not be entering into any agreements for goods or services with any company, firm, joint venture, or individual, a copy of the written confirmation from that prime contractor
8. Report MBE/WBE accomplishments on Form 5700-52A annually (within 15 days after October 1st).

NOTE: It is up to the WPCLF/WSRLA loan recipient whether or not to require completion and submission of Forms 6100-3 and 6100-4 from all bidders with the bid proposal or to accept completion and submission from the successful bidder(s) only at some time after bids are received. Regardless of whether the forms are completed and submitted with the bids or at some later time once the successful bidders are identified, completed forms are to be submitted to Ohio EPA with the bid package.

To comply with DBE program requirements all prime contractors must do the following:

1. Follow, document, and maintain documentation of their good faith efforts.
2. Complete and submit **Form 6100-4 DBE Subcontractor Utilization Summary** as part of the bid proposal package to the loan recipient.
3. Have its Disadvantaged Business Enterprise subcontractors complete **Form 6100-3 DBE Subcontractor Proposed Performance Form** and submit those as part of the bid proposal package to the loan recipient.
4. Provide **Form 6100-2 DBE Subcontractor Actual Participation Form** to all of its Disadvantaged Business Enterprise subcontractors for completion at the end of the work.
5. During construction, provide the data necessary so that the loan recipient can report MBE/WBE accomplishments on Form 5700-52A annually (within 15 days after October 1st).

Bidders List

The Borrower must create, maintain, and use a bidders list for purposes of soliciting both MBE/WBEs and non-MBE/WBEs during procurement of construction, equipment, supplies, and services. This list shall include:

1. Entity's name with point of contact;
2. Entity's mailing address, telephone number, and e-mail address;
3. The procurement on which the entity bid or quoted, and when; and
4. Entity's status as an MBE/WBE or non-MBE/WBE.

Borrowers that receive less than \$250,000 or less in any one fiscal year can be exempt from maintaining a Bidders List.

The Bidders List shall be maintained until the project period has expired and the Borrower is no longer receiving EPA funding. The Bidders List must include all firms that bid on the prime contracts, or bid or gave a quote on subcontracts, including both MBE/WBEs and non-MBE/WBEs.

Required Contract Conditions

The DBE Specification language and instructions to the bidders and Forms 6100-2, 6100-3 and 6100-4 must be included in the contract documents and referenced in the Instructions to Bidders, informing bidders that the forms must be completed and submitted with their bid for all WPCLF and WSRLA projects:

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the owner.
2. The prime contractor must notify the owner in writing prior to the termination of any Disadvantage Business Enterprise subcontractor for convenience by the prime contractor.
3. If a Disadvantage Business Enterprise contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six Good Faith Efforts (listed below) if soliciting a replacement contractor.
4. The prime contractor must employ the six Good Faith Efforts even if the prime contractor has achieved its fair share objectives.
5. An owner must ensure that each procurement contract it awards contains the following terms and conditions:

The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

Good Faith Efforts

Borrowers and their prime contractors must follow, document, and maintain documentation of their good faith efforts as listed below to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach.

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

DBE Forms

Form 6100-3 – Each prime contractor must have its DBE subcontractors complete **Form 6100-3 DBE Subcontractor Proposed Performance Form**. This form gives the DBE subcontractor the opportunity to report the scope and cost of the subcontract and it should be forwarded to the Prime Contractor along with the DBE's quote. Each subcontractor completes one Form 6100-3. The Borrower must submit all Form 6100-3 forms to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined.

Form 6100-4 – Each prime contractor must complete and submit **Form 6100-4 DBE Subcontractor Utilization Summary** as part of the prime contractor's bid proposal package to the Borrower. This form summarizes the Prime Contractor's intended use of identified DBE(s) and the estimated dollar amount of each subcontract. Only one Form 6100-4 form is required from each Prime Contractor. The Borrower must submit this form to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined.

Form 6100-2 - The prime contractor must provide **Form 6100-2 DBE Subcontractor Actual Participation Form** to all of its Disadvantaged Business Enterprise subcontractors.

This form gives the DBE subcontractor the opportunity to describe the work the DBE received from the Prime Contractor, how much the DBE was paid and any other concerns the DBE might have. Disadvantaged Business Enterprise subcontractors must send completed Form 6100-2 directly to the Region 5 DBE Coordinator after the work by the subcontractor is done and is NOT submitted with the bid package to Ohio EPA.

Region 5 MBE/WBE Coordinator
USEPA, Acquisition and Assistance Branch
77 West Jackson Boulevard (MC-10J)
Chicago, IL 60604

Reporting During Construction – Form 5700-52A

The purpose of MBE/WBE reporting is to monitor the grant recipient's accomplishments in utilizing MBEs and WBEs; and adherence to the good faith efforts (i.e., outreach to MBEs, WBEs, and other DBEs); and progress in achieving MBE and WBE Goals. During the progress of the construction project, the loan recipient must complete & submit Form 5700-52A annually (**within 15 days after October 1st**). If there were no MBEs or WBEs utilized, or no procurement expenditures of any kind were made during the reporting period, a "negative report" is still required.

Reports are to be sent to:

Florel Fraser, Ohio EPA – DEFA
P.O. Box 1049
Columbus, OH 43216-1049
E-mail address: Florel.Fraser@epa.ohio.gov
Phone: (614) 644-3636

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form**

This form is intended to capture the DBE¹ subcontractor's² description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity:	

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services , Equipment or Supplies	Price of Work Submitted to the Prime Contractor
DBE Certified By: ☐ ODOT ☐ DAS/EDGE ☐ Other: _____ Meets/ exceeds EPA certification standards? ☐ YES ☐ NO ☐ Unknown		

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form**

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 I.

Prime Contractor Signature	Print Name
Title	Date

Subcontractor Signature	Print Name
Title	Date

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form**

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE¹ subcontractors² and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Issuing/Funding Entity:			

I have identified potential DBE certified subcontractors	☐ YES ☐ NO		
If yes, please complete the table below. If no, please explain:			
Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt.	Currently DBE Certified?

Continue on back if needed

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form**

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Prime Contractor Signature	Print Name
Title	Date

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form**

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE¹ subcontractor² the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity:	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services , Equipment or Supplies	Amount Received by Prime Contractor

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

Disadvantaged Business Enterprise (DBE) Program DBE Subcontractor Participation Form

Please use the space below to report any concerns regarding the above EPA-funded project:

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Subcontractor Signature	Print Name
Title	Date

ALERT

“Total Procurement” fields and “MBE/WBE Combined Procurement” fields located in section 4B of this form should include Federal funds provided under the assistance agreement, recipient matching funds, and funds from other sources that are included in the assistance agreement.

Due to process time of Paperwork Reduction Act procedures, EPA is not able to update the [EPA Form 5700-52A](#) immediately to reflect this clarification.

If EPA grant recipients have questions about [EPA Form 5700-52A](#), please work with your respective Grants Specialist or [DBE Coordinator](#).



U.S. ENVIRONMENTAL PROTECTION AGENCY MBE/WBE UTILIZATION UNDER FEDERAL GRANTS AND COOPERATIVE AGREEMENTS

This collection of information is approved by OMB under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. (OMB Control No. 2030-0020). Responses to this collection of information are required to obtain an assistance agreement (40 CFR Part 30, 40 CFR Part 31, and 40 CFR Part 33 for awards made prior to December 26, 2014, and 2 CFR 200, 2 CFR 1500, and 40 CFR Part 33 for awards made after December 26, 2014). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The public reporting and recordkeeping burden for this collection of information is estimated to be 1 hour per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates and any suggested methods for minimizing respondent burden to the Regulatory Support Division Director, U.S. Environmental Protection Agency (2821T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

1A. REPORTING PERIOD October 1, — September 30,				1B. REPORT TYPE ☐ Annual ☐ Final Report (Project completed)	
1C: Revision of a Prior Year Report? ☐ No ☐ Yes If yes, what reporting period is being revised and briefly describe the changes made. Note: The revised report will replace the associated original report in its entirety.					
2A. RECIPIENT UNIQUE ENTITY IDENTIFIER					
2B. RECIPIENT REPORTING CONTACT Name: Email: Phone:					
3. FEDERAL AWARD IDENTIFICATION NUMBER (FAIN) (For SRF state recipients, please include all numbers for all open assistance agreements being reported on this form.)					
4A. If NO procurements were made this reporting period (by the recipient, sub-recipient(s), loan recipient(s), and prime contractor(s)), CHECK and SKIP to Block No. 6. (Procurements are all expenditures through contract, order, purchase, lease or barter of supplies, equipment, construction, or services needed to complete Federal assistance programs.) ☐					
4B. Total Procurements & MBE/WBE Accomplishments This Reporting Period (in dollars)					
	Construction	Non-Construction	Total		
Total Procurement:	\$ _____	\$ _____	\$ _____		
MBE/WBE Combined Procurement:	\$ _____	\$ _____	\$ _____		
5A. Good Faith Efforts: If procurements were made, indicate whether your organization has followed the six Good Faith efforts found in 40 CFR Part 33, Subpart C, 40 CFR 33.501 and 2 CFR 200.321. ☐ Yes, my organization has implemented and documented each of the six Good Faith Efforts on the procurements made during this reporting period. ☐ No, my organization has not implemented and documented each of the six Good Faith Efforts on the procurements made during this reporting period.			5B. If procurements were made, but no MBE/WBE procurements are being reported, then check the applicable box(es) for the reason(s) why no MBE/WBE procurements were made. ☐ No MBE/WBE(s) applied ☐ No MBE/WBE(s) were qualified ☐ Other:		
6. NAME OF RECIPIENT'S AUTHORIZED REPRESENTATIVE			TITLE		
7. SIGNATURE OF RECIPIENT'S AUTHORIZED REPRESENTATIVE			DATE		

Instructions:

A. General Instructions:

MBE/WBE utilization is based on 40 CFR Part 33 and 2 CFR Parts 200 and 1500. The reporting requirement reflects the change in the reporting threshold described in Recipient/ Applicant Information Notice-2018-G04 issued by EPA's Office of Grants and Debarment on September 7, 2018 (<https://www.epa.gov/grants/rain-2018-g04>). EPA Form 5700-52A must be completed annually by recipients of financial assistance agreements where the combined total of funds budgeted for procuring supplies, equipment, construction and services exceeds the current Simplified Acquisition Threshold as set by the Federal Acquisition Regulation at 48 CFR Subpart 2.1. This reporting requirement applies to all new and existing awards and voids all previous reporting requirements.

In determining whether the threshold is exceeded for a particular assistance agreement, the analysis must focus on funds budgeted for procurement under the supplies, equipment, construction, services or "other" categories, and include funds budgeted for procurement under sub- awards or loans.

Reporting will also be required in cases where the details of the budgets of sub-awards/loans are not clear at the time of the grant awards and the combined total of the procurement and sub-awards and/or loans exceeds the Simplified Acquisition Threshold.

For example, if the Simplified Acquisition Threshold is \$250,000, then if a recipient has \$300,000 budgeted under procurement, then completion of this report is required.

When reporting is required, all procurement actions are reportable, not just the portion which exceeds the Simplified Acquisition Threshold.

If at the time of award the budgeted funds exceed the Simplified Acquisition Threshold but actual expenditures fall below, a report is still required.

If at the time of award, the combined total of funds budgeted for procurements in any category is less than or equal to the Simplified Acquisition Threshold and is

maintained below the threshold, no DBE report is required to be submitted.

Recipients are required to report 30 days after the end of each federal fiscal year (i.e. October 30th), per the terms and conditions of the financial assistance agreement.

Final reports are due October 30th or 120 days after the end of the project period, whichever comes first.

MBE/WBE program requirements, including reporting, are material terms and conditions of the financial assistance agreement. Failure to comply may lead to termination of the financial assistance agreement which is then reported to the OMB-designated integrity and performance system accessible through SAM (currently FAPIIS) pursuant to 2 CFR 200.339(b).

B. Submission:

Recipients must submit completed forms to the point of contact associated with the awarding office for the applicable assistance agreement.

Information on specific points of contact for EPA's Headquarters and ten Regional Offices is located at:

<https://www.epa.gov/grants/frequently-asked-questions-disadvantaged-business-enterprises>

Questions regarding the completion of this form should be directed to the DBE Coordinator associated with the awarding office for the applicable assistance agreement. A list of the DBE Coordinators for each awarding office can be located here:

<https://www.epa.gov/grants/epa-dbe-program-coordinators>

c. Instructions:

1A. Specify Federal fiscal year this report covers. The Federal fiscal year runs from October 1st through September 30th (**e.g. November 29, 2020 falls within Federal fiscal year 2021**)

1B. Specify report type. Check the annual reporting box if this is an annual report. If it is a final report, check the final report box to indicate if the project is completed.

1C. Indicate if this is a revision to a previous year and provide a brief description of the revision you are making including what reporting period is being revised. The revised report will replace the associated original report in its entirety.

2A. Provide your organization's Unique Entity Identifier. More information about Unique Entity Identifier, including its meaning, can be found in 2 CFR Part 25.

2B. Identify the name and contact information for the person located within the recipient organization that can be contacted if questions arise from this report.

3. Provide the Federal Award Identification Number (FAIN) assigned by EPA. A separate report must be submitted for each Assistance Agreement.

***For SRF recipients:** In box 3 list numbers for ALL OPEN Assistance Agreements being reported on this form.

4A. Self-explanatory. **Note:** Procurement means expenditures under the supplies, equipment, construction, services or "other" categories, and include funds expended for procurement under sub-awards or loans.

4B. Provide the total dollar amount (in dollars) of **ALL** procurements awarded this reporting period by construction, non-construction, and grand total by the recipient, sub-recipients, and SRF loan recipients, **including** MBE/WBE expenditures, not just the portion which exceeds the threshold. For example: Actual dollars for procurement from the procuring office; actual contracts let from the contracts office; actual goods, services, supplies, etc., from other sources including the central purchasing/ procurement centers).

Provide the total dollar amount (in dollars) of MBE/WBE procurements **ONLY** awarded this reporting period by construction, non-construction, and grand total by the recipient, sub-recipients, SRF loan recipients, and prime contractors not just the portion which exceeds the threshold.

***For SRF recipients only:** In 4B, please enter the total annual procurement amount under all of your SRF Assistance Agreements. The figure reported in this section is **not** directly tied to an individual Assistance Agreement identification number. **(SRF state recipients report state procurements in this section)**

5A. Self-explanatory.

5B. If procurements were made during this reporting period, but no procurements with MBE(s) or WBE(s) are being reported, then select the reason why. If "Other" is chosen, please fill in with the reason.

6. Self-explanatory.

7. Self-explanatory.

****This data is requested to comply with provisions mandated by: statute or regulations (40 CFR Part 33 and/or 2 CFR Parts 200 and 1500); OMB Circulars; or added by EPA to ensure sound and effective assistance management. Accurate, complete data are required to obtain funding, while no pledge of confidentiality is provided.**

Davis-Bacon Wage Rate Requirements

(required contract provision)

Background and Applicability

On October 30, 2009, P.L. 111-88, "Making appropriations for the Department of the Interior, environment, and related agencies for the fiscal year ending September 30, 2010, and for other purposes," was enacted. This law provides appropriations for both the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF) for Fiscal Year 2010, while adding new requirements to these already existing programs. One new requirement requires the application of Davis-Bacon Act requirements.

Application of the Davis-Bacon Act requirements extend not only to assistance agreements funded with Fiscal Year 2010 appropriations, but to all assistance agreements executed on or after October 30, 2009, whether the source of the funding is prior year's appropriations, state match, bond proceeds, interest earnings, principal repayments, or any other source of funding so long as the project is financed by an SRF assistance agreement. If a project began construction prior to October 30, 2009 but is financed or refinanced through an assistance agreement executed on or after October 30, 2009, Davis-Bacon Act requirements will apply to all construction that occurs on or after October 30, 2009, through completion of construction.

Ohio EPA Responsibilities

With respect to the Water Pollution Control Loan Fund (WPCLF) and Water Supply Revolving Loan Account (WSRLA) revolving funds, EPA provides capitalization grants to each State which in turn provides funding assistance to eligible recipients within the State. Typically, the assistance recipients are municipal or other local governmental entities that manage the funds. Occasionally, the assistance recipients may be a private for profit or not for profit entity. Although EPA and the State are responsible for ensuring assistance recipients incorporate the wage rate requirements set forth herein as part of contracts for WPCLF and WSRLA funding, the assistance recipient has the primary responsibility to maintain payroll records and for compliance with Davis-Bacon Act requirements as described below.

Municipal Or Other Local Governmental Entities Recipient's Responsibilities

The following is intended to help assistance recipients understand and meet their obligations related to Davis-Bacon (DB). Each assistance recipients should, however, review the contract/subcontract requirements that are set forth later in this document for a more full understanding of DB obligations.

Prior to advertising for bids:

- > Obtain the wage determination for the locality in which a covered activity subject to DB will take place from the Department of Labor (DOL) at www.wdol.gov.
- > Incorporate these wage determinations into the request for bids.
- > Include the required contract provisions (see below) into the contract documents.
- > Require prime contracts to include provisions that subcontractors follow the wage determination incorporated into the prime contract.

During the advertisement period:

- > Monitor www.wdol.gov on a weekly basis to ensure that the wage determination contained in the request for bids remains current.
- > If DOL modifies the DB wage determination more than 10 days prior to the bid opening, issue an addendum reflecting the modification.
- > If DOL modifies or supersedes the DB wage determination less than 10 days prior to bid opening and you cannot issue an addendum for the change, you must request a finding from Ohio EPA that there is not reasonable time to notify interested contractors of the modification of the wage determination. The Ohio EPA will give you a report of its findings.

After opening bids:

- > If the contract(s) aren't awarded within 90 days of the bid opening you must monitor www.wdol.gov on a weekly basis to ensure that wage determinations used in the bids remain current.
- > If the contract(s) aren't awarded within 90 days of the bid opening, any modifications or supersedes that DOL makes to the wage determination must be incorporated into the contract unless (1) you request an extension from Ohio EPA AND (2) Ohio EPA obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv).

After contracts are signed and during construction:

- > Review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.
- > DOL may issue a revised wage determination applicable to one or all of your contracts after the award of the contract or execution of the change order which incorporated DB requirements into the contract if DOL determines that you have failed to incorporate a wage determination or have used a wage determination that clearly does not apply to the contract. If this occurs, you shall either terminate the contract or change order and rebid the contract OR incorporate DOL's wage determination retroactive to the beginning of the contract by change order. The contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.
- > Periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. You must use Standard Form 1445 or equivalent documentation to memorialize the interviews.
- > Establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, you must:
 - conduct all interviews in confidence.
 - conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract.
 - conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB.
 - immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements.
- > Periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. You must:
 - establish and follow a spot check schedule based on your assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract.
 - spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract at a minimum.
 - conduct more frequent spot checks if the initial spot check or other information indicates that there

is a risk that the contractor or subcontractor is not complying with DB.

- during the examinations, verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

> Periodically review contractors' and subcontractors' use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the DOL or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews.

> Immediately report potential violations of the DB prevailing wage requirements to Andrew Lausted at EPA Region V at 312-886-0189 and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/esa/contacts/whd/america2.htm>.

If contracts have already been signed and DB requirements need to be incorporated:

> If contracts have already been signed prior to WPCLF/WSRLA funding being provided, you must issue a change order, task order, work assignment or similar legally binding instrument and incorporate the appropriate DOL wage determination from www.wdol.gov as well as the required contract provisions into the contract(s).

> Initiate the contractor and subcontractor review and wage interview requirements as described above and provided in the **Contract And Subcontract Provisions**.

**Private For Profit Or Not For Profit (Non-Governmental) Entities
Recipient's Responsibilities**

The requirements, responsibilities and contract provisions for Private For Profit or Not For Profit Entities (Non-Governmental Entities) is exactly the same as for Municipal Or Other Local Governmental Entities EXCEPT for the following:

Prior to advertising for bids:

> Obtain the proposed wage determinations for specific localities from www.wdol.gov.

> Submit the wage determination to Ohio EPA for approval prior to inserting the wage determination into the solicitation unless subsequently directed otherwise by Ohio EPA.

Contract And Subcontract Provisions For Contracts In Excess Of \$2,000

The following language must be included in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part with WPCLF or WSRLA funds and which is subject to the labor standards provisions of any of the acts listed in §5.1:

NOTE: Modify the first sentence to include the name of the WPCLF/WSRLA funding recipient prior to including these provisions in the contract documents.

Wage Rate Requirements

As used in these provisions "subrecipient" means _____ (fill in WPCLF/WSRLA funding recipient name here).

(a) The following applies to any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public

work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1.

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.wdol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The EPA award official shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department

of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the questions, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account asset for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the

plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the subgrant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees --

(i) *Apprentices.* Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) *Trainees.* Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe

benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

Contract Provision For Contracts In Excess Of \$100,000 And Subject To The Overtime Provisions Of The Contract Work Hours And Safety Standards Act

The following language must be included in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These provisions are to be included in addition to the provisions for contracts in excess of \$2,000. As used in these paragraphs, the terms laborers and mechanics include watchmen and guards.

(b) Contract Work Hours and Safety Standards Act. The following applies to any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. As used in these paragraphs, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

Contract Provision For Contracts In Excess Of \$100,000 Subject ONLY To The Contract Work Hours And Safety Standards Act

In addition to the provisions for contracts in excess of \$2,000, for any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, you must insert clauses requiring:

(c) The following applies to any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1.

The contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid.

The records shall be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Ohio EPA, EPA and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

BUILD AMERICA. BUY AMERICA (BABA) ACKNOWLEDGEMENT

The Contractor acknowledges to and for the benefit of the _____ (“Owner”) and the State of Ohio (State) that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as “Build America, Buy America;” that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States (“Build America, Buy America Requirements”) including iron and steel, manufactured products, and construction materials provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Owner or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Owner). If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

Signature

Date

Name and Title of Authorized Signatory, Please Print or Type

Bidder’s Firm



November 3, 2022

MEMORANDUM

SUBJECT: Build America, Buy America Act Implementation Procedures for EPA Office of Water Federal Financial Assistance Programs

FROM: Radhika Fox
Assistant Administrator

A handwritten signature in dark ink, appearing to be "R. Fox", is placed to the right of the "FROM:" line.

TO: EPA Regional Water Division Directors, Regions I – X
EPA Office of Water Office Directors

OVERVIEW

The Biden-Harris Administration recognized the Nation's critical need for infrastructure investment, championing the Bipartisan Infrastructure Law (BIL), which Congress passed on November 15, 2021 (also known as the Infrastructure Investment and Jobs Act (IIJA)). The BIL will provide an unprecedented level of federal investment in water and wastewater infrastructure in communities across America.

In Title IX of the IIJA, Congress passed the Build America, Buy America (BABA) Act, which establishes strong and permanent domestic sourcing requirements across all Federal financial assistance programs for infrastructure. The U.S. Environmental Protection Agency (EPA) Office of Water is honored to help lead the implementation of these provisions and is proud of its near decade of successful implementation of the American Iron and Steel (AIS) provisions for its flagship water infrastructure programs.

This is a transformational opportunity to build a resilient supply chain and manufacturing base for critical products here in the United States that will spur investment in good-paying American manufacturing jobs and businesses. EPA's efforts to implement BABA will help cultivate the domestic manufacturing base for a wide range of products commonly used across the water sector but not currently made domestically. This will take time, and flexibility will be important to ensure that EPA can leverage critical water investments on time and on budget to protect public health and improve water quality.

IMPLEMENTATION

Recognizing the opportunity and need for BABA implementation guidance, the Made in America Office (MIAO) of the Office of Management and Budget (OMB) published [Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure](#) (OMB Guidance M-22-11) on April 18, 2022. The guidance provides government-wide implementation direction for all Federal financial assistance programs for infrastructure. Despite the extensive guidance developed by MIAO, EPA's Office of Water infrastructure investment programs have received many questions that were not addressed in OMB Guidance M-22-11 or that require further clarification for EPA water infrastructure programs. The following questions and answers serve to supplement OMB Guidance M-22-11 with implementation procedures specific to EPA's relevant water infrastructure programs.

Section 70914(a) of the IIJA states when a Buy America preference under BABA applies: "Not later than... [May 14, 2022], the head of each Federal agency shall ensure that none of the funds made available for a Federal financial assistance program for infrastructure... may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States." Therefore, Federal financial infrastructure investments obligated on or after May 14, 2022, must comply with the BABA requirements. Absent a waiver, all iron, steel, manufactured products, and construction materials permanently incorporated into an infrastructure project subject to the BABA requirements must be produced in the United States. For many of EPA's Office of Water infrastructure investment programs, the vast majority of products permanently incorporated into construction, maintenance, or repair projects must comply with the BABA requirements, with the exception of select construction materials (cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives), which are specifically excepted by the BABA statute.

EPA's Office of Water implements many infrastructure investment programs subject to BABA requirements, including the following:

- Alaska Native Villages and Rural Communities Water Grant Program (ANV) (and any associated Interagency Agreements with the Indian Health Service)
- Clean Water and Drinking Water State Revolving Fund Programs (CW and DWSRF)
- Clean Water and Drinking Water Grants to U.S. Territories and the District of Columbia
- Clean Water Indian and Drinking Water Tribal Infrastructure Grant Set-aside (and any associated Interagency Agreements with the Indian Health Service)
- Coastal Wetlands Planning, Protection and Restoration Act, (CWPPRA) Programs
- Congressionally Directed Spending/Community Project Funding (also known as Community Grants)
- Geographic Programs¹
- Gulf Hypoxia Program
- National Estuaries Program (CWA Section 320)

¹ Geographic Programs include: Great Lakes Restoration Initiative, Chesapeake Bay, San Francisco Bay, Puget Sound, Long Island Sound, Gulf of Mexico, South Florida, Lake Champlain, Lake Pontchartrain, Southern New England Estuaries, Columbia River Basin, Pacific Northwest

- 319 Nonpoint Source Management Program Implementation
- Reducing Lead in Drinking Water Grant Program (SDWA §1459B)
- Assistance for Small and Disadvantaged Communities Grants: Small, Underserved, and Disadvantaged Community Grant Program (SUDC), Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) and Drinking Water Infrastructure Resilience & Sustainability (SDWA §1459A)
- Sewer Overflow and Stormwater Reuse Municipal Grants (OSG)
- USMCA Implementing Legislation (Section 821 and Title IX, USMCA Supplemental Appropriations, 2020)
- U.S.-Mexico Border Water Infrastructure Program
- Voluntary School and Child Care Program Lead Testing and Remediation Grant Program (SDWA 1464(d))
- Water Infrastructure Finance and Innovation Act (WIFIA)

The questions and answers in this document apply to the implementation of BABA requirements for the Office of Water infrastructure programs listed above unless superseded by regulation, statute, or other applicable guidance. For many of the programs listed above which did not have domestic preference requirements prior to BABA, additional implementation details are pending or may be developed after the issuance of these procedures. In addition, EPA notes that more direction will be helpful to inform the determination and definition of domestic content in manufactured goods. Supplemental guidance on these and other issues, from either OMB or EPA, may be forthcoming. These implementation procedures may also apply to additional, unlisted EPA programs which may be required to apply BABA subsequent to publication of this memorandum (e.g., future funding programs which have been authorized, but not yet appropriated).

For more information on the BABA requirements, visit the EPA Office of Water’s dedicated website – <https://www.epa.gov/cwsrf/build-america-buy-america-baba> – or contact your funding authority (such as your grants officer, portfolio manager, or state contact). For information on approved waivers, visit <https://www.epa.gov/cwsrf/build-america-buy-america-baba-approved-waivers>. You may also email questions to BABA-OW@epa.gov.

This Implementation Procedures document is organized to provide responses to questions in the following topic areas:

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QUESTIONS AND ANSWERS

SECTION 1: GENERAL

- Q1.1: Will EPA provide documentation for BABA for bid solicitations and suggested contract language? Will EPA provide suggested language for Assistance Agreements?
 - A1.1: See Appendix 1, which includes suggested language for construction contracts which addresses the BABA requirements. In addition to the language suggested in Appendix 1, EPA also recommends that assistance recipients prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: “By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the certifications are sufficient to demonstrate compliance with Build America, Buy America Act requirements.” In most cases, the assistance recipient’s representatives assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

All Federal Financial infrastructure assistance agreements subject to BABA must have a clause requiring compliance with the requirements. See Appendix 2 for example assistance agreement language.
- Q1.2: Would federally-financed infrastructure projects outside of the United States need to comply with the BABA requirements?
 - A1.2: No. According to the OMB Guidance (M-22-11), a “project” is defined as “...any activity related to the construction, alteration, maintenance, or repair of infrastructure in the United States.” Therefore, the BABA requirements are not implicated for infrastructure projects occurring outside of the United States, such as projects funded through the United States-Mexico-Canada Agreement with infrastructure activities occurring in Mexico or Canada (that is, outside the United States).
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- Q1.3: If most of the project is BABA compliant, and a small portion is not, can an assistance recipient self-fund (i.e., paying with non-federal dollars) the non-compliant products?
 - A1.3: Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. All iron, steel, manufactured products, and construction materials used in a project must meet the BABA requirements unless waived. Absent a waiver, there is no “small portion” or product that does not need to satisfy the BABA requirements unless the requirements are waived (or specifically excluded as is the case for cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products). An assistance recipient may request a waiver or inquire as to whether a broad waiver, such as a *de minimis* waiver, might apply.

- Q1.4: How do international trade agreements affect the implementation of the BABA requirements?
 - A1.4: The BABA requirements apply in a manner consistent with United States obligations under international trade agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to these trade agreements. In general, assistance recipients are not signatories to such agreements, so these trade agreements have no impact on BABA implementation. In the few instances where such an agreement applies to a municipality, that municipality is responsible for determining its applicability and requirements and communicating with the funding authority (such as EPA and/or a state) on the actions taken to comply with BABA.

SECTION 2: PRODUCT COVERAGE

- Q2.1: For products made of iron and steel, what is the difference between predominantly and primarily iron and steel?
 - A2.1: EPA considers the terms “predominantly” and “primarily” to be interchangeable, such that a product is considered predominantly (or primarily) iron and steel if it contains greater than 50 percent iron and steel by material cost.
- Q2.2: What is the definition of construction materials (with examples)?
 - A2.2: From OMB Guidance M-22-11: “construction materials” include an article, material, or supply (other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products) that is or consists primarily of:
 - non-ferrous metals,
 - plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables), (including optic glass),
 - lumber, and
 - drywall.

For example, a plate of glass would be a construction material under BABA, but a framed window that incorporates the glass into a frame would be a manufactured product. Another common construction material for water infrastructure projects would be polyvinyl chloride (PVC) pipe and fittings. However, if PVC components are incorporated into a more complex product such as instrumentation and control equipment or a water treatment unit, those items would be manufactured products.

- Q2.3: What are manufactured products (with examples)?
 - A2.3: From OMB Guidance M-22-11: “...all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of

the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation...”

The manufactured products category would cover the majority of potential water infrastructure products, including complex products made up of a variety of material types and components. For water infrastructure projects, common manufactured products would include, but not be limited to, pumps, motors, blowers, aerators, generators, instrumentation and control systems, gauges, meters, measurement equipment, treatment equipment, dewatering equipment, actuators, and many other mechanical and electrical items.

- Q2.4: Which category will valves fall under for BABA? Will it differ from the American Iron and Steel (AIS) requirements?
 - A2.4: For programs that are subject to BABA and AIS (SRF, WIFIA, and Community Project Funding), projects using valves should classify them as iron and steel products under BABA as long as their material cost is made up of more than 50 percent iron and/or steel. Valves with 50 percent or less iron and/or steel by material cost would be considered manufactured products under the BABA requirements.

In accordance with OMB Guidance M-22-11, an article, material, or supply should be classified into only one of the three categories: iron and steel, manufactured products, or construction materials. Under the AIS requirements, all valves made primarily of iron and steel (that is, those with iron and/or steel material cost greater than 50 percent) must comply with the AIS requirements. For BABA, EPA interprets Section IV of OMB Guidance M-22-11 to mean that iron and steel products are those items that are primarily iron and steel, the same as for the AIS requirements.

- Q2.5: Does EPA have a list of products to be classified as “Iron and Steel” under BABA?
 - A2.5: Although this list is not comprehensive, the following products were classified as AIS products if made primarily (more than 50 percent) of iron and/or steel by materials cost (for programs subject to both AIS and BABA, this list would be equivalent for “iron and steel” items or products under either requirement):

Products likely made “primarily” of iron and steel to be classified as <u>Iron and Steel</u> under BABA		
Lined and Unlined Pipe	Lined and Unlined Fittings	Tanks
Flanges	Pipe Clamps and Restraints	Structural Steel
Valves	Hydrants	Pre-Cast, Iron/Steel Reinforced Concrete (of all types, regardless of iron/steel content percentage)
Manhole Covers and other Municipal Castings	Access Hatches	Ballast Screens
Iron or Steel Benches	Bollards	Cast Bases
Cast Iron Hinged Hatches	Cast Iron Riser Rings	Catch Basin Inlets

Cleanout/Monument Boxes	Construction Covers and Frames	Curb and Corner Guards

Products likely made “primarily” of iron and steel to be classified as <u>Iron and Steel</u> under BABA		
Curb Boxes	Curb Openings	Curb Stops
Detectable Warning Plates	Downspout Shoes	Drainage Grates
Drainage Grate Frames and Curb Inlets	Inlets	Junction Boxes
Lampposts	Manhole Rings and Frames	Manhole Risers
Meter Boxes	Service Boxes	Steel Hinged Hatches
Steel Riser Rings	Trash Receptacles	Tree Grates
Tree Guards	Trench Grates	Valve Boxes
Valve Box Covers and Risers	Access Ramps	Aeration Pipes and Fittings (separate from aeration/blowers)
Angles	Backflow Preventers/Double Check Valves	Baffle Curtains
Iron or Steel Bar	Bathroom Stalls	Beam Clamps
Cable Hanging Systems	Clarifier Tanks	Coiled Steel
Column Piping	Concrete Reinforcing Bar, Wire, and Fibers	Condensate Sediment Traps
Corrugated Pipe	Couplings	Decking
Digester Covers	Dome Structures	Door Hardware
Doors	Ductwork	Expansion Joints
Expansion Tanks (diaphragm, surge, and hydropneumatics)	Fasteners	Fencing and Fence Tubing
Fire Escapes	Flanged Pipe	Flap Gates
Framing	Gate Valves	Generic Hanging Brackets
Grating	Ground Testing Boxes	Ground Test Wells
Guardrails	HVAC Registers, Diffusers, and Grilles	Joists
Knife Gates	Ladders	Lifting Hooks, J-bar, Connectors within, and Anchors for Concrete
Lockers	Man Baskets and Material Platforms	Manhole Steps
Mud Valves	Municipal Casting Junctions	Non-mechanical (aka stationary) Louvers and Dampers
Overhead Rolling Doors/ Uplifting Doors (manual open, no motor)	Pipe Connectors	Pipe Hangers
Pipe Pilings (any type of steel piling)	Pipe Spool (pipe, flanges, connectors, etc.)	Pipe Supports
Pitless Adaptors	Pre-fab Steel Buildings/Sheds (simple structure, unfurnished)	Pre-stressed Concrete Cylinder Pipe (PCCP)
Railings	Reduced Pressure Zone (RPZ) Valves	Roofing
Service Saddles	Sheet Piling	Sinks (not part of eyewash systems)
Solenoid Valves	Stairs	Static Mixers
Stationary Screens	Surface Drains	Tapping Sleeves
Telescoping Valves	Tipping Buckets	Trusses
Tubing	Valve Stem Extensions	Valve Stems (excluding handwheels and actuators)

Wall Panels	Wall Sleeves/Floor Sleeves	Welding Rods
Well Casing	Well Screens	Wire
Wire Cloth	Wire Rod	Wire Rope and Cables

Q2.6: Does EPA have a list of products that could be made “primarily” of iron and steel but would be classified as “manufactured products” under BABA?

A2.6: Although this list is not comprehensive, the following products would be considered “manufactured products” under the BABA requirements, even if the item might be composed primarily of iron and steel by materials cost (Note: These items are not subject to the AIS requirements.):

Products likely made “primarily” of iron and steel to be classified as <u>Manufactured Products</u> under BABA		
Actuator Superstructures/ Support Structures	Aeration Nozzles and Injectors	Aerators
Analytical Instrumentation	Analyzers (e.g., ozone, oxygen)	Automated Water Fill Stations
Blowers/Aeration Equipment	Boilers, Boiler Systems	Chemical Feed Systems (e.g., polymer, coagulant, treatment chemicals)
Chemical Injection Quills	Chemical Injectors	Clarifier Mechanisms/Arms
Compressors	Controls and Switches	Conveyors
Cranes	Desiccant Air Dryer Tanks	Dewatering Equipment
Dewatering Roll-offs	Disinfection Systems	Drives (e.g., variable frequency drives)
Electric/Pneumatic/Manual Accessories Used to Operate Valves (such as electric valve actuators)	Electrical Cabinetry and Housings (such as electrical boxes/enclosures)	Electrical Conduit
Electrical Junction Boxes	Electronic Door Locks	Elevator Systems (hydraulic, etc.,)
Emergency Life Systems (including eyewash stations, emergency safety showers, fire extinguishers, fire suppression systems including sprinklers /piping/valves, first aid, etc.)	Exhaust Fans	Fall Protection Anchor Points
Fiberglass Tank w/Appurtenances	Filters (and appurtenances, including underdrains, backwash systems)	Flocculators
Fluidized Bed Incinerators	Galvanized Anodes/Cathodic Protection	Gear Reducers
Generators	Geothermal Systems	Grinders
Heat Exchangers	HVAC (excluding ductwork)	HVAC Dampers (if appurtenances to aerators/blowers)
HVAC Louvers (mechanical)	Intake and Exhaust Grates (if appurtenances to aerators/blowers)	Instrumentation
Laboratory Equipment	Ladder Fall Prevention Systems	Ladder Safety Posts
Lighting Fixtures	Lightning and Grounding Rods	Mechanical or Actuated Louvers/Dampers
Membrane Bioreactor Systems	Membrane Filtration Systems	Metal Office Furniture (fixed)

Meters (including flow, wholesale, water, and service connection)	Motorized Doors (unit)	Motorized Mixers
Motorized Screens (such as traveling screens)	Motors	Pelton Wheels
Pipeline Flash Reactors (similar to injectors)	Plate Settlers	Precast Concrete without Iron/Steel Reinforcement

Products likely made “primarily” of iron and steel to be classified as <u>Manufactured Products</u> under BABA		
Furnished Pre-fab Buildings (such as furnished with pumps, mechanics inside)	Presses (including belt presses)	Pressure Gauges
Pump Cans/Barrels and Strainers	Pumps	Mechanical Rakes
Safety Climb Cable	Sampling Stations (unless also act as hydrant)	Scrubbers
Sensors	Sequencing Batch Reactors (SBR)	Steel Shelving (fixed)
Slide and Sluice Gates	Spray Header Units	Steel Cabinets (fixed interior/furniture)
Supervisory Control and Data Acquisition (SCADA) Systems	Tracer Wire	Valve Manual Gears, Actuators, Handles
Voltage Transformer	Water Electrostatic Precipitators (WESP)	Water Heaters
Weir Gates		

- Q2.7: Is asphalt paving a covered product under BABA?
 - A2.7: No. EPA interprets Section 70917(c) of the IIJA to exclude asphalt from BABA requirements. Asphalt paving is a type of concrete composed of an aggregate material mixed with a binder (bitumen). EPA considers asphalt concrete to be excluded by section 70917(c) due to its similarities with cement and cementitious materials.

SECTION 3: CO-FUNDING

- Q3.1: If projects are co-funded with funding mechanisms that don’t require BABA, must the entire project comply with BABA?
 - A3.1: Yes. Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. A “project” consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all the contracts and assistance agreements awarded are closely related in purpose, time, and place. This precludes the intentional splitting of projects into separate and smaller contracts or assistance agreements to avoid BABA’s applicability on some portions of a larger project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreements would carry separate requirements.

- Q3.2: How will project requirements be determined for co-funded projects subject to potentially different general applicability/programmatic waiver conditions (such as different adjustment period waivers)?
 - A3.2: OMB Guidance M-22-11 addresses cases with project co-funding from separate programs. EPA would apply the guidance’s “cognizant” program determination to projects that are co-funded with different general applicability/programmatic waivers. For instance, if a project were co-funded between WIFIA and SRF and the majority of the Federal funding for the project is from WIFIA, then WIFIA would be the “cognizant” program for application and determination of waivers. In that case, any conditions from an applicable WIFIA waiver would apply.

SECTION 4: WAIVERS

- Q4.1: Who may apply for a waiver and how do you apply?
 - A4.1: Assistance recipients and their authorized representatives may apply for a project-specific waiver. EPA does not accept waiver requests from suppliers, distributors, or manufacturers unless the assistance recipient endorses and submits the request on its own behalf to the funding authority. In the case where multiple programs are providing federal funds to the project, the assistance recipient should submit the waiver request to the cognizant program, the one providing the greatest amount of federal funds for the project. For information on applying for cost waivers, see questions 4.4 and 4.5. For information on the SRF program roles and responsibilities, see question 7.6.

Project-specific waiver requests should generally include: (1) a brief summary of the project, (2) a description and explanation of the need for the waiver for the product(s) in question, (3) a brief summary of the due diligence conducted in search of domestic alternatives (which could include correspondence between assistance recipient and supplier/distributors), (4) the quantity and materials of the product(s) in question, (5) all engineering specifications and project design considerations relevant to the product(s) in question, (6) the approximate unit cost of items (both foreign and domestic) in addition to an estimated cost of the materials and overall project, (7) the date any products will be needed on site in order to avoid significant project schedule disruptions, and (8) any other pertinent information relevant to EPA’s consideration of the waiver (e.g., if relevant for SRF projects: whether the project is designated as an equivalency project, the date the plans and specifications were submitted to the state, the date of construction initiation, expected date of project completion, any special considerations such as local zoning and building ordinances, seismic requirements, or noise or odor control requirements).

In the case of indirect federal assistance, such as the SRF programs, the state authority reviews and conveys the waiver request to EPA. States should submit waiver requests to the appropriate program waiver request inbox. For SRF projects, please use CWSRFWaiver@epa.gov or DWSRFWaiver@epa.gov.

- Q4.2: Can an assistance recipient request a waiver based on a specification written for a specific brand or model of product (that is, a specification that names a branded item or model)?
 - A4.2: In most cases, performance-based specifications are expected and required for the majority of infrastructure projects funded by EPA's financial assistance programs. In rare cases where "branded" or product-specific sourcing may be included in project specifications, it is suggested that the specifications include the item in question (that is, not simply a catalog page, but also materials of construction, sizing, quantities, and applicable engineering performance design characteristics for the project, etc.) in addition to the standard phrase "or equal." For the purposes of product alternative market research, EPA will evaluate the BABA requirements based on performance-based engineering specifications for the product(s) in question. If the project's specifications do not include performance-based specifications, or at least an "or equal" designation, EPA will base its research on an "or equal" designation using best professional judgment to the extent practicable.
- Q4.3: If a manufactured product is not readily available domestically, will EPA provide short-term "limited availability" product waivers?
 - A4.3: EPA will address the unavailability of domestic products through the waiver process, including potential national short-term waivers for specific products, if appropriate. To the extent practicable and with the intent to maximize domestic market and supply chain development, EPA intends to address issues of broad product unavailability with targeted, time-limited, and conditional waivers, as prescribed in OMB Guidance M-22-11. EPA will follow its robust and thorough product research processes (those put into place for the AIS requirements for the SRF and WIFIA programs and expanded for the new BABA requirements) to identify and determine those products for which proposed national/general applicability waivers may be appropriate.
- Q4.4: What information is needed when applying for a cost waiver under BABA?
 - A4.4: As part of the cost waiver request, the assistance recipient must demonstrate that implementation of the BABA requirements will increase the overall project cost more than 25 percent. Depending on the circumstances of the overall project cost increases, documentation to justify the cost waiver can vary but may include itemized cost estimates or bid tabulations comparing project costs with and without BABA implementation. Assistance recipients should begin assessing the potential cost impacts of the BABA requirements during the design phase of a project.
- Q4.5: Can administrative costs associated with tracking and verification of certifications be considered when determining if the cost of a project increases by 25 percent or more?
 - A4.5: Yes. Section 70914(b)(3) of the IIJA states that a waiver may be provided if the overall

cost of the project increases by more than 25 percent due to the “inclusion of iron, steel, manufactured products, or construction materials produced in the United States.” EPA interprets this to mean that the “inclusion” of the BABA-covered products could encompass reasonable administrative costs associated with complying with the BABA requirements, such as staff, contractor, and technological resources to collect and track BABA compliance documentation.

- Q4.6: How can assistance recipients and construction contractors address product delivery delays?
 - A4.6: Assistance recipients should reasonably plan for material procurement to account for known potential supply chain issues or extended lead times and shall notify the funding authority well in advance of the issues so that prompt attention can be given to explore options. Where extended lead times for compliant products are impacting project schedules and may significantly impact construction progress, timely communication with the funding agency is important. For products that are unavailable within a reasonable timeframe to meet the objectives and schedule of a project, EPA may consider a non-availability waiver with adequate justification. An assistance recipient would need to apply for the waiver and contact its funding authority (such as EPA and/or a state) to initiate the waiver process.

SECTION 5: DOCUMENTING COMPLIANCE

- Q5.1: Who will be responsible for BABA enforcement?
 - A5.1: Responsibility for BABA implementation applies at all levels, from manufacturers to suppliers and distributors, construction contractors, assistance recipients, and funding authorities.

The manufacturers have responsibility to provide adequate and accurate documentation of the products manufactured. If suppliers and distributors are involved, they are responsible for passing along compliance documentation for products supplied to projects that are subject to the BABA requirements.

The assistance recipient and their representatives are primarily responsible for ensuring the documentation collected for products used on the project is sufficient to document compliance with the BABA requirements.

The funding authority is responsible for providing oversight and guidance as needed to ensure the proper implementation of the requirements. The Uniform Grants Guidance (UGG) (Title 2 of the Code of Federal Regulations (CFR) Part 200) applies to many Federal financial assistance agreements that will include BABA requirements. The general provisions of 2 CFR Part 200 determine the responsible party for the grant funding authority.

For information on SRF program roles and responsibilities, see question 7.6. At all levels, where fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-888- 546-8740

or OIG_Hotline@epa.gov. More information can be found at this website:
<http://www.epa.gov/oig/hotline.htm>.

- Q5.2: When will the BABA requirements be assessed for compliance? Do assistance recipients need to have waivers for potential non-domestic products before assistance agreements are in place, at the time products are procured or products are incorporated into the project (i.e., used)?
 - A5.2: Compliance is assessed where the domestic product is used (or installed) at the project site. Proper compliance documentation, whether it is a BABA certification letter or a waiver, should accompany a product prior to its “use”, in accordance with Section 70914(a) of IIJA. This may occur prior to assistance agreements being in place but is not necessary. Additionally, communication of BABA requirements through appropriate Terms and Conditions in financial assistance agreements and in project solicitation and contract documents is key in ensuring all parties involved are informed of the requirements for the project before construction is underway.
- Q5.3: How can product compliance with the BABA requirements be demonstrated?
 - A5.3: Assistance recipients and their representatives should ensure that the products delivered to the construction site are accompanied by proper documentation that demonstrate compliance with the law and be made available to the funding authority upon request. The documentation may be received and maintained in hard copy, electronically, or could be embedded in construction management software. The use of a signed certification letter for the project is the most direct and effective form of compliance documentation for ensuring products used on site are BABA-compliant prior to their installation; however, other forms of documentation are also acceptable as long as collectively, the following can be demonstrated:
 - (1) Documentation linked to the project. For example, this can be in the form of the project name, project location, contract number, or project number.
 - (2) Documentation linked to the product used on the project. For example, description of product(s) (simple explanation sufficient to identify the product(s)), or an attached (or electronic link to) purchase order, invoice, or bill of lading.
 - (3) Documentation includes statement attesting that the products supplied to the assistance recipient are compliant with BABA requirement. Reference to the Infrastructure Investment and Jobs Act (“IIJA”) or the Bipartisan Infrastructure Law (BIL) are also acceptable. For iron and steel items under BABA, references to the American Iron and Steel (AIS) requirements are also acceptable and reciprocal with BABA for such items.
 - (4) Documentation that manufacturing occurred in the United States, which could include, for example, the location(s) of manufacturing for each manufacturing step that is being certified. It is acceptable for manufactured products to note a single point of manufacturing, documenting that the final point of manufacturing is in the United States. Note that each BABA category may require different determinations for

compliance.

- (5) Signature of company representative (on company letterhead and signature can be electronic). The signatory of the certifying statement affirms their knowledge of the manufacturing processes for the referenced product(s) and attests that the product meets the BABA requirements.

In addition to compliance documentation, assistance recipients or their representatives should also conduct a visual inspection of the product when it arrives to the project site, especially for iron and steel products which are often stamped with the country of origin. (Note: A country of origin stamp alone is not sufficient verification of compliance with BABA and assistance receipts should not rely on it to ensure compliance.)

EPA may develop alternative procedures for demonstrating compliance. Additional project- or program-specific instructions may be developed on a case-by-case basis in order to meet individual circumstances.

- Q5.4: Will EPA provide a form or template for tracking and documenting compliance?
- A5.4: EPA does not require a specified format for tracking or documenting compliance. Assistance recipients are free to develop any system (from simple to complex software) for tracking items used on the project and the accompanying compliance documentation, e.g., certification letters, applicable waivers, if it helps with implementation and compliance. Elements that may help with keeping track of compliance may include: product description, quantity required/used, product category (i.e., iron and steel, manufactured product, or construction material), status of obtaining certification letter, product cost, and whether the item might qualify as *de minimis*, or qualify under another applicable waiver.
- Q5.5: If a manufacturer claims to comply with the Buy American Act, does it also comply with BABA?
 - A5.5: No. With the exception of the AIS requirements – which EPA interprets to be equivalent to the “iron and steel” requirements under BABA – EPA does not have an interpretation about the comparability of other domestic preference requirements relative to BABA. Any products that are to be certified as compliant with BABA should include a specific reference to the BABA requirements and appropriate attestation from a responsible manufacturing company official. See Question 5.3 for EPA’s recommendations for BABA certification letters.
- Q5.6: How will assistance recipients manage certification letters for hundreds, possibly thousands of products?

A5.6: EPA recognizes that the new BABA requirements will cover most products used in typical water and wastewater infrastructure projects, and that the number of items which may require certification at large and/or complex projects may reach several hundred. EPA is concerned about the potential administrative burden that this would place on assistance recipients. EPA recommends that projects with a high number of potentially covered

products meet with their funding authority about potential compliance strategies to minimize burden and streamline compliance activity. Assistance recipients should prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: “By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the documentation is sufficient to demonstrate compliance with Build America, Buy America Act requirements.” In most cases, the assistance recipient’s representatives may assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

- Q5.7: Who is responsible for documenting the 55 percent content requirement for manufactured products under BABA? What if the final manufacturer cannot trace or verify domestic origin for all components?
 - A5.7: The manufacturer who signs a certification letter is responsible for documenting compliance with any of the three categories of products (iron and steel, manufactured products, or construction materials). For manufactured products, BABA requires that greater than 55 percent of the total cost of all components of the manufactured product be from domestic sources. EPA recommends that the certification letter for manufactured products document whether the item passes the content test in the final product along with a statement attesting to compliance with the BABA requirements for manufactured products.
- Q5.8: How do final product fabricators document compliance when the final step of manufacturing may be simply assembling components?
 - A5.8: It is acceptable, in many cases, especially for highly complex manufactured products that utilize many sub-components, for the final point of assembly to certify without using a “step certification” process. Multiple certifications (i.e., step certifications) or a singular certification can be used for a product, as long as the certifying official is willing to attest to the product’s compliance with BABA requirements at all stages of manufacturing.
- Q5.9: Will Material Test Reports be acceptable in lieu of a BABA certification for iron and steel?
 - A5.9: Material Test Reports (MTRs, commonly referred to as “Mill Certifications” or “Mill Certs”) provide the chemical composition of steel and iron from a mill or foundry. If an MTR accompanies the delivery of steel or iron to a project site with an invoice or bill of lading, EPA will consider it sufficient to demonstrate compliance (equivalent to a certification letter) as long as the MTR includes a manufacturer representative’s signature in addition to the location (city and state) of the mill/foundry. It is common for MTRs to be the first letter in a “step certification” if the product is further fabricated or painted, etc., by another manufacturer.
- Q5.10: Can a manufacturer use a fillable certification letter for products?

- A5.10: EPA recommends that certifications be signed by representatives of the manufacturing entity. EPA does not oppose manufacturers using forms to internally develop letters within their company, thereby providing signed, non-manipulable certification letters to suppliers, distributors, and/or assistance recipients. A fillable form that can be changed by someone outside of the manufacturer after signature does not demonstrate compliance and may create compliance concerns for the manufacturer or assistance recipient.
- Q5.11: Are product certifications from suppliers and distributors allowed?
 - A5.11: EPA recommends that representatives of product manufacturers certify compliance and discourages suppliers and distributors from creating certification letters. EPA does not rule out the possibility that a third-party certification process, such as a certification by a distributor, may be viable. However, EPA is currently not aware of a system or proposed system that meets the EPA's recommendations for documentation of product certification.
- Q5.12: How long should assistance recipients keep compliance documentation?
 - A5.12: Assistance recipients should apply recordkeeping requirements for the project according to the procedures dictated by the funding authority. For most EPA grant programs, this is prescribed in the UGG at 2 CFR 200.334-200.338; e.g., the SRF programs require a minimum of three years. Other funding programs may require longer documentation retention periods.

SECTION 6: PROGRAMS WITH AMERICAN IRON AND STEEL REQUIREMENTS

- Q6.1: Does BABA supersede the American Iron and Steel (AIS) Requirements?
 - A6.1: The BABA requirements for items considered "iron and steel" are equivalent to those for covered iron and steel products under the AIS requirements in the Clean Water Act and the Safe Drinking Water Act. These requirements apply to the CWSRF, DWSRF, WIFIA, and Water infrastructure Community Grants. BABA includes a "Savings Provision" (Section 70917(b)) that states that BABA does not affect existing domestic content procurement preferences for infrastructure projects funded by Federal financial assistance programs that meet the requirements of section 70914. EPA views the AIS requirements as meeting the "iron and steel" product requirements of BABA Section 70914, as they both include the key requirement that items made of iron and steel be wholly manufactured in the United States from the point of melting and/or pouring the iron or steel components through final manufacturing step. Because of the "Savings Provision" of Section 70917, the AIS requirements satisfy the "iron and steel" requirements of BABA. For the programs that have AIS requirements, EPA intends to implement BABA requirements the same way for iron and steel items as it has done for AIS products.

- Q6.2: For iron and steel products, does a manufacturer need to demonstrate compliance from initial melting through the finished product?
 - A6.2: For iron and steel products, the BABA requirements are the same as the existing AIS requirements, in that all of the iron and steel in a covered product (that is, the product is comprised of more than 50 percent iron and steel by material cost) must be melted and poured in the United States and all subsequent manufacturing processes (such as grinding, rolling, bending, reheating, and casting) must occur in the United States.

Q6.3: Will EPA apply the same manufacturing standards for BABA iron and steel products as for the American Iron and Steel (AIS) requirements?

- A6.3: Yes. For AIS, EPA did not require raw materials used in the production of steel or iron to be domestically sourced. For BABA, EPA interprets the requirements to be the same. Hence, like AIS, raw materials in the production of iron and steel subject to BABA requirements would not need to be domestically sourced. The key step for both AIS and BABA domestic iron and/or steel production is the melting/pouring (that is, the location of the furnace), which must be in the United States.
- Q6.4: Will the certification process be similar to the process established for the American Iron and Steel requirements?
 - A6.4: EPA expects the certification process for the BABA requirements to be very similar to that established for the AIS requirements. For iron and steel products, the process should remain the same for AIS and BABA. EPA recommends for manufactured products and for construction materials that certification letters include direct reference to the product/material content requirements under BABA, in addition to an affirmative statement verifying that the product meets the BABA requirements.
- Q6.5: Will duplicate certification letters be required for AIS and BABA for iron/steel products?
 - A6.5: No. Compliance with BABA requirements will be sufficient to demonstrate compliance with AIS requirements for iron and steel products. If a project is subject to BABA, the only demonstration of compliance necessary is with the BABA requirements, of which the iron and steel requirements are equivalent to those of the AIS statutory requirements: the iron or steel in a product made primarily or predominantly of iron and steel (comprising more than 50 percent iron and steel by material cost) must be melted and/or poured in the United States and all subsequent manufacturing processes must occur in the United States.

SECTION 7: PROGRAM-SPECIFIC ISSUES

- Q7.1.: How do the BABA requirements apply to Community Grants?
 - A7.1: The Community Project Funding/Congressionally Directed Spending grants for the construction of drinking water, wastewater, and stormwater infrastructure and for water

quality protection are subject to the requirements specified in the explanatory statement accompanying the Consolidated Appropriations Act (Explanatory Statement for Division G of P.L. 117-13, the Consolidated Appropriations Act of 2022). The explanatory statement asserts: “Applicable Federal requirements that would apply to a Clean Water State Revolving Fund or Drinking Water State Revolving Fund project grant recipient shall apply to a grantee receiving a CPF grant under this section.” Therefore, the federally funded Community Project Funding/Congressionally Directed Spending grants are subject to the same requirements that apply to CWSRF or DWSRF projects, including BABA and AIS requirements. See also A1.2.

- Q7.2: Should SRF projects covered by the BABA SRF Projects Design Planning Adjustment Period Waiver follow the same procedures for demonstrating compliance as outlined for American Iron and Steel requirements?
 - A7.2: Yes. The SRF Design Planning Adjustment Period waiver does not waive the iron and steel requirements under BABA. The SRF programs have existing domestic preference requirements for SRF projects under CWA Section 608 and SDWA Section 1452(a)(4) (AIS requirements) to use iron and steel products that are produced in the United States. Sections 70917(a) and (b) of BIL explain the application of BABA to existing domestic preference requirements. Specifically, the savings provision in Section 70917(b) states that existing domestic preference requirements that meet BABA requirements are not affected by BABA. The statutory AIS requirements were existing at the time BABA became law and satisfy the BABA iron and steel requirements. Therefore, the statutory AIS requirements that have previously applied to SRF-funded projects will continue to do so, and compliance with AIS requirements will satisfy the BABA iron and steel requirements. Demonstration of compliance for iron and steel products will follow the AIS implementation policies for projects subject to the waiver.
- Q7.3: For SRF programs, is BABA considered a federal cross-cutting authority? (i.e., do “equivalency” rules apply?)
 - A7.3: Yes, BABA is considered a federal cross-cutting requirement that applies to SRF assistance equivalent to the federal capitalization grant (i.e., “equivalency” projects). EPA’s SRF regulations at 40 CFR 35.3145 and 35.3575 require states and recipients of SRF funds equivalent to the amount of the federal capitalization grant to comply with federal cross-cutting requirements. Section 70914 of the IIJA, which states when a Buy America preference applies, explains that “none of the funds made available for a Federal financial assistance program for infrastructure...may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States.” Therefore, BABA only applies to projects funded in an amount equivalent to the federal capitalization grant and not to those projects receiving funds in excess of the capitalization grant (i.e., “non-equivalency” projects). (Note: The AIS requirements continue to apply for all SRF projects, including non-equivalency projects, and all WIFIA and Community Grant projects, because equivalency does not apply.)

- Q7.4: Do the BABA requirements apply to Drinking Water State Revolving Fund set-asides?
 - A7.4: Due to requirements related to the deposit of funds in the DWSRF program, almost all of the funds used to conduct set-aside activities are Federal dollars. Therefore, Federal cross-cutting requirements must be applied to all set-aside activities. However, in the case of most set-aside activities, the cross-cutting requirements will not be implicated because of the nature of the activities conducted under the set-asides. Because the BABA requirements only apply to infrastructure, and infrastructure typically is not an eligible set-aside expenditure (with one potential exception being loans for incentive-based source water protection measures under the Local Assistance and Other State Programs Set-Aside), the BABA requirements will not apply to most set-aside activities.
- Q7.5: What if an SRF project is refinanced using Federal financial assistance on or after May 14, 2022?
 - A7.5: If an SRF project began construction, financed from another funding source, prior to May 14, 2022, but is refinanced through an assistance agreement executed on or after that date, BABA requirements will apply to all construction that occurs on or after May 14, 2022, through completion of construction, unless a waiver applies. There is no retroactive application of the BABA requirements where a refinancing occurs for an SRF project that has completed construction prior to May 14, 2022. (Note: If SRF funding is used for the refinancing, the AIS requirements may still apply depending on the timing of construction.)
- Q7.6: What are the roles and responsibilities for SRF programs for BABA implementation?
 - A7.6: Implementation of the BABA requirements for the State Revolving Fund programs will continue the roles and responsibilities from the successful AIS implementation process.

As with AIS, it is both the assistance recipient's and the state's responsibility to ensure compliance with the BABA requirements. The state is the recipient of a federal capitalization grant and must comply with all grant conditions, including a condition requiring adherence to BABA requirements.

Consequently, states are strongly advised to conduct site visits of projects during construction and review documentation demonstrating the assistance recipient's proof of compliance. In EPA's experience, most states conduct periodic site visits and arrange timely meetings with funded projects. Observed best practices typically include a meeting early in the process (sometimes before bid and usually prior to commencing construction) and at least one project site visit during the construction process. Assistance recipients must maintain documentation of compliance with the BABA requirements, as explained in question 5.3. The documents must be kept by the assistance recipient and should be reviewed by the state during project reviews.

The state's role in the waiver process is to review any waiver requests submitted to the state to ensure that all necessary information has been provided by the assistance recipient prior to forwarding the request to EPA. If a state finds the request lacking, the state should work with

the assistance recipient to help obtain complete information. Question 4.1 explains the information needed by EPA to expediently review a waiver request.

In order to implement the BABA requirements, EPA has developed an approach for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow states, on behalf of the assistance recipients, to apply for waivers of the BABA requirements directly to EPA Headquarters. Only waiver requests received and/or endorsed from states will be considered. Pursuant to BABA, EPA has the responsibility to make findings as to the issuance of waivers to the BABA requirements.

Step-by-step SRF Waiver Process

The waiver process begins with the assistance recipient. To fulfill the BABA requirements, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American-made iron and steel, manufactured goods, and construction materials. It is essential that the assistance recipient include the BABA terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 2 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three statutory conditions is demonstrated to EPA and approved.

To apply for a project-specific waiver, the assistance recipient should email the request in the form of a Word document (.doc) or editable PDF (.pdf) to the funding program. It is strongly recommended that each state identify a person or persons for BABA communications. The state designee(s) will review the application for the waiver and determine whether the necessary information has been included (Note: More information may be provided in the future regarding what information is required to be included in waiver requests). Once the waiver application is complete, the designee (State) will forward the application to the EPA for review.

Evaluation by EPA

After receiving an application for waiver of the BABA requirements and ensuring sufficient information was provided, EPA will publish the request on its website for 15 days and receive public comment. EPA will then determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the state designee whether a waiver request has been approved or not approved as soon as such a decision has been made. Granting such a waiver is a four-step process:

1. Research – After receiving an application for a waiver, EPA will perform market research to determine whether the iron, steel, manufactured goods, or construction materials are available domestically.
2. Posting – After research, if no domestic product has been identified, EPA is required to

publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at:
<https://www.epa.gov/cwsrf/build-america-buy-america-baba-waivers-open-public-comment>.

3. Evaluation – After receiving an application for waiver of the BABA requirements, EPA will determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver to determine whether or not to grant the waiver.

4. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program and post the signed waiver on the Agency's website. The assistance recipient should keep a copy of the signed waiver in its project files.

(Note: Additional steps may be required in the future regarding the waiver process depending on additional guidance from OBM) APPENDIX 1

AMERICAN IRON AND STEEL ACKNOWLEDGEMENT

The Contractor acknowledges to and for the benefit of the City of _____ (“Purchaser”) and the State of Ohio (the “State”) that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as “American Iron and Steel;” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Signature

Date

Name and Title of Authorized Signatory, Please Print or Type

Bidder’s Firm

- ☐ Check here if the WPCLF or WSRLA applicant will be requesting an individual waiver for non-American made iron and steel products. Please note that the waiver box does not need to be marked for nationwide waivers.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 20 2014

OFFICE OF WATER

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: f (Andrew D. Sawyers, Director C.
y) Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the “Administrator”) finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

1) What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

8) What if a project has split funding from a non-SRF source?

Many States intend to fund projects with “split” funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A “project” consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which

case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

9) What about refinancing?

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12)

Covered Iron and Steel Products

11) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

- Lined or unlined pipes or fittings;
- Manhole Covers;
- Municipal Castings (defined in more detail below);
- Hydrants;
- Tanks;
- Flanges;
- Pipe clamps and restraints;
- Valves;
- Structural steel (defined in more detail below);
- Reinforced precast concrete; and
- Construction materials (defined in more detail below).

12) What does the term ‘primarily iron or steel’ mean?

‘Primarily iron or steel’ places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

13) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

15) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

16) What does ‘produced in the United States’ mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components

do not have to be of domestic origin.

17) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

19) What is the definition of ‘municipal castings’?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

- Access Hatches;
- Ballast Screen;
- Benches (Iron or Steel);
- Bollards;
- Cast Bases;
- Cast Iron Hinged Hatches, Square and Rectangular;
- Cast Iron Riser Rings;
- Catch Basin Inlet;
- Cleanout/Monument Boxes;
- Construction Covers and Frames;
- Curb and Corner Guards;
- Curb Openings;
- Detectable Warning Plates;
- Downspout Shoes (Boot, Inlet);
- Drainage Grates, Frames and Curb Inlets;
- Inlets;
- Junction Boxes;
- Lampposts;
- Manhole Covers, Rings and Frames, Risers;

Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

20) What is ‘structural steel’?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

21) What is a ‘construction material’ for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

22) What is not considered a ‘construction material’ for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters,

heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

25) How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

26) How should a State ensure assistance recipients are complying with the AIS requirement?

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: <http://www.epa.gov/oig/hotline.htm>.

28) How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to the EPA for review.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to

determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA’s website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: http://water.epa.gov/grants_funding/aisrequirement.cfm
2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.
3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachments

Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
General • Waiver request includes the following information: — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor		
Cost Waiver Requests • Waiver request includes the following information: — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		
Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

Appendix 2: HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests • Does the waiver request include the following information? — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market • Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?				
Availability Waiver Requests • Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? — Supplier information or other documentation indicating availability/delivery date for materials — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials • Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers? • Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information) • Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: — Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State — Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States — Correspondence with construction trade associations indicating the non-availability of the materials • Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?				

Appendix 5: Sample Certifications

The following information is provided as a sample letter of **step** certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

**American Iron & Steel (AIS) Requirement of the Consolidated Appropriations Act of 2014
(Public Law 113-76)**

Q&A Part 2

PRODUCT QUESTIONS

1. Q: Do all fasteners qualify for de minimis exemption?

A: No. There is no broad exemption for fasteners from the American Iron and Steel (AIS) requirements. Significant fasteners used in SRF projects are not subject to the de minimis waiver for projects and must comply with the AIS requirements. Significant fasteners include fasteners produced to industry standards (e.g., ASTM standards) and/or project specifications, special ordered or those of high value. When bulk purchase of unknown-origin fasteners that are of incidental use and small value are used on a project, they may fall under the national de minimis waiver for projects. The list of potential items could be varied, such as big-box/hardware-store-variety screws, nails, and staples. The key characteristics of the items that may qualify for the de minimis waiver would be items that are incidental to the project purpose (such as drywall screws) and not significant in value or purpose (such as common nails or brads).

EPA also clarifies that minor components of two listed products – valves and hydrants -- may not need to meet the AIS requirements if the minor components compromise a very small quantity of minor, low-cost fasteners that are of unknown origin.

2. Q: Does PCCP pipe have to be domestically produced?

A: Yes. Pre-stressed concrete cylinder pipe (PCCP) or other similar concrete cylinder pipes would be comparable to pre-cast concrete which is specifically listed in the Consolidated Appropriations Act of 2014 as a product subject to the AIS requirement.

3. Q: If the iron or steel is made from recycled metals will the vendor/supplier have to provide a certification document certifying that the recycled metals are domestically produced?

A: No. Recycled source materials used in the production of iron and steel products do not have to come from the U.S. Iron or steel scrap, for instance, are considered raw materials that may come from anywhere. While certification is not required for the raw material, EPA does recommend that additional final processing of iron and steel be certified to have occurred in the U.S.

4. Q: Do tanks used for filtration systems, if delivered to the construction site separately and then filled with filtration media onsite, have to be domestically produced?

A: No. Tanks that are specifically designed to be filters, or as parts of a filtration system, do not have to be domestically produced because these parts are no longer simply tanks, even if the filter media has not been installed and will be installed at the project site, as is customary to do for shipping purposes. These parts have only one purpose which is to be housing for filters and cannot be used in another fashion.

5. Q: Can a recipient use non-domestic flanged pipe?

A: No. While the Consolidated Appropriations Act of 2014 does not specifically mention flanged pipe, since it does mention both pipe and flanges, both products would need to be domestically produced. Therefore, flanged pipe would also need to be domestically produced.

6. Q: Can a recipient use non-domestic couplings, expansion joints, and other similar pipe connectors?

A: No. These products would be considered specialty fittings, due to their additional functionality, but still categorized under the larger “fitting” categorization. Fittings are defined as a material that joins pipes together or connects to a pipe (AWWA, The Drinking Water Dictionary, 2000). Therefore, these products must comply with the AIS requirements and be produced domestically.

7. Q: Can a recipient use non-domestic service saddles and tapping sleeves?

A: No. These products are necessary for pipe repair, to tap a water main, or to install a service or house connection. Therefore, they are included under the larger “pipe restraint” category which is a specifically identified product subject to the domestic preference in the Consolidated Appropriations Act of 2014.

8. Q: The AIS guidance does not appear to cover reused items (i.e., existing pipe fittings, used storage tanks, reusing existing valves). How should reused items be addressed?

A: The AIS guidance does not address reuse of items. Reuse of items that would otherwise be covered by AIS is acceptable provided that the item(s) was originally purchased prior to January 17, 2014, the reused item(s) is not substantially altered from original form/function, and any restoration work that may be required does not include the replacement or addition of foreign iron or steel replacement parts. EPA recommends keeping a log of these reused items by including them on the assistance recipient’s de minimis list, and stating therein that these items are reused products. The donation of new items (such as a manufacturer waiving cost for certain delivered items because of concerns regarding the origin of a new product) is not, however, considered reuse.

9. Q: What does “time needed” mean in the AIS guidance, in reference to the definition of “Reasonably Available Quantity”?

A: For considering whether a product would meet reasonably available quantity, “time needed” is based on the construction schedule. If the item is delayed and there is substantial impact on the overall construction schedule, this would not be according to the “time needed.”

10. Q: If a product is not specifically included on the list of AIS covered products, must it comply with AIS?

A: Possibly. The AIS requirements include a list of specifically covered products, one of which is construction materials, a broad category of potential products. For construction materials, EPA’s AIS guidance includes a set of example items that it considers construction materials composed primarily of iron and steel and covered by the Act. This example list in the guidance is not an all-inclusive list of potential construction materials. However, the guidance also includes a list of items that EPA specifically does not consider construction materials, generally those of electrical or complex-mechanical nature. If a product is similar to the ones in the non-construction material list (and it is also not specifically listed by the Act), it is not a construction material. For all other items specifically included in the Act, coverage is generally self-evident.

11. Q: If a listed iron and steel product is used as a part for an assembled product that is non-domestic, do the AIS requirements apply?

A: AIS requirements only apply to the final product as delivered to the work site and incorporated into the project. Other assemblies, such as a pumping assembly or a reverse osmosis package plant, are distinct products not listed and do not need to be made in the U.S. or composed of all U.S. parts. Therefore, for the case of a non-covered product used in a larger non-domestic assembly, the components, even if specifically listed in the Consolidated Appropriations Act, do not have to be domestically produced.

12. Q: Is cast iron excluded from the AIS requirements?

A: No. Cast iron products that fall under the definition of iron and steel products must comply with the AIS requirements.

13. Q: The guidance states that “construction materials” do not include mechanical equipment, but then identifies ductwork as a construction material. Please clarify.

A: Ductwork is not mechanical equipment, therefore it is considered a “construction material” and must comply with the AIS requirements.

14. Q: Do “meters” mentioned in EPA’s guidance as non-construction materials include both flow meters and water meters?

A: Yes. “Meters” includes any type of meter, including: flow meters, wholesale meters, and water meters/service connections.

15. Q: Must coiled steel be domestic?

A: Yes. Coiled steel is an intermediate product used in the production of steel pipe and must come from a U.S. source or subject to a waiver in order to comply with the AIS requirements.

16. Q: Are pig iron, direct reduced iron (DRI), and ingot considered raw materials?

A: No. These are considered intermediate products used in the production of iron or steel and must come from a U.S. source or subject to a waiver in order to comply with the AIS requirements.

17. Q: Can assistance recipients rely on a marking that reads, “Made in the USA,” as evidence that all processes took place in the U.S.?

A: No. This designation is not consistent with our requirements that all manufacturing processes of iron and steel products must take place in the U.S.

18. Q: When determining what constitutes a product made “primarily” of iron or steel, who makes this determination?

A: The manufacturer will show if its product qualifies as primarily made of iron or steel. The recipient should expect the manufacturer to provide documentation/ certification that its product is AIS compliant.

19. Q: Do aerators need to be produced domestically in order to comply with AIS?

A: No. Aerators, similar to pumps, are mechanical equipment that do not need to meet the AIS requirements. “Blowers/aeration equipment, compressors” are listed in EPA’s guidance as non-construction materials.

20. Q: Are Sluice and Slide Gates considered valves?

A: No. Valves are products that are generally encased / enclosed with a body, bonnet, and stem. Examples include enclosed butterfly, ball, globe, piston, check, wedge, and gate valves. Furthermore, “gates” (meaning sluice, slide or weir gates) are listed in EPA’s guidance as non-construction materials.

AIS PROCESS QUESTIONS

21. Q: Will notices of waiver applications be published in the federal register?

A: No. Applications for waivers will be published on EPA’s website (http://water.epa.gov/grants_funding/aisrequirement.cfm). EPA will provide 15 days for open public comment, as noted on the website.

22. Q: Will states be collecting the step certification paper trail, as presented in the AIS guidance?

A. No. Assistance recipients must maintain documentation of compliance with AIS. EPA recommends use of the step certification process. This process is a best practice and traces all manufacturing of iron and steel products to the U.S. If the process is used, the state does not have to collect the documentation. The documents must be kept by the assistance recipient and reviewed by the state during project reviews.

23. Q: Why is it considered a best practice for states to conduct site visits, when it is the assistance recipient's responsibility to meet the AIS requirements?

A: It is both the assistance recipient's and the state's responsibility to ensure compliance with the AIS requirements. The state is the recipient of a federal grant and must comply with all grant conditions, including a condition requiring that the AIS requirements be adhered to. Therefore, it is recommended that states conduct site visits of projects during construction and review documentation demonstrating the assistance recipient's proof of compliance.

24. Q: Please further define the state's role in the waiver process.

A: The state's role in the waiver process is to review any waiver requests submitted to the state in order to ensure that all necessary information has been provided by the assistance recipient prior to forwarding the request to EPA. If a state finds the request lacking, the state should work with the assistance recipient to help obtain complete information.

25. Q: How much time does EPA have to evaluate the waiver during the evaluation step?

A: At a minimum, EPA is required to provide 15 days for open public comment. There is no specific deadline or time limit for EPA to review waiver requests. Each waiver request will come with its own specific details and circumstances and may require a different amount of time for review and analysis. For example, public interest waivers in general may take longer to review than availability waivers which are typically more straightforward. However, EPA understands that construction may be delayed while waiting for a waiver and will make every effort to review and issue decisions on waiver requests in a timely manner.

PROJECT QUESTIONS

26. Q: What if a project is funded by another funding entity (i.e., United States Department of Agriculture – Rural Development) where AIS is not required and begins construction after January 17, 2014 but then applies to the SRF to refinance the project? Are they ineligible?

A: The project is not ineligible. AIS requirements will apply to any construction that occurs after the assistance agreement is signed, through the end of construction. If construction is complete, there is no retroactive application of the AIS requirements.

27. Q: If the assistance recipient can demonstrate through market research that the AIS requirement will exceed the 25 percent cost threshold, is the entire project exempt from the AIS requirement?

A: If the waiver application shows that the inclusion of American iron and steel products causes the entire cost of the project to increase by more the 25 percent, a waiver may be granted for the entirety of the project.

28. Q: Can the recipient use non-SRF funds to pay for the non-compliant item.

A: No. It is not an acceptable to use non-SRF funds to pay for a non-compliant item. The Consolidated Appropriations Act of 2014 requires that all iron and steel products, no matter the source of funding, must be made in the U.S. if SRF funds are used in the project.

29. Q: What constitutes “satisfactory quality” as defined in the AIS guidance, in reference to the availability waiver process.

A: “Satisfactory quality” means the product meets the project design specifications. A waiver may be granted if a recipient determines that the project plans and design would be compromised because there are no American made products available that meet the project design specifications.

30. Q: The guidance states that the AIS requirement applies to any project “funded in whole or in part” by an SRF. Where is this in the Act?

A: The Act states that, “None of the funds made available by a ... [State SRF program] ... shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.” This sentence clearly states that no SRF program may use its funds for a project unless all of the iron and steel products used in the project are made in the U.S. This is true even if only \$1 of SRF funding is used in the project.

31. Q: There is always an expectation on the part of an assistance recipient that the construction phase of a planning and/or design only loan will be funded through the SRF. If the original planning and/or design only loan was executed prior to a January 17, 2014, does this mean the entire project will be exempt from the AIS requirement?

A: If the original loan includes construction, and was executed prior to January 17, 2014, then the AIS provision does not apply to the project. If the original loan was only for planning and/or design, then a written commitment or documented “expectation” is needed to show exemption from the

requirements. Appearance on a priority list in an Intended Use Plan along with written reasonable assurance from the state that the recipient will receive SRF funding for project construction could provide sufficient evidence of “expectation of funding”.

- 32. Q: What if there has been a change order or redesign requiring new plans and specifications to be approved and they were approved after January 17, 2014: does the project now have to comply with AIS?**

A: In most cases, no. Change orders are typically small enough changes that the original plan and specification date will still hold true. For example, if a pipe alignment has to be changed for a block or two due to unforeseen conditions, but new plans and specifications had to be submitted for this section of the project, then that could be considered a minor change. However, if there has been a major redesign, perhaps the whole project had to be redesigned starting from scratch, then the new plans and specification approval date would apply.

- 33. Q: What if the bids on a project with plans and specifications approved before January 17, 2014 but the loan is signed after January 17, 2014 come in low, and there is significant funding remaining in the loan agreement, so the community designs a second project with the remaining funds: does that project have to comply with the AIS requirements?**

A: If the second project is closely related in purpose, place and time to the first project, then the second project would be exempt from the AIS requirements. It is the assistance recipient’s responsibility (with state oversight) to show that a project is closely related, or not, in purpose, place and time.

- 34. Q: What if the assistance agreement was signed after January 17, 2014, state approval of plans for the first phase of the project was in place prior to January 17, 2014, but state approval of the plans for the second phase of the project was received after January 17, 2014?**

A: In such a case, the AIS provision would not apply to the first phase of the project. If the second phase of the project is considered the same project as the first phase, due to its close relation in purpose, place and time, the entire project may be exempt. It is the assistance recipient’s responsibility (with state oversight) to show that phases of a project is closely related, or not, in purpose, place and time.

- 35. Q: Do products purchased through procurement-only contracts have to be comply with AIS?**

A: Yes. For projects funded by SRF, the products procured under any form of contract must comply with AIS. A procurement-only contract generally involves the bulk purchase of common items (such as pipe, concrete, and/or pumps) of independent timing from a set of planned projects. If products which are purchased through a procurement-only contract are being installed under another contract, the procurement-only contract would probably not be considered a separate project in purpose, place and time; and therefore, would have to comply with the AIS requirements.

March 2015

American Iron & Steel Requirement for the Clean Water and Drinking Water State Revolving Funds

Q&A Part 3

*For CWSRF and DWSRF: On **January 17, 2014**, Public Law 113-76, the "Consolidated Appropriations Act, 2014," was enacted and included an American Iron and Steel requirement for the Clean Water and Drinking Water State Revolving Fund programs through the end of fiscal year 2014. Since then, the AIS requirement has continued for both programs, but through different statutes, with a few changes as described in the questions and answers provided below.*

*For CWSRF: On **June 10, 2014**, the Water Resources Reform and Development Act amended the Clean Water Act to include permanent requirements for the use of AIS products in CWSRF assistance agreements. Section 608 of the CWA now contains requirements for AIS that repeat those of the Consolidated Appropriations Act, 2014. All CWSRF assistance agreements must comply with Section 608 of the CWA for implementation of the permanent AIS requirement.*

*For DWSRF: On **December 16, 2014**, the President signed Public Law 113-235, the "Consolidated and Further Continuing Appropriations Act, 2015," which provides fiscal year 2015 full-year appropriations through September 30, 2015. This law continues the requirement for the use of AIS products in DWSRF assistance agreements through September 30, 2015.*

CWSRF PROGRAM

- 1. Q: The Water Resources Reform and Development Act amended the Clean Water Act to include permanent requirements for the use of AIS for CWSRF funded assistance agreements. Does the CWA include an exemption for plans and specifications approved prior to the enactment of the legislation similar to the exemption included in the Consolidated Appropriations Act (CAA) 2014?**

A: Yes. The WRRDA amendment to the CWA, which included AIS requirements, included a similar exemption as the CAA 2014. For any CWSRF assistance agreement signed on or after October 1, 2014, if the plans and specifications were approved prior to June 10, 2014 (the enactment of WRRDA), then the project is exempt from AIS requirements. For assistance agreements signed prior to October 1, 2014, the previous dates in the CAA 2014 apply (see March 20, 2014, AIS guidance document).

If a project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the plans and specifications approval date for purposes of this exemption in Section 608 (f).

The following table summarizes AIS exemptions based on the plans and specifications approval date for CWSRF funded projects.

CWSRF AIS Project Exemption Based on Plans and Specifications Approval Date		
<u>Assistance Agreement Signed:</u>	<u>Exempt from AIS if Plans and Specifications Were Approved Before:</u>	<u>Basis for Exemption:</u>
1/17/2014 through 9/30/2014	4/15/2014	- Consolidated Appropriations Act 2014 - National waiver signed 4/15/2014*
On or after 10/1/2014	6/10/2014	Clean Water Act Section 608

** To be covered by the national waiver, the plans and specifications had to be submitted to the state prior to 1/17/2014*

2. Q: Does the AIS requirement apply to refinanced CWSRF projects?

A: Yes, in some cases. If a project began construction, financed from a non-CWSRF source prior to June 10, 2014, but is refinanced through a CWSRF assistance agreement executed on or after October 1, 2014, AIS requirements will apply to all construction that occurs on or after June 10, 2014, through completion of construction, unless engineering plans and specifications were approved by the responsible state agency prior to June 10, 2014. For CWSRF projects funded on or after October 1, 2014, there is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to June 10, 2014.

DWSRF PROGRAM

3. Q: The Consolidated and Further Continuing Appropriations Act 2015 continues the AIS requirements for DWSRF funded assistance agreements. Does the Act include an exemption for plans and specifications approved prior to the enactment of the legislation, similar to the exemption included in the Consolidated Appropriations Act (CAA) 2014?

A: Yes. The Consolidated and Further Continuing Appropriations Act 2015 includes a similar exemption as the CAA 2014. For any assistance agreement signed on or after December 16, 2014 (the enactment of the Act), if the plans and specifications were approved prior to December 16, 2014, then the project is exempt from the AIS requirements. For assistance agreements signed prior to December 16, 2014, the previous dates in the CAA 2014 apply (see March 20, 2014 AIS guidance document).

If a project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the plans and specifications approval date for purposes of the exemption in Section 424(f).

4. Q: Do DWSRF assistance agreements signed during the time period between September 30, 2014, and December 16, 2014, still have to comply with the AIS requirements?

A: Yes. The Continuing Appropriations Resolution 2015 was signed on September 19, 2014, which extended funding for the DWSRF with the same conditions that were made applicable by the language in the Fiscal Year 2014 appropriations, including the requirement for the use of American Iron and Steel products in projects receiving financial assistance from the DWSRF. Therefore, all assistance agreements starting October 1, 2014, through the enactment of the Consolidated and Further Continuing Appropriations Act 2015 (signed December 16, 2014), must include the AIS requirements. However, if the plans and specifications for any of these projects were approved prior to April 15, 2014 (the date the national waiver was signed), then the project is exempt from the AIS requirements.

The following table summarizes AIS exemptions based on the plans and specifications approval date for DWSRF funded projects.

DWSRF AIS Project Exemption Based on Plans and Specifications Approval Date		
<u>Assistance Agreement Signed:</u>	<u>Exempt from AIS if Plans and Specifications Were Approved Before:</u>	<u>Basis for Exemption:</u>
1/17/2014 through 9/30/2014	4/15/2014	• Consolidated Appropriations Act 2014 • National waiver signed 4/15/2014*
10/1/2014 through 12/15/2014	4/15/2014	• Continuing Appropriations Resolution 2015 (continued CAA 2014 requirements)** • National waiver signed 4/15/2014*
12/16/2014 through 9/30/2015	12/16/2014	• Consolidated and Further Continuing Appropriations Act 2015

** To be covered by the national waiver, the plans and specifications had to be submitted to the state prior to 1/17/2014*

*** Following the first continuing resolution, there were two additional CRs to fill the gap between 12/11/2014 and 12/16/2014*

5. Q: Does the AIS requirement apply to refinanced DWSRF projects?

A: Yes, in some cases. If a project began construction, financed from a non-DWSRF source prior to December 16, 2014, but is refinanced through a DWSRF assistance agreement executed on or after December 16, 2014, AIS requirements will apply to all construction that occurs on or after December 16, 2014, through completion of construction, unless engineering plans and

specifications were approved by the responsible state agency prior to December 16, 2014. For DWSRF projects funded on or after December 16, 2014, there is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to December 16, 2014.

BOTH CWSRF AND DWSRF PROGRAMS

6. **Q: If a coating is applied to the external surface of a domestic iron or steel component, and the application takes place outside of the United States, would the product be compliant under the AIS requirements?**

A: Yes. The product would still be considered a compliant product under AIS requirements. Any coating processes that are applied to the external surface of iron and steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the coating processes occur, provided that final assembly of the product occurs in the United States.

The exemption above only applies to coatings on the *external surface* of iron and steel components. It does not apply to coatings or linings on internal surfaces of iron and steel products, such as the lining of lined pipes. All manufacturing processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

OFFICE OF WAIRM

DECISION MEMORANDUM

SUBJECT: De Minimis Waiver of Section 436 of P.L. 113-76, Consolidated Appropriations Act (CAA), 2014

FROM: Nancy K. Stoner
Acting Assistant Administrator

The EPA is hereby granting a nationwide waiver pursuant to the "American Iron and Steel (AIS)" requirements of P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), section 436 under the authority of Section 436(b)(1) (public interest waiver) for de minimis incidental components of eligible water infrastructure projects. This action permits the use of products when they occur in de minimis incidental components of such projects funded by the Act that may otherwise be prohibited under section 436(a). Funds used for such de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel" (AIS) requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use specific domestic iron and steel products that are produced in the United States if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Fiscal Year 2014, unless the agency determines it necessary to waive this requirement based on findings set forth in Section 436(b). The Act states, "[the requirements] shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency...finds that- (1) applying subsection (a) would be inconsistent with the public interest" 436(b)(1).

In implementing section 436 of the Act, the EPA must ensure that the section's requirements are applied consistent with congressional intent in adopting this section and in the broader context of the purposes, objectives, and other provisions applicable to projects funded under the SRF. Water infrastructure projects typically contain a relatively small number of high-cost components incorporated into the project. In bid solicitations for a project, these high-cost components are generally described in detail via project specific technical specifications. For these major components, utility owners and their contractors are generally familiar with the conditions of availability, the potential alternatives for each detailed specification, the approximate cost, and the country of manufacture of the available components.

Every water infrastructure project also involves the use of thousands of miscellaneous, generally low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. For many of these incidental components, the country of manufacture and the availability of alternatives is not always readily or reasonably identifiable prior to procurement in the normal course of business; for other incidental components, the country of manufacture may be known but the miscellaneous character in conjunction with the low cost, individually and (in total) as typically procured in bulk, mark them as properly incidental. Examples of incidental components could include small washers, screws, fasteners (i.e., nuts and bolts), miscellaneous wire, corner bead, ancillary tube, etc. Examples of items that are clearly not incidental include significant process fittings (i.e., tees, elbows, flanges, and brackets), distribution system fittings and valves, force main valves, pipes for sewer collection and/or water distribution, treatment and storage tanks, large structural support structures, etc.

The EPA undertook multiple inquiries to identify the approximate scope of de minimis incidental components within water infrastructure projects during the implementation of the American Reinvestment and Recovery Act (ARRA) and its requirements (Buy American provisions, specifically). The inquiries and research conducted in 2009 applies suitably for the case today. In 2009, the EPA consulted informally with many major associations representing equipment manufacturers and suppliers, construction contractors, consulting engineers, and water and wastewater utilities, and performed targeted interviews with several well-established water infrastructure contractors and firms who work in a variety of project sizes, and regional and demographic settings to ask the following questions:

- What percentage of total project costs were consumables or incidental costs?
- What percentage of materials costs were consumables or incidental costs?
- Did these percentages vary by type of project (drinking water vs. wastewater treatment plant vs. pipe)?

The responses were consistent across the variety of settings and project types, and indicated that the percentage of total costs for drinking water or wastewater infrastructure projects represented by these incidental components is generally not in excess of 5 percent of the total cost of the materials used in and incorporated into a project. In drafting this waiver, the EPA has considered the de minimis proportion of project costs generally represented by each individual type of these incidental components within the many types of such components comprising those percentages, the fact that these types of incidental components are obtained by contractors in many different ways from many different sources, and the disproportionate cost and delay that would be imposed on projects if the EPA did not issue this waiver.

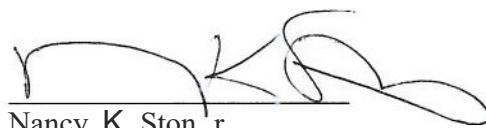
Assistance recipients who wish to use this waiver should in consultation with their contractors determine the items to be covered by this waiver and must retain relevant documentation (i.e., invoices) as to those items in their project files.

If you have any questions concerning the contents of this memorandum, please contact Timothy Connor, Chemical Engineer, Municipal Support Division, at connor.timothy@epa.gov or (202) 566-1059 or Kirsten Anderer, Environmental Engineer, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

April 5, 2014

Issued on: _____

Approved by: _____

A handwritten signature in black ink, appearing to read 'Nancy K. Stoner', written over a horizontal line.

Nancy K. Stoner
Acting Assistant Administrator

Ohio Water Pollution Control Loan Fund
Use of American Iron and Steel - De Minimis Final Utilization and Certification Form

The Consolidated Appropriations Act of 2014 (P.L. 113-76) Section 436 requires the use of American & Steel in SRF-funded projects. Under the authority of Section 436(b)(1), the EPA has issued a public interest waiver for De Minimis incidental components. The assistance recipient wishing to use this waiver should consult with their contractor(s) to maintain an itemized list of components covered under De Minimis. At the conclusion of the project, this form must be completed and retained in the assistance recipient's project files and a copy provided to DEFA. Please print clearly or type.

Project Name: _____ Loan Agrmt #: _____

NOTE: The De Minimis waiver is only applicable to the cost of materials for the entire project. Do not include other project costs (labor, installation costs, etc.) in the "Total Cost of Materials". The cost of a material must include delivery to the site and any applicable tax. Must have sufficient documentation to support all costs included in this calculation.

Funds used for de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

Total Cost of Materials: 5% Limit: 1% limit:

Manufacturer & Component Description	Part/Model #	Quantity (if applicable)	Cost per Unit (if applicable)	Component's Total Cost	How is Cost Documented?*

Use additional sheets as necessary

Total De Minimis Cost of Components:

If approaching the 5% or 1% limits, contact DEFA immediately

* Documentation must demonstrate confirmation of the components' actual costs (invoice, etc.).

Completed by:

Name: _____

Title: _____

Signature: _____

Date: _____

Violating Facilities Clause
(Required Contract Provision)

Language prohibiting this use of equipment or services from anyone on the EPA List of Violating Facilities must be included in the contract documents.

Violating Facilities:

The Contractor agrees to comply with all applicable standards, orders or requirements under Section 306 of the Clean Air Act, 42 USC 1857 (h), Section 508 of the Clean Water Act, 33 USC 1368, Executive Order 11738, and EPA regulations, 40 CFR Part 32, which prohibits the use under non-exempt Federal contracts, grants, or loans of facilities included on the EPA List of Violating Facilities.

NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.

Requirement For Utilization Of Small Businesses In Rural Areas (SBRA)

(Required Contract Provision)

The following policy should be added to the “Instructions to Bidders” section and referenced in the Table of Contents for the contract documents:

This procurement is subject to the EPA policy of encouraging the participation of small businesses in rural areas. It is EPA policy that recipients of EPA financial assistance awards utilize the services of small businesses in rural areas (SBRAs), to the maximum extent practicable. The objective is to assure that such small business entities are afforded the maximum practicable opportunity to participate as subcontractors, suppliers and otherwise in EPA-awarded financial assistance programs. This policy applies to all contracts and subcontracts for supplies, construction, and services under EPA grants or cooperative agreements. Small purchases are also subject to this policy.

If possible, also add the following language to the “Advertisement for Bids”:

This procurement is subject to the EPA policy of encouraging the participation of small business in rural areas (SBRAs).

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Insurance Provisions
(Required Contract Provision)

Section 3.5 of the WPCLF/WSRLA Loan Agreement contains specific requirements regarding insurance for all contractors and all subcontractors for the life of the contract. These insurance requirements must be reflected in the contract documents. Adjust the following language as needed to meet the specifics of the construction project and local requirements while still meeting the provisions of the Loan Agreement.

The Contractor shall, at his expense, furnish and maintain insurance in the form and amounts specified in subparagraphs 1 through 7 inclusive, of this section. Policies shall be with acceptable insurance companies authorized to do business in the State of Ohio.

The Contractor shall not commence Work nor shall he permit any of his Sub-contractors to commence Work until the insurance policies specified hereinafter, or otherwise required, have been submitted to, and approved by the Owner. Such insurance policies shall be kept in force until the Contractor receives final payment.

Insurance shall be endorsed so that it cannot be changed or canceled in less than ten (10) days after receipt by the Contractor and the Owner of written notice of such proposed action from the Insurer.

The insurance specified in Subparagraphs 1, 2, 3 and 4 shall be written under the comprehensive general form of liability insurance contracts.

The Contractor shall furnish three (3) certificates or, whenever specifically requested by the Owner, three (3) certified copies of the insurance policies themselves and a receipt evidencing full payment of the premiums.

In addition to the insurance described hereinafter, the Contractor shall secure and maintain such other insurance as may be designated elsewhere in the Contract document.

If the Contractor is required to repair or perform Work after the completion of the Work involved under this Contract or obtain new policies in accordance with the requirements in this section.

1. *Builders Risk*: In addition to such fire and other physical damage insurance as the Contractor elects to carry for his own protection, he shall also secure and maintain in the name of the Owner, the government agency sponsoring the Project, Subcontractors, the Consulting Engineer and any other parties having an interest in the Project, as named insured as their interest may appear; a builders' risk policy for fire, extended coverage, vandalism and malicious mischief in the amount of one hundred (100) percent of the value of the complete parts of the Project and Materials in storage, except that such coverage shall not be required in connection with sewer, water main or paving construction. Pump or lift station construction shall not be considered sewer or water main construction for purposes of this paragraph.

2. *Workers Compensation*: The Contractor shall provide Workers Compensation Insurance for all employees engaged in Work who may come within the protection of the workers compensation law, and, where applicable, employer's General Liability Insurances for employees not so protected and shall require all Subcontractors to provide corresponding insurance.

The Contractor shall indemnify the Owner and the Consulting Engineer against any and all liabilities, cost and expenses due to accidents or other occurrences covered by the workers compensation law.

3. *Contractor's Motor Vehicle Bodily Injury and Property Damage Liability Insurance*: Insurance to cover liability arising from the use and operation of motor vehicles in connection with the performance of the Contract (as customarily defined in liability insurance policies), whether they be owned, hired or non-owned by the Contractor, as follows:

- a. Bodily Injury Liability: \$500,000 for each person; limit of \$1,000,000 for each occurrence.
- b. Property Damage Liability: \$500,000 for each occurrence.

4. *Contractor's Public Liability and Property Damage Liability Insurance*: Contractor's Public Liability Insurance providing a limit of not less than \$500,000 for all damages arising out of bodily injuries, including accidental death to one person, and a total limit of \$1,000,000 for all damages arising out of bodily injuries, including accidental death, to two or more persons in any one occurrence. Contractor's Property Damage Liability Insurance providing for a limit on not less than \$500,000 for all damages to or destruction of property.

Coverage under this policy shall include, to the limits indicated above, the collapse or damage to any structure, building or its contents, public or private utility, or pavement during construction and for two (2) years thereafter.

Whenever Work under the Contract is to be done in the vicinity of existing underground utilities or structures, coverage under the policy shall also include, to the limits indicated, all damages to said underground utilities or structures during construction and for a period of two (2) years thereafter. Whenever Work under the Contract is to be done by blasting, coverage under the policy shall also include, to the limits indicated above, all damages of any kind whatsoever caused by blasting.

5. *Contractor's Protective Public Liability and Property Damage Liability Insurance*: Contractor's Protective Public Liability and Property Damage Liability Insurance for operations performed by Subcontractors providing for coverage and limits corresponding to those described in subparagraph 4.

6. *Owner's Protective Public Liability and Property Damage Liability Insurance*: Regular Owner's Protective Public Liability and Property Damage Liability Insurance for operations performed by the Contractor or any Sub-contractor providing for coverage and limits corresponding to those described in subparagraph 4.

This policy shall be written in the name of the Owner as a separate policy from those specified elsewhere herein.

7. *Railroad Protective Liability Insurance*: In any of the Work under this Contract is on railroad R/W, the Contractor shall at its sole cost and expense, procure and provide, for and in behalf of each railroad company. Protective Liability Insurance (AARAASHO form) with minimum limits per occurrence of not less than \$2,000,000 for bodily injury, death and/or property damage, subject to an aggregate limit of \$6,000,000 per annum. The policy shall name each railroad company as the insured and be issued to the Contractor. Each railroad company shall be provided with a copy of each policy of insurance prior to commencement of any work.

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Materials Testing
(Required Contract Provision)

In addition to the details included with specific equipment testing in the specifications, include an overall statement regarding testing for the project. Adjust the following language as needed to meet the specifics of the construction project

Testing Services

1. Contractor shall appoint, employ, and pay for specified services of an independent firm to perform testing.
2. The independent firm will perform tests and other services specified in individual specification sections and as required by the Architect/Engineer.
3. Testing and source quality control may occur on or off the project site. Perform offsite testing as required by the Architect/Engineer or the Owner.
4. Reports will be submitted by the independent firm to the Architect/Engineer and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
5. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - a. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.
 - b. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
6. Testing does not relieve Contractor to perform Work to contract requirements.
7. Re-testing required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.

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Continuous Treatment Provisions

(Required Contract Provision)

It is important that construction activities not result in any temporary violations of NPDES permit requirements (for permitted facilities) and construction activities should interrupt wastewater service to the individual resident as little as possible. For drinking water projects, it is important that construction activities not result in any disruption of service. Any disruption of service must be immediately reported to the Ohio EPA, Drinking Water Section of the appropriate district office.

The following example language is a sample of what might be appropriate for construction work occurring at an existing wastewater treatment plant. The language actually incorporated into the contract documents must be adjusted to meet the specifics of the construction project.

Continuous Treatment (wastewater projects)

Federal regulations prohibit by-passing of any sewage during construction operations. The Contractor will be responsible for providing any required temporary pumping facilities piping, etc., necessary to complete the project without any plant by-passing and continuous treatment must be provided at the same level during construction as existed prior to construction.

Unless otherwise previously or subsequently specified, the Contractor shall procure and pay for all permits, licenses, and approvals necessary for the execution of his Contract.

The Contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to the performance of the work required to complete their Contract.

The following example language is a sample of what might be appropriate for construction work occurring at an existing drinking water treatment plant. The language actually incorporated into the contract documents must be adjusted to meet the specifics of the construction project.

Continuous Treatment (drinking water projects)

The Contractor will be responsible for obtaining approval from Ohio EPA for use of temporary pumping facilities, piping and other items in order to complete the project without any plant by-passing. Continuous treatment must be provided at the same level during construction as existed prior to construction.

Unless otherwise previously or subsequently specified, the Contractor shall procure and pay for all permits, licenses, and approvals necessary for the execution of his Contract.

The Contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to the performance of the work required to complete their Contract.

NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.

CONTRACT CHANGE ORDER

RECIPIENT _____ CHANGE ORDER NBR _____
 LOAN NUMBER _____ CONTRACT _____
 OWDA PROJECT No. _____ DATE _____
 Description of Change: _____

The time provided for completion in the contract for the above items is (increased/decreased) by ____ calendar days.

RECOMMENDED BY: _____ DATE: _____
 (Engineer)

APPROVED BY: _____ DATE: _____
 (Recipient)

ACCEPTED BY: _____ DATE: _____
 (Contractor)

 (Company)

Original Contract Amt		OWDA APPROVAL The above proposal is hereby accepted and I recommend that it be approved and made a part of the contract noted above. The approval does not constitute an increase in the total loan amount, but represents approval for the work.
Previous Changes (+ / --)		
This Change (+ / --)		
Adjusted Contract Amt		
Ohio EPA Acceptance		Chief Engineer
Date		Date

CHANGE ORDER INSTRUCTIONS:

All Change Orders for this work, regardless of costs and whether Water Pollution Control Loan Fund (WPCLF) or Water Supply Revolving Loan Account (WSRLA) funding will be used to finance the changes, must be submitted to Ohio EPA for review.

Changes Requiring Prior Approval

Any change which substantially modifies the Project Facilities as specified in the Ohio EPA approved Facilities Plan and Final Permit to Install or Final Plan Approval (when applicable) or alters the direct or indirect impact of the Project Facilities upon the environment must be incorporated into a Change Order. One copy of the Change Order prior to execution is to be submitted to Ohio EPA for review and prior approval of the acceptability of the change. "Prior to execution" means before the Change Order is signed by the Owner.

Ohio EPA will review the Change Order and inform the Owner of the technical, environmental and operational acceptability of the change, and give the Owner permission to proceed with the proposed work.

All Other Changes

Change Orders not requiring prior approval as described above must be submitted to Ohio EPA within one (1) month of the time at which they are approved by the Owner. All change orders must be submitted electronically to dedicated change order email addresses for WPCLF and WSRLA projects.

Change Order Approval Process

After the Change Order is executed, one (1) copy of the Change Order, including the supporting documentation, is to be sent electronically to Ohio EPA for final review.

The dedicated e-mail address for the electronic submittal of WPCLF Change Orders is EPAWPCLFCO@epa.ohio.gov.

The dedicated e-mail address for the electronic submittal of WSRLA Change Orders is EPAWSRLACO@epa.ohio.gov.

After the Change Order is accepted and eligible costs determined, Ohio EPA will issue a letter informing the Owner and authorizing OWDA to disburse funds from Project Contingency for the work. The OEPA letter will be sent electronically along with a PDF of the WPCLF/WSRLA Change Order form which will be signed by all parties including Ohio EPA and OWDA.

Payments for Change Order Work

The Owner is precluded from submitting to the OWDA payment requests for Eligible Project Costs associated with the Change Orders until such time as the Ohio EPA's approval of the Change Orders has been obtained.

Local Protest Procedure

(suggested contract provision)

Some statement as to when a valid protest must be filed, in what form it must be filed and who it must be filed with should be included. ORC 153.12 has some default procedures for handling WPCLF and disputes. If the owner wants more control than provided in ORC, a procedure needs to be spelled out in the Contract Documents.

The following example language is a sample of language that could be included. Review all local procedures and requirements and adjust the language to meet the specifics of the project.

Protests

A protest based upon an alleged violation of the procurement requirement may be filed against the OWNER's procurement action by a party with an adversely affected direct financial interest. The protest shall be filed with the Mayor. The OWNER shall determine the protest. The OWNER may request additional information or a hearing in order to resolve the protest.

A protest shall be filed as early as possible during the procurement process, but must be received by the OWNER no later than one week after the basis of the protest is known or should have been known, whichever is earlier. If the protest is mailed, the protester bears the risk of nondelivery with in the required time period.

A protest must clearly present the procurement requirement being protested, the facts which support the protest, and any other information necessary to support the protest.

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Basis And Method For Award

(suggested contract
provision)

The contract documents should include some language that clearly states what the Owner will consider when determining the successful bidder and to provide a clear basis for the Owner when they have a need to reject the low bidder and go with a different bidder.

The following example language is a sample of language that could be included. Review all local procedures and requirements and adjust the language to meet the specifics of the project.

Basis for Award

1. Owner reserves the right to reject any and all Bids, to waive any and all informalities and to negotiate contract terms with the successful Bidder, and the right to disregard all nonconforming, nonresponsive or conditional bids. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.
2. In evaluating Bids, Owners shall consider the qualifications of the Bidder, whether or not the Bids comply with the prescribed requirements and alternates and unit prices if requested in the Bid forms. The Owner intends to accept alternates (if any are accepted) in the order in which they are listed in the Bid Form but Owner may accept them in any order or combination.
3. Owner may consider the qualifications and experience of Subcontractors and other persons and organizations (including those who are to furnish the principle items of material or equipment) proposed for those portions of the work as to which the identity of Subcontractors and other persons and organizations must submitted as provided in the Supplementary Conditions. Operating costs, maintenance considerations, performance data and guarantees of materials and equipment may also be considered by Owner.
4. Owner may conduct investigations he deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of the Bidders, proposed Subcontractors, and other persons and organizations to do the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.
5. Owner reserves the right to reject the Bid of any Bidder who does not pass investigation of evaluation to Owner's satisfaction. Owner may reject any Proposal where the unit price or individual lump sum prices are unbalanced and/or unfavorable to the Owner's interest.
6. Owner will not make any award or permit any award at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549 "Debarment and Suspension." Each Contractor and supplier (over \$25,000) shall complete the Certification Regarding Debarment, Suspension, and Other Responsibility Matters.
7. If Contract is awarded, it will be awarded to the lowest responsive responsible Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interest of the Project.
8. If the contract is awarded, Owner will give the Successful Bidder a Notice of Award within the time stated in the Advertisement after the day of the Bid opening.

9. When owner gives a Notice of Award to the Successful Bidder, it will be accompanied by at least three unsigned counterparts of the Agreement and three copies of all other Contract Documents. Within ten days thereafter, Contractor shall sign and deliver at least three counterparts of the Agreement to Owner with three copies of all other Contract Documents attached. Within fifteen days thereafter, Owner will deliver one copy of all fully signed counterparts to Contractor.

NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.

Payment Methods

(suggested contract provision)

To minimize uncertainty and arguments that can slow down the progress of construction it is useful to provide language stating how and when the Contractor will get paid. In addition to ORC and other local requirements, the involvement of public funding Agencies such as the WPCLF, Ohio Public Works Commission and Community Development Block Grant impact the process and timing for payments.

The following example language is a sample of language that could be included. Review all local procedures and requirements and adjust the language to meet the specifics of the project.

1. At least ten (10) days before each progress payment falls due (but not more often than once a month), the Contractor will submit to the Engineer a partial payment estimated filled out and signed by the Contractor covering the work performed during the period covered by the partial payment estimate and supported by such data as the Engineer may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitable stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the Owner as will establish the Owner's title to the material and equipment and protect his interest therein, including applicable insurance. The Engineer will, with ten (10) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the Owner, or return the partial payment estimate to the Contractor indicating in writing his reason for refusing to approve payment.

In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate. The Owner will, within 30 days of presentation to him of an approved partial payment estimate, pay Contractor for labor performed and material incorporated in the Work, at the rate of 92 percent of the amount of the estimate as approved by the Engineer until 50 percent of the Work is completed. All labor performed and material incorporated in the Work after the job is 50 percent of completed shall be paid for at the rate of 100 percent of the amount of additional labor and material furnished and approved and the amount labor and material furnished and approved the amount previously retained shall be deposited in an escrow account. The funds in the escrow account with accumulated interest are to be paid the Contractor at the same time and in the same manner as specified for payment of the of the retained amount in Section 5.

Payment for material and equipment delivered and not incorporated shall be based on the scheduled of quantities and cost submitted. Any money due from Owner shall, on the day that it is due, be paid to Contractor, or deposited in an escrow account, whichever is applicable, with one or more banks or building and loan associations in the state selected by mutual agreement between the Contractor and the Owner. The agreement shall contain the following provisions:

- A. The money shall be deposited in a savings account or the escrow agent shall properly invest the entire escrow principal in obligations selected by the escrow agent, as stipulated in the agreement.
- B. The escrow agent shall hold the escrow principal and income until receipt of notice from the Owner and the Contractor, of until receipt of an arbitration order specifying the amount of escrow principal to be released and the person to whom it is to be released. Upon receipt of the notice or order, the agent shall properly pay such amount of principal and the portion of amount of the escrow income to the person indicated.

- C. The escrow agent shall be compensated for its services as agreed to by the Owner and the Contractor from the income from the escrow account.
- 2. The request for payment may also include an allowance for the cost of such major material and equipment which are suitably stored either at the site or near the site.

NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.

Prohibition on Telecommunications and Video Surveillance

§ 200.216 Prohibition on certain telecommunications and video surveillance services or equipment.

- (a) Recipients and subrecipients are prohibited from obligating or expending loan or grant funds to:
 - (1) Procure or obtain;
 - (2) Extend or renew a contract to procure or obtain; or
 - (3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in [Public Law 115–232](#), section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
 - (i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
 - (ii) Telecommunications or video surveillance services provided by such entities or using such equipment.
 - (iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.
- (b) In implementing the prohibition under [Public Law 115–232](#), section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.
- (c) See [Public Law 115–232](#), section 889 for additional information.
- (d) See also [§ 200.471](#).

Resources:

[2 CRF 200.216](#)

FAQ's: [Sec. 889 of 2019 NDAA FAQ_20201124.pdf \(performance.gov\)](#)

[Public Law 115-232, Section 889](#)

[§ 200.471](#)

WPCLF/WSRLA CONTRACT DOCUMENTS REVIEW

Funding Applicant:	
Project Name:	Project Number:
Date Bid Advertisement will start:	Date Bids will be opened:
Engineer's estimate of construction cost:	
Time of completion for work (e.g., 9 months):	

Please provide the Section/PDF Page number from the contract documents that corresponds with each item below.

Program Requirements -Any item checked as "No" must be explained on a separate sheet

☐ Yes ☐ No	EEO Certification	Section/Page # _____
☐ Yes ☐ No	Certification Regarding Debarment & Suspension	Section/Page # _____
☐ Yes ☐ No	Prohibition on telecommunications and video surveillance equipment	Section/Page # _____
☐ Yes ☐ No	Contract provisions describing DBE requirements	Section/Page # _____
☐ Yes ☐ No	DBE Forms 6100-3, 6100-4 and 6100- 2	Section/Page # _____
☐ Yes ☐ No	Davis-Bacon wage rate requirements	Section/Page # _____
☐ Yes ☐ No	Build America, Buy America Acknowledgement Form	Section/Page # _____
☐ Yes ☐ No	American Iron and Steel Acknowledgement Form	Section/Page # _____
☐ Yes ☐ No	Violating Facilities clause	Section/Page # _____
☐ Yes ☐ No	Small Businesses in Rural Areas (SBRA)	Section/Page # _____
☐ Yes ☐ No	Insurance for both the contractor and all subcontractors:	Section/Page # _____
	☐ Yes ☐ No Workers' Compensation	☐ Yes ☐ No Vehicle Liability
	☐ Yes ☐ No Public Liability	☐ Yes ☐ No Flood (if appropriate)
	☐ Yes ☐ No Property Damage	☐ Yes ☐ No Builders Risk (can be held by owner instead)
☐ Yes ☐ No	Material Testing (statement regarding testing for specifications)	Section/Page # _____
☐ Yes ☐ No	Project-specific continuous service/treatment provisions	Section/Page # _____
☐ Yes ☐ No	WPCLF/WSRLA Change Order form & instructions	Section/Page # _____
☐ Yes ☐ No	Bid proposal forms (necessary for determining loan eligibility)	Section/Page # _____

Other Contract Requirements

☐ N/A - superseded by local requirements		
☐ Yes ☐ No	Text of the bid advertisement	Section/Page # _____
☐ Yes ☐ No	Engineer's estimate of cost for construction	Section/Page # _____
☐ Yes ☐ No	Description of how the bid price, including any alternates, is determined	Section/Page # _____
☐ Yes ☐ No	Notice to Proceed form	Section/Page # _____
☐ Yes ☐ No	Any material or equipment designated from a "sole source?" If yes, attach a description and justification for each item.	Section/Page # _____
☐ Yes ☐ No	Bid includes a dedicated contract contingency/allowance amount	Section/Page # _____
	Contract contingency is ☐ a fixed dollar amount ☐ a fixed percentage of the contract total	

Ohio Revised Code Requirements - The following are required for municipalities (cities, villages, counties, sewer districts) but may be superseded by local charter or other local requirements.

☐ N/A - superseded by local requirements	☐ N/A - not a municipality	
☐ Yes ☐ No	Bid Guarantee in the form required by ORC	Section/Page # _____
☐ Yes ☐ No	Payment and Performance Bonds in the form required by ORC	Section/Page # _____
☐ Yes ☐ No	Provisions for payment retention in conformance with ORC	Section/Page # _____
☐ Yes ☐ No	A specific time for completion of the work	Section/Page # _____

Checklist Prepared by: _____

Phone or E-mail _____

Bid Package Submittals

The following documents must be submitted to Ohio EPA – DEFA within one week after bids are received, or sooner dependent on your individual project schedule.

1. One copy of all addenda when they are issued.
2. A complete copy of the successful bidder's proposal(s).
3. A bid tabulation (a list of all bidders and their line item amounts) in the same format as the proposal.
4. The engineer's bid evaluation and recommendation.
5. A signed copy of the Contractor's EEO Certification Form
6. A signed copy of the Certification Regarding Debarment, Suspension, and Other Responsibility Matters.
7. Completed copies of Form 6100-3 Individual DBE Subcontractor Proposed Performance Form and Form 6100-4 DBE Subcontractor Utilization Summary that were provided by the successful bidder(s), as well as any alternate "good faith efforts" documentation.
8. A resolution from the loan recipient's governing body tentatively awarding the contract to the successful bidder.
9. A copy of the site title opinion stating that all sites, easements and / or right-of-way necessary to construct the project have been acquired.
10. Signed Build America, Buy America Acknowledgement Form, if applicable.
11. Signed American Iron and Steel Acknowledgement Form.
12. Useful Life Worksheet (must be completed for loan requests greater than 20 years)
 - WPCLF Useful Life Worksheet: <https://epa.ohio.gov/static/Portals/29/documents/ofa/CW-Useful-Life-Worksheet.xlsx?ver=2019-10-31-153519-907>
 - WSRLA Useful Life Worksheet: <https://epa.ohio.gov/static/Portals/29/documents/ofa/DW-Useful-Life-Worksheet.xlsx?ver=2019-10-31-153519-907>

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project Description
2. Contractor's use of Site and premises.
3. Owner occupancy.
4. Permits.
5. Specification conventions.

1.2 PROJECT DESCRIPTION

- A. Work of the Project is the construction of an approximately 5,000 LF gravity sanitary sewer main running along the Little Miami Bike Trail to the project site where a new one-story 1,500 square foot control building and the head of a new sanitary force main and site improvements occur. From this point, the new sanitary force main sewer will continue running along the existing Little Miami Bike Trail to the point where it will cross the river suspended from an existing railroad bridge and continue to the end of the new force main at the Lebanon Waste Water Treatment Facility. Minor work will occur at the Lebanon Waste Water Treatment Facility to receive the new sanitary force main sewer.
- B. Perform Work of the Contract under Stipulated Sum contract with Owner according to Conditions of Contract.

1.3 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas indicated on Drawings or as established in coordination with the Owner.
1. Noisy and Disruptive Operations such as Use of Jack Hammers and Other Noisy Equipment not allowed in close proximity to existing building during regular hours of operation. Coordinate and schedule such operations with Owner to minimize disruptions.
- B. Time Restrictions for Performing Work: 7AM – 7PM Monday thru Sunday except Holidays or as directed by Owner. Construction Manager to confirm with Owner and Architect access to the site for work during weekends.

C. Utility Outages and Shutdown:

1. Coordinate and schedule electrical and other utility outages with Owner and Architect.
2. Outages: Allowed only at previously agreed upon times. In general, schedule outages at times when facility is not being used.

D. Construction Plan: Before starting construction, submit construction plan regarding access to Work, use of Site, and any utility outages for acceptance by Owner. After acceptance of plan, construction operations shall comply with accepted plan unless deviations are accepted by Owner in writing. Construction Plan shall be periodically updated to provide the Owner with reasonable notice of changes to the Plan.

1.4 OWNER OCCUPANCY

- A. Owner will need to access premises during construction.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner access and usage.

1.5 PERMITS

- A. The basic building permit will be obtained by the Owner.
- B. General Contractor shall obtain necessary permits for construction of any other work as required by the Authority Having Jurisdiction.

1.6 SPECIFICATION CONVENTIONS

- A. These Specifications are written in imperative mood and streamlined form. This imperative language is directed to Contractor unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.7 EXAMINATION OF CONTRACT DOCUMENTS AND THE SITE

- A. Before submitting the Guaranteed maximum Price for final Owner Approval, the Contractor shall examine all Contract Documents, including, but not limited to, the Drawings, Specifications, and Addenda for all divisions of Work for the Project, noting in particular all requirements that may affect its Work in any way.
- B. The Contractor's failure to become acquainted with the extent and nature of Work required to complete any portion of the Work in conformity with the requirements of the Contract Documents, shall not be a basis for additional compensation.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 10 00

SECTION 01 21 00

ALLOWANCES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Owner's Contingency allowance.
- B. Related Sections
 - 1. Section 01 29 00 - Payment Procedures.
 - 2. Section 01 32 16 - Construction Progress Schedules.
 - 3. Individual specification sections.
- C. Include in Contract Sum cash allowances scheduled at end of Section and contingency allowance specified in this Section.
- D. Designate in Construction Progress Schedule specified in Section 01 32 16 delivery dates for products under each allowance.

1.2 OWNER'S CONTINGENCY ALLOWANCE

- A. Include in Contract Sum a stipulated sum of \$750,000 for use upon Owner's instruction.
- B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.
- C. Funds will be drawn from Contingency Allowance only by Change Order.
- D. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 ALLOWANCE SCHEDULE

- A. Owner's Contingency Allowance: \$750,000.

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Product Substitution Procedures.

1.2 GENERAL

- A. Definition: Proposal by Contractor to use manufacturer, product, material, or system different from one required in Contract Documents.
- B. Do not substitute Products unless a substitution request has been approved by Architect.
- C. Substitutions during Bidding: Refer to Instructions to Bidders.
- D. Architect will consider substitution requests within 30 days after award of Contract. After initial 30 day period, substitutions requests will be considered only due to non-availability of a specified Product through no fault of Contractor.
- E. In case of non-availability of a specified Product notify Architect in writing as soon as non-availability becomes apparent.

1.3 SUBSTITUTION REQUESTS

- A. Submit substitution requests on form provided by Architect.
- B. Document specified product and proposed substitution with complete data, including:
 - 1. Product identification, including name and address of manufacturer.
 - 2. Product description, performance and test data, and reference standards.
 - 3. Sample, if requested.
 - 4. Description of any anticipated effect that acceptance of proposed substitution will have on Progress Schedule, construction methods, or other items of Work.
 - 5. Description of any differences between specified product and proposed substitution.
 - 6. Difference in cost between specified product and proposed substitution.
- C. Burden of proof for substantiating compliance of proposed substitution with Contract Document requirements remains with Contractor.
- D. A request constitutes a representation that the Contractor:
 - 1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - 2. Will provide the same warranty for the substitution as for the specified Product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.

5. Will reimburse Owner for design services associated with re-approval by authorities or revisions to Contract Documents to accommodate the substitution.
- E. Substitutions will not be considered if:
 1. They are indicated or implied on Shop Drawings or other submittals without submittal of a substitution request.
 2. Approval will require substantial revision of Contract Documents without additional compensation to Architect.
- F. Submit hard copy or electronically in Adobe PDF format to the Architect
- G. Architect will notify Contractor of approval or rejection of each Substitution Request.
- H. Approved Substitutions will be incorporated into Contract by Change Order or Construction Change Directive.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

DOCUMENT 01 25 19

SUBSTITUTION REQUEST FORM

DATE: _____

TO: _____

ATTENTION: _____

PROJECT: _____

We submit for your consideration the following product as a substitution for the specified product:

Section No.	Paragraph	Specified Product

_____	_____	_____

Proposed Substitution: _____

Reason for Substitution: _____

Product Data:

Attach complete technical data for both the specified product and the proposed substitution. Include information on changes to Contract Documents that the proposed substitution will require for its proper installation.

Samples:

___ Attached ___ Will be furnished upon request

Does the substitution affect dimensions shown on Drawings?

___ No ___ Yes (explain) _____

Effects of proposed substitution on other Work:

Differences between proposed substitution and specified Product:

Manufacturer's warranties of the proposed substitution are:

☐ Same ☐ Different (explain) _____

Maintenance service and spare parts are available for proposed substitution from:

Previous installations where proposed substitution may be seen:

Project: _____	Project: _____
Owner: _____	Owner: _____
Architect: _____	Architect: _____
Date Installed: _____	Date Installed: _____

Cost savings to be realized by Owner, if proposed substitution is approved:

Change to Contract Time, if proposed substitution is approved:

☐ No Change ☐ Add _____ days ☐ Deduct _____ days

Submittal constitutes a representation that Contractor has read and agrees to the provisions of Section 01 2500.

Submitted by Contractor:

Signature

Firm

For Use by Architect:

Based on the information supplied by the Contractor the Architect has reviewed the proposed substitution on the basis of design concept of the Work and conformance with information given in Contract Documents.

☐ Approved ☐ Approved as Noted ☐ Rejected

Submit Additional Information: _____

By: _____ Date: _____

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Supplemental Instructions.
 - 2. Proposal Requests.
 - 3. Contractor proposed changes.
 - 4. Construction Change Directives.
 - 5. Change Orders.
- B. Related Sections:
 - 1. Section 01 60 00 - Product Requirements.

1.2 CHANGE PROCEDURES

- A. Architect's Supplemental Instructions:
 - 1. Format: AIA Document G710 - Architect's Supplemental Instructions.
 - 2. Architect will advise of minor changes in Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract.
- B. Proposal Requests:
 - 1. Format: AIA Document G709 - Proposal Request.
 - 2. Architect may issue a Proposal Request that includes a detailed description of a proposed change with supplemental or revised Drawings and specifications.
 - 3. Prepare and submit an estimate of any change to Contract Sum or Contract Time within 7 days after receipt. Include:
 - a. Quantities and unit costs, with total cost or credit to Owner. If requested, furnish documentation of quantities.
 - b. Taxes, delivery charges, equipment rentals, and trade discounts as applicable.
 - c. If change in Contract Time is involved, provide updated Progress Schedule.
 - 4. Do not stop work or initiate changes in response to a Proposal Request. If approved, Architect will prepare and issue a Change Order.
 - 5. Submit electronically in Adobe PDF format.
- C. Contractor Proposed Changes:
 - 1. Format: Contractor's standard.
 - 2. Contractor may propose a change by submitting request for change to Architect.
 - 3. Describe proposed change, reason for change, its full effect on Work, and any change to Contract Sum or Contract Time. Include:
 - a. Quantities and unit costs, with total cost or credit to Owner. If requested, furnish documentation of quantities.
 - b. Taxes, delivery charges, equipment rentals, and trade discounts as applicable.
 - c. If change in Contract Time is involved, provide updated Progress Schedule.
 - 4. Document any required substitutions in accordance with Section 01 60 00.
 - 5. Submit electronically in Adobe PDF format.

- D. Construction Change Directive:
 - 1. Architect may issue a directive, signed by Owner, instructing Contractor to proceed with a change for subsequent inclusion in a Change Order.
 - 2. Documentation will describe changes in Work and designate method of determining any change to Contract Sum or Contract Time. Promptly execute change.
- E. Change Orders:
 - 1. Format: AIA Document G701 - Change Order.
 - 2. Execution: Architect to issue Change Orders for signature of parties as provided in Conditions of the Contract. Submit 3 copies for signature by Architect, Owner and Contractor

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 26 13

REQUESTS FOR INFORMATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Requests for Information (RFI's).
- B. Related Sections:
 - 1. Section 01 25 00 - Substitution Procedures.
 - 2. Section 01 26 00 - Contract Modification Procedures.
 - 3. Section 01 33 00 - Submittal Procedures.
 - 4. Section 01 77 00 - Closeout Procedures.

1.2 GENERAL

- A. If the Contractor finds any perceived ambiguity, conflict, error, omission, or discrepancy within the Contract Documents, including the Drawings, Specifications, and Addenda, or between any of the Contract Documents and Applicable Law, the Contractor shall submit a written Request for Interpretation ("RFI") to the A/E for an interpretation or clarification.
- B. Request for Information (RFI): Request from Contractor seeking interpretation or clarification of Contract Documents not involving Substitutions or changes to Contract Sum or Contract Time.
- C. Before submitting any RFI to the A/E, the Contractor shall carefully review the Contract Documents to ensure that the Contract Documents do not answer the RFI.
- D. Any interpretation or clarification of the Contract Documents made by any Person other than the A/E, or in any manner other than writing, shall not be binding and the Contractor shall not rely upon it.
- E. The Contractor shall not be compensated for a claim alleging insufficient data, incomplete, ambiguous, conflicting, or erroneous Contract Documents or proposed Contract Documents, or assumed conditions regarding the nature, extent, or character of the Work, if the Contractor did not submit a related RFI prior to commencing work.
- F. RFI's constitute a request for information only.
- G. Do not submit RFI's:
 - 1. To request approval of Substitutions; refer to Section 01 25 00.
 - 2. To request changes known to include changes to Contract Sum or Contract Time; refer to Section 01 26 00.
 - 3. To request approval of submittals; refer to Section 01 33 00.
 - 4. To submit Project Record Documents; refer to Section 01 77 00.

1.3 SUBMITTALS

- A. Submit RFI's on standard form provided by Contractor.
- B. Include on each RFI:
 - 1. Name of Contractor.
 - 2. Project name.
 - 3. Date submitted.
 - 4. Sequential RFI number.
 - 5. Applicable Drawing sheet and detail numbers or Specification Section numbers.
 - 6. Date when response information is required to avoid impact on Construction Schedule and Construction Cost.
- C. Review and sign RFI's submitted by Subcontractors, Sub-Subcontractors, or Suppliers prior to submittal to Architect.
- D. Maintain log of RFI's showing RFI number and current status of each RFI.
- E. When RFI's require submittal of drawings, follow submittal procedures specified for Shop Drawings in Section 01 33 00.
- F. Submit electronically in Adobe PDF format.
- G. Allow minimum 7 days for Architect's review and response to each RFI.
- H. Contractor shall not email questions to the Architect without the required RFI form attached.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Schedule of Values.
 - 2. Applications for Payment.
- B. Related Sections:
 - 1. Section 01 77 00 - Closeout Procedures.

1.2 SCHEDULE OF VALUES

- A. General:
 - 1. Submit a Schedule of Values to Architect at least 20 days prior to submitting first Application for Payment.
 - 2. Upon request of Architect, furnish additional data to support values given that will substantiate their correctness.
 - 3. Approved Schedule of Values will be used as basis for reviewing Contractor's Applications for Payment.
- B. Form and Content:
 - 1. Format: AIA Document G703 - Continuation Sheet of Application and Certification for Payment.
 - 2. Use Table of Contents of Project Manual as basis of format for listing costs of Work.
 - 3. List installed value of component parts of Work in sufficient detail to serve as basis for computing values for progress payments.
 - 4. Include separate line items for:
 - a. Site mobilization.
 - b. Bonds and insurance.
 - c. Contractor's overhead and profit.
 - 5. For items on which payment will be requested for stored materials, break down value into:
 - a. Cost of materials, delivered and unloaded, with taxes paid.
 - b. Total installed value.
 - 6. For each line item that has a value of more than \$25,000.00, break down costs to list major products or operations under each item.
 - 7. Total of costs listed in Schedule shall equal Contract Sum.
- C. Submit electronically in Adobe PDF format.
- D. Review and Resubmittal:
 - 1. After initial review by Architect, revise and resubmit if required.
 - 2. Revise and resubmit along with next Application for Payment when a Change Order is issued. List each Change Order as a new line item.

1.3 APPLICATIONS FOR PAYMENT

- A. Preparation:
 - 1. Format: AIA Document G702 - Application and Certification for Payment, supported by AIA Document G703 - Continuation Sheet.
 - 2. Prepare required information in typewritten format or on electronic media format.
 - 3. Use data from reviewed Schedule of Values. Provide dollar value in each column for each line item representing portion of work performed.
 - 4. List each authorized Change Order as a separate line item, listing Change Order number and dollar value.
 - 5. Prepare Application for Final Payment as specified in Section 01 77 00.
- B. Waivers of Lien:
 - 1. Along with the each Application for Payment, submit waivers of lien from Contractor and each Subcontractor or Sub-subcontractor included on the current month's Application for Payment.
 - 2. Submit partial waivers on each item for amount requested, prior to deduction of retainage.
 - 3. For completed items, submit full or final waiver.
- C. Submittal:
 - 1. Submit one hard copy and one electronic copy in Adobe PDF format of each Application for Payment.
 - 2. Payment period: Submit by the 25 day of each month.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project coordination.
 - 2. Coordination drawings.
 - 3. Project meetings.
- B. Related Sections:
 - 1. Section 01 77 00 - Contract Closeout.

1.2 PROJECT COORDINATION

- A. Submit required project submittals electronically in Adobe PDF format.
- B. Coordinate scheduling, submittals, and work of various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.
- C. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.
- D. Coordinate space requirements and installation of mechanical and electrical items that are indicated diagrammatically on Drawings.
 - 1. Follow routing shown as closely as practical; place runs parallel with building lines.
 - 2. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and cleanup of work of separate Sections in preparation for Substantial Completion.
- G. After Owner occupancy, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents to minimize disruption of Owner's activities.

1.3 COORDINATION DRAWINGS

- A. Coordination Drawings:
 - 1. Prior to commencement of Work, prepare coordination drawings to define relationship of mechanical, plumbing, fire protection, and electrical components with beams, columns, ceilings and walls.
 - 2. Include plans, elevations, sections, and details required to define relationships between components.

3. Prepare drawings at 1/4 inch = 1'-0" scale for general layout and 3/8 inch = 1'-0" for plans and sections in congested areas including equipment spaces.
4. Submit two paper copies and one copy electronically in a PDF format.
- B. Hold coordination meetings with trades providing mechanical, plumbing, fire protection, and electrical work.
- C. Resolve conflicts between trades, prepare composite coordination drawings and obtain signatures on original composite coordination Drawings.
- D. When conflicts cannot be resolved:
 1. Cease work in areas of conflict and request clarification prior to proceeding.
 2. Prepare drawings to define and to indicate proposed solution.
 3. Submit drawings for approval when actual measurements and analysis of Drawings and Project Manual indicate that various systems cannot be installed without significant deviation from intent of Contract Documents.
- E. Submit original composite coordination drawings as part of Project Record Documents specified in Section 01 77 00.

1.4 PROJECT MEETINGS

- A. Schedule and administer preconstruction conference, progress meetings and pre-installation conferences.
- B. Make physical arrangements for meetings; notify involved parties at least 5 days in advance.
- C. Record significant proceedings and decisions at each meeting; reproduce and distribute copies to parties in attendance and others affected by proceedings and decisions made.

1.5 PRECONSTRUCTION CONFERENCE

- A. Schedule within 10 days after date of Notice to Proceed at Contractor's Project field office.
- B. Attendance:
 1. Contractor.
 2. Owner.
 3. Architect and principal consultants as required
 4. Major subcontractors and suppliers as Contractor deems appropriate. Representative of Testing Laboratory for Construction Materials.
- C. Review and Discuss:
 1. Relation and coordination of various parties, and responsible personnel for each party.
 2. Use of premises, including office and storage areas, temporary controls, and security procedures.
 3. Construction schedule and critical work sequencing.
 4. Processing of:
 - a. Contract modifications.
 - b. Shop Drawings, Product Data, and Samples.
 - c. Applications for Payment.
 - d. Substitutions.

- e. Requests for Information.
- f. Other required submittals.
- 5. Adequacy of distribution of Contract Documents.
- 6. Procedures for maintaining contract closeout submittals.
- 7. Installation and removal of temporary facilities.
- 8. Notification procedures and extent of testing and inspection services.

1.6 PROGRESS MEETINGS

- A. Schedule weekly progress meetings.
- B. Location: Contractor's Project field office.
- C. Attendance:
 - 1. Contractor.
 - 2. Owner / Owner's Representative
 - 3. Architect and consultants as appropriate to agenda.
 - 4. Subcontractors and suppliers as appropriate to agenda.
 - 5. Others as appropriate to agenda.
- D. Review and Discuss:
 - 1. Work progress since previous meeting, including:
 - a. Field observations, deficiencies, conflicts, and problems.
 - b. Progress and completion date.
 - c. Corrective measures needed to maintain quality standards, progress, and completion date.
 - 2. Status of:
 - a. Requests for information.
 - b. Submittals.
 - c. Contract modifications.
 - 3. Coordination between various elements of Work.
 - 4. Maintenance of Project Record Documents.

1.7 PRE-INSTALLATION CONFERENCES

- A. Where required in individual specification Section, convene a pre-installation conference at project site or other designated location.
- B. Require attendance of parties directly affecting or affected by work of the specific Section.
- C. Review conditions of installation, preparation and installation procedures, and coordination with related work.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Construction progress schedule.
- B. Related Sections:
 - 1. Section 01 11 00 - Summary of Work: Work sequence.
 - 2. Section 01 29 00 - Payment Procedures.

1.2 FORMAT

- A. Prepare Progress Schedule on network analysis system using the critical path method.
- B. Sequence of Listings: The chronological order of the start of each item of Work.
- C. Scale and Spacing: To provide space for notations and revisions.
- D. Sheet Size: Multiples of 8-1/2 x 11 inches.

1.3 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by Specification Section number.
- C. Identify work of separate floors and other logically grouped activities.
- D. Provide sub-schedules for each phase of Work identified in Section 01 11 00.
- E. Provide sub-schedules to define critical portions of the entire Progress Schedule.
- F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- G. Provide separate schedule of submittal dates for Shop Drawings, Product Data, and Samples, including:
 - 1. Dates reviewed submittals will be required from Architect.
 - 2. Decision dates for selection of finishes.
 - 3. Delivery dates for Owner furnished products and Products identified under Allowance.
- H. Coordinate content with Schedule of Values specified in Section 01 29 00.
- I. Revisions:

1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
 2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
- J. Provide narrative report to define problem areas, anticipated delays, and impact on Progress Schedule. Report corrective action taken, or proposed, and its effect.

1.4 SUBMITTAL

- A. Submit initial Progress Schedule within 14 days after date of Notice to Proceed. After review, resubmit required revised data within 10 days.
- B. Submit revised Progress Schedule with each Application for Payment.
- C. Submit electronically in Adobe PDF format.

1.5 DISTRIBUTION

- A. Distribute copies of approved Progress Schedule to project site file, Subcontractors, suppliers, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in Progress Schedule.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submittal procedures.
 - 2. Proposed Products list.
 - 3. Submittal schedule.
 - 4. Shop Drawings.
 - 5. Product Data.
 - 6. Samples.
 - 7. Quality control submittals.
- B. Related Sections:
 - 1. Section 01 40 00 - Quality Requirements.

1.2 SUBMITTAL PROCEDURES

- A. Number each submittal with Project Manual section number and a sequential number within each section. Number resubmittals with original number and an alphabetic suffix.
- B. Identify Project, Contractor, Subcontractor or supplier, pertinent Drawing sheet and detail numbers, and specification Section number, as appropriate.
- C. Submit all submittals listed under “Submittals for Review” simultaneously for each Product or Specification Section.
- D. Where multiple Products function as an assembly, group submittals for all related Products into single submittal.
- E. Architect will not review incomplete submittals.
- F. Apply Contractor’s stamp, signed or initialed certifying that:
 - 1. Submittal was reviewed.
 - 2. Products, field dimensions, and adjacent construction have been verified.
 - 3. Information has been coordinated with requirements of Work and Contract Documents.
- G. Schedule submittals to expedite the Project and delivery to Architect. Coordinate submittals of related items.
- H. For each submittal, allow 7 days for Architect’s review, excluding delivery time to and from Contractor.
- I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of completed Work.

- J. Revise and resubmit submittals when required; identify all changes made since previous submittal.
- K. Distribute copies of reviewed submittals to concerned parties and to Project Record Documents file. Instruct parties to promptly report any inability to comply with provisions.

1.3 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Notice to Proceed, submit a complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.
- C. Submit electronically in a PDF format.

1.4 SUBMITTAL SCHEDULE

- A. Within 15 days after date of Notice to Proceed, submit a submittal schedule showing all submittals proposed for project, including submittals listed as:
 - 1. Submittals for Review.
 - 2. Quality Control Submittals.
 - 3. Closeout Submittals.
- B. Include for each submittal:
 - 1. Specification section number.
 - 2. Description of submittal.
 - 3. Type of submittal.
 - 4. Anticipated submittal date.
 - 5. For submittals requiring Architect's review, date reviewed submittal will be required from Architect.
- C. Submit electronically in Adobe PDF format.

1.5 SHOP DRAWINGS

- A. Present information in clear and thorough manner.
- B. Identify details by reference to sheet and detail numbers or room number shown on Drawings.
- C. Reproductions of details contained in Contract Documents are not acceptable.
- D. Coordinate specific requirements for each shop drawing and what is required by the Contractor and their Subcontractors. Submit one copy plus the number of copies the Contractor needs for distribution and/or Submit electronically in Adobe PDF format. Architect will return all but one copy to Contractor for printing and distribution as necessary.

1.6 PRODUCT DATA

- A. Mark each copy to identify applicable products, models, options, and other data.

- B. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Submit electronically in Adobe PDF format. Architect will return one copy to Contractor for printing and distribution.

1.7 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Where so indicated, submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Architect's selection.
- C. Include identification on each sample, with full Project information.
- D. Unless otherwise specified in individual specifications, submit two of each sample.
- E. Architect will notify Contractor of approval or rejection of samples, or of selection of color, texture, or pattern if full range is submitted.

1.8 QUALITY CONTROL SUBMITTALS

- A. Quality control submittals specified in Section 01 4000 are for information and do not require Architect's responsive action except to require resubmission of incomplete or incorrect information.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 35 46

INDOOR AIR QUALITY MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes special requirements for Indoor Air Quality (IAQ) management during construction operations.
 - 1. Control of emissions during construction.
 - 2. Control of moisture during construction.
- B. Procedures for testing baseline IAQ. Baseline IAQ requirements specify maximum indoor pollutant concentrations for acceptance of the facility.

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- B. Adequate ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.
- C. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.
 - 1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
- D. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.
- E. Interior final finishes: Materials and products applied within the vapor barrier of the building that will be exposed at interior, occupied spaces; including flooring, wallcovering, finish carpentry, and ceilings.
- F. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.

- G. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

1.3 SUBMITTALS

- A. Submit Product Data:
 - 1. Submit product data for filtration media to be used during construction and prior to occupancy. Include Minimum Efficiency Reporting Value (MERV).
 - 2. Submit Material Safety Data Sheets for inclusion in Operation and Maintenance Manual for the following products.
 - a. Floor and wall patching/leveling materials.
 - b. Caulking and sealants.
 - c. Insulating materials.
 - d. Concrete curing compounds.
 - e. Paints and Coatings.
 - f. Lubricants.
 - g. Cleaning products.
- B. Submit inspection and testing reports:
 - 1. Moisture control inspections.
 - 2. Moisture penetration testing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 IAQ MANAGEMENT – EMISSIONS CONTROL

- A. During construction operations, follow the recommendations in SMACNA IAQ Guidelines for Occupied Buildings under Construction.
- B. HVAC Protection:
 - 1. Seal return registers during construction operations.
 - 2. Provide temporary exhaust during construction operations.
 - 3. To the greatest extent possible, isolate and/or shut down the return side of the HVAC system during construction. When ventilation system must be operational during construction activities, provide MERV 8 or greater temporary filtration on all return air grilles.
- C. Source Control: Provide materials and products with low pollutant emissions as specified.
 - 1. Potential sources of Volatile Organic Compound (VOC) emissions include the following:
 - a. Paints, stains, and varnishes.
 - b. Solvents.
 - c. Adhesives and wood preservatives.
 - d. Waxes, polishes, and cleansers.
 - e. Lubricants and sealants.
 - f. Fuels.
 - g. Plastics.

2. Potential sources of Combustion Contaminants include the following:
 - a. Furnaces and generators.
 - b. Gas or kerosene space heaters.
 - c. Tobacco products.
 - d. Vehicles.
 3. Potential sources of Biological Contaminants include the following:
 - a. Cooling towers.
 - b. Humidifiers.
 - c. Cooling coils and drain pans.
 - d. Damp duct insulation and filters.
 - e. Condensation.
 - f. Re-entrained sanitary exhausts.
 - g. Rodents and bird droppings.
 4. Potential sources of Urea-Formaldehyde Contaminants include the following:
 - a. Particle board and plywood.
 - b. Cabinetry.
 - c. Insulation.
 5. Potential sources of Soil Gas Contaminants include the following:
 - a. Soil and rock (radon).
 - b. Sewer drain traps.
 6. Potential sources of Pesticide Contaminants include the following:
 - a. Termiticides, insecticides, and rodenticides.
 - b. Fungicides.
 - c. Disinfectants.
 - d. Herbicides.
 7. Potential sources of Particle and Fiber Contaminants include the following:
 - a. Paper printing and handling.
 - b. Insulation.
 - c. Vacuuming and cleaning of construction areas.
- D. Pathway Interruption: Isolate areas of work as necessary to prevent contamination of clean or occupied spaces. Provide pressure differentials and/or physical barriers to protect clean or occupied spaces.
- E. Housekeeping: During construction, maintain project and building products and systems to prevent contamination of building spaces.
- F. **No smoking inside the building during construction.**
- G. Temporary Ventilation: Provide an ACH (air changes per hour) of 1.5 or more and as follows:
1. Provide minimum 48 hour pre-ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degree F maximum continuously during the ventilation period. Do not ventilate within limits of Work unless otherwise approved by Architect.
 2. Provide adequate ventilation during and after installation of interior wet products and interior finishes.

3. Provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 during construction. Coordinate with work of Division 23, Heating Ventilating and Air Conditioning (HVAC).
- H. Scheduling: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.

3.2 IAQ MANAGEMENT – MOISTURE CONTROL

- A. Housekeeping:
1. Keep materials dry. Protect stored on-site and installed absorptive materials from moisture damage.
 2. Verify that installed materials and products are dry prior to sealing and weatherproofing the building envelope.
 3. Install interior absorptive materials only after building envelope is sealed and weatherproofed.
- B. Inspections: Document and report results of inspections; state whether or not inspections indicate satisfactory conditions.
1. Examine materials for dampness as they arrive. If acceptable to Architect/Owner, dry damp materials completely prior to installation; otherwise, reject materials that arrive damp.
 2. Examine materials for mold as they arrive and reject materials that arrive contaminated with mold.
 3. Inspect stored and installed absorptive materials regularly for dampness and mold growth. Inspect after each rain event, but no less than once per week.
 - a. Where stored on-site or installed absorptive materials become wet, notify Architect and General Contractor. Inspect for damage. If acceptable to Architect/General Contractor, dry completely prior to closing in assemblies; otherwise, remove and replace with new materials.
 4. Weather-proofing: Inspect moisture control materials as they are being installed. Include the following:
 - a. Air barrier: Verify air barrier is installed without punctures and/or other damage. Verify air barrier is sealed completely.
 - b. Flashing: Verify correct shingling of the flashing for windows, doors, and other penetrations.
 - c. Insulation layer: Verify insulation is installed without voids.
 5. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.
 6. HVAC: Inspect HVAC system and verify the following:
 - a. Condensate pans are sloped and plumbed correctly.
 - b. Access panels are installed to allow for inspection and cleaning of coils and ductwork downstream of coils.
 - c. Ductwork is air sealed.
 - d. Chilled water line and refrigerant line insulation are installed and sealed.
- C. Schedule:
1. Schedule work such that absorptive materials, including but not limited to porous insulations, paper-faced gypsum board, ceiling tile, and finish flooring, are not installed until they can be protected from rain and construction-related water.

2. Weather-proof as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air barriers, flashing, exterior sealants and roofing, at the earliest possible time.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. References.
 - 2. Quality assurance and control of installation.
 - 3. Mockups.
 - 4. Manufacturer's field services and reports.
 - 5. Design data and calculations.
 - 6. Test reports and certifications.
 - 7. Manufacturer's installation instructions.

1.2 REFERENCES

- A. For products or workmanship specified by reference to association, trade or industry standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Conform to edition of reference standard in effect as of date of Project Manual.
- D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.3 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

- A. The Contractor shall provide all labor and materials necessary for the entire completion of the Work described in the Contract Documents.
- B. The Drawings govern dimensions, details, and locations of the Work. The Specifications govern quality of materials and workmanship.
- C. In the event of inconsistency or conflict within the Contract Documents, the Contractor shall provide the better quality or greater quantity of Work and comply with the stricter requirement.
- D. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- E. Comply fully with manufacturers' instructions, including each step in sequence.
- F. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

- G. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- H. Perform work by persons qualified to produce workmanship of specified quality.
- I. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 MOCKUPS

- A. Definition:
 - 1. Mockups are field samples constructed, applied, or assembled at the project site for review by the Owner and Architect that illustrate materials, equipment, or workmanship.
 - 2. Approved mockups establish the standard of quality by which the Work will be judged.
- B. Construct, apply, or assemble specified items, with related attachment and anchorage devices, flashings, seals, and finishes.
- C. Perform work in accordance with applicable specifications sections.
- D. Erect at project site at location acceptable to Architect. Protect from damage.
- E. Removal:
 - 1. Mockups may remain as part of the Work only when so designated in individual specification sections.
 - 2. Do not remove mockups until removal is approved by Architect or upon Final Completion.
 - 3. Where mockup is not permitted to remain as part of the Work, clear area after removal of mockup has been approved by Architect.

1.5 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, or startup of equipment, as applicable, and to initiate instructions when necessary.
- B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- C. Submit report to Architect within 10 days of observation.

1.6 DESIGN DATA AND CALCULATIONS

- A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide design data and calculations.
- B. Accuracy of design data and calculations is the responsibility of the Contractor.

- C. When so specified, prepare design data and calculations under the direction of a professional engineer licensed in the state in which the Project is located. Affix engineer's seal to submittals.
- D. Submit electronically in Adobe PDF format.

1.7 TEST REPORTS AND CERTIFICATIONS

- A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide test reports and manufacturers' certifications.
- B. Indicate that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Submittals may be recent or previous test results on material or Product, but must be acceptable to Architect.
- D. Submit electronically in Adobe PDF format.

1.8 MANUFACTURER'S INSTALLATION INSTRUCTIONS

- A. When Contract Documents require that Products be installed in accordance with manufacturer's instructions:
 - 1. Submit manufacturer's most recent printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, as applicable.
 - a. Submit in quantities specified for Product Data.
 - b. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
 - c. Identify conflicts between manufacturers' instructions and requirements of Contract Documents.
 - 2. Perform installation of Products to comply with requirements of manufacturer's instructions.
 - 3. If installation cannot be performed in accordance with manufacturer's instructions, notify Architect and await instructions.
 - 4. Submit electronically in Adobe PDF format.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 45 23

TESTING AND INSPECTION SERVICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Laboratory selection and payment.
 - 2. Laboratory duties.
 - 3. Contractor's responsibilities.
- B. Related Sections: Individual specifications sections contain specific tests and inspections to be performed.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
 - 2. D3666 - Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials.
 - 3. D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 4. E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
 - 5. E543 - Standard Specification for Agencies Performing Nondestructive Testing.

1.3 QUALITY ASSURANCE

- A. Owner will employ and pay for services of an independent testing laboratory to perform specified testing and inspection.
- B. Contractor shall cooperate with the Testing Laboratory to facilitate performance of its work.
- C. Refer to the Conditions of the Contract for provisions related to special inspections and testing.
- D. Qualifications of Laboratory:
 - 1. Meet requirements of ASTM [C1077] [D3666] [D3740] [E329] [and] [E543].
 - 2. Authorized to operate in State in which project is located.

1.4 LABORATORY DUTIES

- A. Cooperate with Architect and Contractor; provide qualified personnel after due notice.
- B. Perform specified inspections, sampling, and testing of materials and methods of construction:

1. Comply with specified standards.
 2. Ascertain compliance or noncompliance of materials with requirements of Contract Documents.
- C. Promptly notify Architect and Contractor] of observed irregularities or deficiencies of Work or products.
- D. Promptly submit written report of each test and inspection; electronically in Adobe PDF format to Architect, Owner, and Contractor.
- E. Each report to include:
1. Date issued.
 2. Project title and number.
 3. Testing Laboratory name, address, and telephone number.
 4. Name of Inspector and signature of individual in charge.
 5. Date and time of sampling or inspection.
 6. Record of temperature and weather conditions.
 7. Date of test.
 8. Identification of product and specification section.
 9. Location of sample or test in project.
 10. Type of inspection or test.
 11. Results of tests and compliance or noncompliance with Contract Documents.
 12. Interpretation of test results when requested by Architect or Contractor.
- F. Perform additional tests when required by Architect or Contractor.
- G. Laboratory is not authorized to:
1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Approve or accept any portion of work.
 3. Perform any duties of Contractor.

1.5 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with Laboratory personnel, provide access to Work, and to manufacturer's operations.
- B. When materials require testing prior to being incorporated into Work, secure and deliver to Laboratory adequate quantities of representative samples of materials proposed to be used.
- C. Furnish copies of product test reports as required.
- D. Furnish incidental labor and facilities:
1. To provide access to work to be tested.
 2. To obtain and handle samples at site or at source of product to be tested.
 3. To facilitate inspections and tests.
 4. For safe storage and curing of test samples.
- E. Notify Laboratory sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.

- F. When tests or inspections cannot be performed after such notice, reimburse Owner for Laboratory personnel and travel expenses incurred due to Contractor's negligence.
- G. Make arrangements with Laboratory and pay for additional samples and tests required for Contractor's convenience.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

3.1 TESTING AND INSPECTION SCHEDULE

- A. Fill and Backfill - Section 31 23 00: Perform field in place density tests, ASTM D2922, at following rates; minimum of three tests for each lift or area:
 - 1. Under structures: One test for each 2500 square feet or fraction thereof, per lift.
 - 2. Trench and retaining walls backfill: One test for each 100 linear feet or fraction thereof, per lift.
- B. Load-Bearing Masonry Construction - Section 04 20 00:
 - 1. Masonry units: Inspect masonry units prior to and during installation for compliance with specified requirements.
 - 2. Masonry assemblies: Determine compressive strength of masonry by the prism method, ASTM E447, Method B.
 - 3. Masonry construction:
 - a. Verify dimensions and condition of grout spaces and type, quantity, and placement of reinforcement during installation and just prior to closing of cleanouts.
 - b. Verify type, quantity, and installation of reinforcement, anchors, and ties.
 - c. Inspect placement of grout.
 - 4. Grout: Mold and test one set of compressive strength cubes in accordance with ASTM C1019 for each 2500 square feet of masonry wall area or fraction thereof.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary utilities.
 - 2. Field offices and sheds.
 - 3. Temporary controls.
 - 4. Protection of installed Work.
 - 5. Security.
 - 6. Progress cleaning.
 - 7. Water, erosion, sediment, dust, and mold and mildew control.
 - 8. Access roads and parking areas.
 - 9. Removal.

1.2 REFERENCES

- A. Green Seal, Inc. (GS) 37 - Environmental Standard for Industrial and Institutional Cleaners.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 TEMPORARY ELECTRICITY

- A. Provide temporary electrical service of capacity and characteristics required for construction.
- B. Electrical Contractor shall provide temporary electric service.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.
- D. Maintain distribution system and provide routine repairs.

3.2 TEMPORARY LIGHTING

- A. Provide temporary lighting for construction and security purposes.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lamps and provide routine repairs.

- D. Provide portable lights when required to provide minimum lighting levels necessary for specific work.

3.3 TEMPORARY HEAT

- A. Provide temporary heating devices required to maintain specified ambient temperatures for construction.
- B. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless otherwise indicated in individual specification sections.

3.4 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to facilitate curing of materials, disperse humidity, and prevent accumulations of dust, fumes, vapors, or gases.
- B. Provide temporary fan units as required to maintain clean air for construction.

3.5 TEMPORARY TELEPHONE, FACSIMILE, AND COMPUTER SERVICES

- A. Contractor shall be accessible during normal business hours via mobile telephone with voice mail or an answering service.
- B. Provide temporary telephone service required during construction.
- C. Provide plain paper facsimile machine in Contractor's field office on separate telephone line from Contractor's field telephone.
- D. Provide computer in Contractor's field office with printer, Internet access, scanner, and email service.

3.6 TEMPORARY WATER

- A. Provide temporary water required for construction.
- B. Connect to an existing source for water required for construction.
- C. Costs of water used shall be paid for by the General Contractor.
- D. Extend branch piping and provide temporary hoses so that water is available at locations needed for work.
- E. Protect from freezing.
- F. Maintain distribution system and provide routine repairs.

3.7 TEMPORARY SANITARY FACILITIES

- A. Provide chemical toilets for use during construction.

- B. Permanent toilets may not be used during construction.
- C. Maintain facilities in clean and sanitary condition.

3.8 FIELD OFFICES AND SHEDS

- A. Provide temporary field offices and storage sheds required for construction.
- B. Do not unreasonably encumber site or premises with excess materials or equipment.
- C. Temporary Structures:
 - 1. Portable or mobile buildings, structurally sound, weathertight, with floors raised above ground.
 - 2. Thermal transmission resistance: Compatible with occupancy and storage requirements.
 - 3. Provide connections for utility services when required.
 - 4. Provide steps and landings at entrances.
- D. Field Office:
 - 1. Size required for Contractor's use and to provide space for project meetings.
 - 2. Adequate electrical power, lighting, heating, and cooling to maintain human comfort.
 - 3. Provide facilities for storage of Project Record Documents.
 - 4. Provide thermometer mounted at convenient outside location, not in direct sunlight.

3.9 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to allow Owner's use of site and premises, and to protect existing facilities and adjacent properties from construction operations.
- B. Fencing:
 - 1. Provide temporary fencing for construction operations.
 - 2. Construction: Commercial grade chain link.
 - 3. Height: 6 feet.
 - 4. Locate to protect construction operations, materials, and equipment.
 - 5. Provide vehicular and pedestrian gates as required.
- C. Tree and Plant Protection:
 - 1. Protect existing trees and plants at site that are designated to remain.
 - 2. Employ qualified tree surgeon to remove roots and branches that interfere with construction.
 - 3. Provide temporary barriers to height of 6 feet around individual or groups of trees and plants.
 - 4. Do not permit vehicular traffic, parking, storage of materials, dumping of harmful chemicals or liquids, or standing or continuously running water within root zones.
 - 5. Supervise earthwork operations to prevent damage to root zones.
 - 6. Replace trees and plants that are damaged or destroyed due to construction operations.

3.10 EXTERIOR CLOSURES

- A. Provide temporary weathertight closures for exterior openings to provide acceptable interior working conditions, to allow for temporary heating and maintenance of ambient temperatures required in individual specification sections, to protect the Work, and to prevent entry of unauthorized persons.
- B. Provide access doors with locking hardware.

3.11 PROTECTION OF INSTALLED WORK

- A. Protect installed work from construction operations; provide special protection when required in individual specification sections.
- B. Minimize traffic, storage, and construction activities on roof surfaces. If traffic, storage, or activity is necessary, obtain recommendations for protection from roofing manufacturer.
- C. Prohibit traffic from landscaped areas.

3.12 SECURITY

- A. Provide a project security program, to:
 - 1. Protect the Work, stored products, and construction equipment from theft and vandalism.
 - 2. Prevent entry by unauthorized persons.

3.13 PROGRESS CLEANING

- A. Maintain areas free from waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Provide containers for collection of waste materials, debris, and rubbish; remove and dispose of off site as required by construction activities.
- C. Periodically clean interior areas to provide suitable conditions for finish work.

3.14 TEMPORARY CONTROLS

- A. Water Control:
 - 1. Grade site to drain. Prevent puddling water.
 - 2. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
 - 3. Provide water barriers to protect site from soil erosion.
- B. Erosion and Sediment Control:
 - 1. Plan and execute methods to control surface drainage from cuts, fills, borrow areas, and waste disposal areas. Prevent erosion and sedimentation.
 - 2. Minimize amount of bare soil exposed at any one time.
 - 3. Provide temporary measures such as silt fences, dikes, berms, settlement basins, and drainage systems to prevent water flow and sedimentation.

4. Periodically inspect earthwork to detect erosion and sedimentation; promptly employ corrective measures.
- C. Dust Control:
 1. Provide dust control materials and methods to minimize dust from construction operations.
 2. Prevent dust from dispersing into atmosphere.
- D. Mold and Mildew Control:
 1. Provide continuous measures to prevent formation of mold and mildew in construction.
 2. Do not install materials sensitive to mold and mildew growth until protection can be provided.
 3. Promptly remove and replace materials exhibiting mold and mildew growth.

3.15 ACCESS ROADS AND PARKING AREAS

- A. Construct and maintain temporary roads accessing public thoroughfares to serve construction needs.
- B. Provide for access by emergency vehicles.
- C. Keep fire hydrants and water control valves free from obstruction and accessible for use.
- D. Provide parking facilities for construction personnel. When parking needs exceed on site capacity, provide additional off site facilities.
- E. Maintain existing construction and restore to original or specified condition at completion of Work.

3.16 REMOVAL

- A. Remove temporary utilities, equipment, facilities, and services when construction needs can be met by use of permanent construction or upon completion of Project.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing and permanent facilities used during construction to original or to specified condition.

END OF SECTION

SECTION 01 58 00

PROJECT IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project identification sign.
 - 2. Maintenance and removal.

1.2 QUALITY ASSURANCE

- A. Project Sign:
 - 1. This section pertains to project signs previously installed.
- B. Do not erect other signs at site without Owner's approval, except those required by governing authorities.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Structure and Framing: New lumber, structurally adequate.
- B. Sign Surfaces: Exterior grade plywood with medium density overlay, nominally 3/4 inch thick, standard large sizes to minimize joints.
- C. Rough Hardware: Galvanized steel or aluminum.
- D. Paints: Alkyd type, exterior quality, semi-gloss sheen.

2.2 FABRICATION

- A. Provide sign of construction, design, and content as shown on Drawings.
 - 1. Area: 32 square feet.
 - 2. Bottom edge of sign: 6 feet above ground.
 - 3. Content:
 - a. Project title and logo.
 - b. Owner's name.
 - c. Names and titles of Architect and Consultants.
 - d. Name of Contractor and major Subcontractors.
 - 4. Graphic design, colors, and lettering style: As designated by Architect.

2.3 SIGN LOCATION

- A. Project sign to be located per drawings or as determined by coordination between the General Contractor, Owner and Architect.

PART 3 EXECUTION

3.1 MAINTENANCE

- A. Maintain signs and supports clean. Repair deterioration and damage.

3.2 REMOVAL

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Products.
 - 2. Transportation and handling.
 - 3. Storage and protection.
 - 4. Product options.
- B. Related Sections:
 - 1. Section 01 25 00 - Substitution Procedures.

1.2 PRODUCTS

- A. Provide interchangeable components by the same manufacturer for identical items.
- B. Do not use products containing asbestos or other known hazardous materials.

1.3 TRANSPORTATION AND HANDLING

- A. Coordinate delivery of Products to prevent conflict with Work and adverse conditions at site.
- B. Transport and handle Products in accordance with manufacturer's instructions.
- C. Promptly inspect shipments to ensure that Products comply with requirements of Contract Documents, are undamaged, and quantities are correct.
- D. Provide equipment and personnel to handle products by methods to prevent damage.

1.4 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturer's instructions with manufacturer's seals and labels intact and legible.
- B. Store Products on site unless prior written approval to store off site has been obtained from Owner.
- C. Store Products subject to damage by elements in weathertight enclosures. Maintain temperature and humidity within ranges required by manufacturer's instructions.
- D. Exterior Storage:
 - 1. Store fabricated Products above ground; prevent soiling and staining.
 - 2. Cover products subject to deterioration with impervious sheet coverings; provide ventilation to prevent condensation.
 - 3. Store loose granular materials in well drained area on solid surfaces; prevent mixing with foreign matter.

- E. Arrange storage areas to permit access for inspection. Periodically inspect stored products to verify that products are undamaged and in acceptable condition.

1.5 PRODUCT OPTIONS

- A. Products specified by reference standard only:
 - 1. Select any Product meeting the specified standard.
 - 2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.
- B. Products specified by naming two or more acceptable Products: Select any named Product.
- C. Products specified by stating that the Contract Documents are based on a Product by a single manufacturer followed by the statement "Equivalent products by the following manufacturers are acceptable":
 - 1. Select the specified Product or a Product by a named manufacturer having equivalent or superior characteristics to the specified Product and meeting the requirements of the Contract Documents.
 - 2. If the specified Product is not selected, submit Product Data to substantiate compliance of proposed Product with specified requirements.
 - 3. The specified Product establishes the required standard of quality.
- D. Products specified by naming one or more Products followed by "or approved substitute" or similar statement:
 - 1. Submit a substitution request under provisions of Section 01 25 00 for Products not listed.
 - 2. The specified Product establishes the required standard of quality.
- E. Products specified by naming one or more Products or manufacturers followed by the statement "Substitutions: Under provisions of Division 01":
 - 1. Submit a substitution request under provisions of Section 01 25 00 for Products not listed.
 - 2. The specified Product establishes the required standard of quality.
- F. Products specified by naming one Product followed by the statement "Substitutions: Not permitted": Substitutions will not be allowed.
- G. Products specified by required performance or attributes, without naming a manufacturer or Product:
 - 1. Select any Product meeting specified requirements.
 - 2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 71 23

FIELD ENGINEERING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Survey and field engineering.
 - 2. Submittals.
 - 3. Records.
- B. Contractor shall provide and pay for field engineering services required for Project:
 - 1. Survey work required in execution of Work.
 - 2. Other professional engineering services specified or required to execute Contractor's construction methods.

1.2 QUALIFICATIONS

- A. Technician: Qualified, experienced instrument technician.
- B. Surveyor: Qualified land surveyor, licensed in State in which project is located.
- C. Engineer: Registered professional engineer of discipline required for specific service on Project. Licensed in State in which project is located.

1.3 SUBMITTALS

- A. Submit documentation to verify accuracy of field engineering work upon Architect's request.
- B. Submit certification that elevations and locations of improvements are in conformance with Contract Documents.

1.4 SURVEY REFERENCE POINTS

- A. Existing horizontal and vertical control points for project are those designated on Drawings.
- B. Locate, verify, and protect control points prior to beginning Work; preserve permanent reference points during construction.

1.5 PROJECT SURVEY REQUIREMENTS

- A. Establish minimum of two permanent bench marks on site, referenced to survey control points. Record locations on Project Record Documents.
- B. Establish lines and levels, locate and lay out, by instrumentation:
 - 1. Site improvements:
 - a. Stakes for grading, fill, and topsoil placement.
 - b. Utility slopes and invert elevations.

2. Building foundation and column locations, floor elevations, and other controlling dimensions.
 3. Controlling lines and levels required for mechanical and electrical trades.
- C. Verify property corners, easements, building setbacks, and horizontal control dimensions with information contained in Contract Documents.
- D. Promptly notify Architect of any errors or discrepancies noted; await instructions prior to proceeding with Work.

1.6 RECORDS

- A. Maintain accurate log of control and survey work.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Requirements and limitations for cutting and patching of work.
- B. Related sections:
 - 1. Section 01 25 00 - Substitution Procedures.

1.2 SUBMITTALS

- A. Submit written request in advance of executing cutting or alteration that affects:
 - 1. Work of Owner or separate contractor.
 - 2. Structural integrity of project.
 - 3. Integrity or effectiveness of weather exposed or moisture resistant elements or systems.
 - 4. Efficiency, operational life, maintenance, or safety of operational elements.
 - 5. Visual qualities of sight exposed elements.
- B. Include in Request:
 - 1. Identification of project.
 - 2. Description of work affected.
 - 3. Necessity for cutting or patching.
 - 4. Effect of cutting or patching on work of Owner or separate contractor, or on structural, weatherproof, or visual integrity of project.
 - 5. Description of proposed work:
 - a. Scope of cutting and patching.
 - b. Subcontractor and trades to execute work.
 - c. Products proposed to be used.
 - d. Extent of refinishing.
 - 6. Alternate to cutting and patching.
 - 7. Cost proposal, if applicable.
 - 8. Written permission of any separate contractor whose work will be affected.
- C. If conditions of work or schedule necessitate a change of material from that originally installed, submit substitution request in accordance with Section 01 25 00.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 PREPARATION

- A. Examine existing conditions of work, including elements subject to movement or damage during cutting and patching.

- B. After uncovering work, examine conditions affecting installation of new products or performance of work.
- C. Provide protection for other portions of project.
- D. Provide protection from elements.

3.2 CUTTING AND PATCHING

- A. Execute cutting to include excavating, fitting, and patching of Work required to:
 - 1. Make several parts fit properly.
 - 2. Uncover work to provide for installation of ill timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to requirements of Contract Documents.
 - 5. Provide routine penetrations of nonstructural surfaces for installation of piping and electrical conduit.
- B. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances, and finishes.
- C. Execute cutting and demolition by methods that will prevent damage to other work, and will provide proper surfaces to receive installation of repairs and new work.
- D. Execute excavating and backfilling by methods that will prevent damage to other Work, and will prevent settlement.
- E. Employ original installer or fabricator to perform cutting and patching for:
 - 1. Weather exposed or moisture resistant elements.
 - 2. Sight exposed finished surfaces.
- F. Restore work that has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.
- G. Refinish entire surfaces as necessary to provide an even finish:
 - 1. Continuous surfaces: To nearest intersections.
 - 2. Assembly: Refinish entirely.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Closeout procedures.
 - 2. Final cleaning.
 - 3. Adjusting.
 - 4. Project record documents.
 - 5. Operation and maintenance data.
 - 6. Warranties.
 - 7. Spare parts and maintenance materials.
 - 8. Starting of systems.
 - 9. Demonstration and instructions.

1.2 CLOSEOUT PROCEDURES

- A. Final Inspection:
 - 1. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with the Contract Documents and ready for Architect's inspection.
 - 2. If Architect performs reinspection due to failure of Work to comply with claims of status of completion made by Contractor, Owner will compensate Architect for such additional services and will deduct the amount of such compensation from final payment to Contractor.
- B. Submit final Application for Payment showing original Contract Sum, adjustments, previous payments, retainage withheld from previous payments, and sum remaining due.
- C. Closeout Submittals:
 - 1. Evidence of compliance with requirements of governing authorities.
 - 2. Certificate of Occupancy.
 - 3. Project Record Documents.
 - 4. Operation and Maintenance Data.
 - 5. Warranties.
 - 6. Keys and keying schedule.
 - 7. Spare parts and maintenance materials.
 - 8. Evidence of payment of Subcontractors and suppliers.
 - 9. Final lien waiver.
 - 10. Certificate of insurance for products and completed operations.
 - 11. Consent of Surety to final payment.
- D. Owner will occupy all portions of the building as specified in Section 01 10 00.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean surfaces exposed to view:
 - 1. Clean glass.
 - 2. Remove temporary labels, stains and foreign substances.
 - 3. Polish transparent and glossy surfaces.
 - 4. Vacuum carpeted surfaces; damp mop hard surface flooring.
- C. Clean equipment and fixtures to a sanitary condition.
- D. Clean or replace filters of operating equipment.
- E. Clean debris from roofs and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 ADJUSTING

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

1.5 PROJECT RECORD DOCUMENTS

- A. Maintain following record documents on site; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Material Safety Data Sheets.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. Make entries neatly and accurately.
- E. Label each set or volume with title "PROJECT RECORD DOCUMENTS", project title, and description of contents.
 - 1. Organize contents according to Project Manual table of contents.
 - 2. Provide table of contents for each volume.
- F. Drawings: Mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Drawings.

- G. Specifications: Mark each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and Modifications.
- H. Shop Drawings: Mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Shop Drawings.
- I. Submit one hard copy and one electronic copy in PDF Format.

1.6 OPERATION AND MAINTENANCE DATA

- A. Identify as "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.
- B. Contents:
 - 1. Directory: List names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Operation and maintenance instructions: Arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
 - 3. Project documents and certificates including:
 - a. Shop drawings and product data.
 - b. HVAC balance reports.
 - c. Certificates.
 - d. Copies of warranties and bonds.
- C. Submittal:
 - 1. Submit one Hard copy and Submit electronically in Adobe PDF format at least 15 days prior to final inspection.
 - 2. Architect will notify Contractor of any required revisions after final inspection.
 - 3. Revise content of documents as required prior to final submittal.
 - 4. Submit one hard copy of revised documents and one copy electronically in Adobe PDF format within 10 days after final inspection.

1.7 WARRANTIES

- A. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.
- B. Include Table of Contents.
- C. Submit one hard copy and one copy electronically in Adobe PDF format along with final Application for Payment.
- D. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.8 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to Project site in location as directed; obtain receipt prior to final payment.

1.9 STARTING OF SYSTEMS

- A. Notify Owner and Architect at least seven days prior to startup of each system or piece of equipment.
- B. Prior to beginning startup verify that:
 - 1. Lubrication has been performed.
 - 2. Drive rotation, belt tension, control sequences, tests, meter readings, and electrical characteristics are within manufacturer's requirements.
 - 3. Utility connections and support components are complete and tested.
- C. Execute start-up under supervision of applicable manufacturer's representative or [Contractor's] [Construction Manager's] personnel in accordance with manufacturers' instructions.
- D. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to startup, and to supervise placing equipment or system in operation.
- E. Submit written report that equipment or system has been properly installed and is functioning correctly.

1.10 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

- C. Utilize Operation and Maintenance Manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed upon times, at equipment location.
- E. Prepare and insert additional data in Operation and Maintenance Manuals when need for additional data becomes apparent during instruction.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 04 20 00 – UNIT MASONRY

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. Unit Masonry Clay Face Bricks.
- 2. Mortar and grout.
- 3. Steel reinforcing bars.
- 4. Masonry joint reinforcement.
- 5. Ties and anchors.
- 6. Embedded flashing.
- 7. Miscellaneous masonry accessories.

B. Products installed but not furnished in this Section include the following:

- 1. Other products indicated on the Drawings as being built into masonry.

C. Related Sections:

- 1. Section 03 30 00 – Cast -in - Place Concrete.
- 2. Section 06 11 20 – Wood Framing and Sheathing.
- 3. Section 07 92 00 – Joint Sealants.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Unit masonry Clay Face Brick: Show size, profile and coursing.
 - 3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
 - 1. Concrete masonry units
 - 2. Unit masonry clay face brick
 - 3. Colored mortar.
 - 4. Weep holes/vents.
- D. Samples for Verification: For each type and color of the following:
 - 1. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 - 2. Weep holes and vents.
 - 3. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - b. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - c. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.

5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of typical wall area of each type.
 2. Build mockups for typical exterior wall in sizes approximately 60 inches long by 60 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in each mockup.
 - b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - c. Include veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean exposed faces of mockups with masonry cleaner as indicated.
5. Use mockup to test water repellents and graffiti resistant coatings.
6. Protect accepted mockups from the elements with weather-resistant membrane.
7. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, testing and inspecting agency representative, installers whose work interfaces with or affects masonry.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and the following:
1. Do not perform masonry work when atmospheric temperature is below 40°F or is predicted to fall below 40°F or rise above 90°F within 72 hours without taking following precautions:
 - a. Work shall conform to prior referenced standard. Masonry temperature shall not be less than 20°F when laid; Remove visible ice on masonry units. Heat mortar and maintain above freezing until used in masonry.
 - b. 20°F - 25°F: Provide heat source and wind breaks on both sides of masonry under construction.
 - c. Below 20°F: Provide enclosure for masonry under construction and heat source to maintain temperature above 32°F.
 - d. 40°F to 32°F Completed Masonry: Protect completed masonry with cover for 24 hours after construction.
 - e. 32° F to 25°F Completed Masonry: Completely enclose completed masonry with cover for 24 hours after construction.
 - f. 25° F to 20°F Completed Masonry: Protect completed masonry with insulating cover for 24 hours after construction.
 - g. Below 20°F Completed Masonry: Provide enclosure and supplemental heat as required to maintain masonry temperature above 32°F for 24 hours after construction.
 - h. Accelerating admixtures may be used only with non-load bearing masonry.
 2. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for corners, and other special conditions.
 - 2. Provide square units for outside corners unless otherwise indicated.
 - 3. Unit Compressive Strength: Provide units with a minimum average net-area compressive strength of 2000 psi at 28 days unless otherwise noted.
 - 4. Weight Classification: Normal weight below grade and light weight above grade, unless otherwise indicated.
 - 5. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - a. 4 inches (102 mm) nominal; 3-5/8 inches (92 mm) actual.
 - b. 6 inches (152 mm) nominal; 5-5/8 inches (143 mm) actual.
 - c. 8 inches (203 mm) nominal; 7-5/8 inches (194 mm) actual.
 - d. 10 inches (254 mm) nominal; 9-5/8 inches (244 mm) actual.
 - e. 12 inches (305 mm) nominal; 11-5/8 inches (295 mm) actual.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

E. Aggregate for Grout: ASTM C 404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

G. Water: Clean and potable, free of deleterious materials which would impair strength or bond, or which may cause efflorescence.

2.4 REINFORCING STEEL

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2.5 JOINT REINFORCEMENT

A. General: ASTM A951 and as follows:

1. Stainless-steel wire, ASTM A580, Type 304 or 316.

B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet (3 m), with prefabricated corner and tee units, and complying with requirements indicated below:

1. Wire Diameter for Side Rods: 0.1875 inch (4.8 mm).
2. Wire Diameter for Cross Rods: 0.1483 inch (3.8 mm).

C. For single-wythe masonry, provide type as follows with single pair of side rods:

1. Ladder design with perpendicular cross rods spaced not more than 16 inches (407 mm) o.c.
2. Product: D/A 320 Ladur by Dur-O-Wall, Inc. or equal.

2.6 TIES AND ANCHORS, GENERAL

A. Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

- B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A82; with ASTM A153, Class B-2 coating.
- C. Stainless-Steel Wire: ASTM A580/A580M, Type 304 or 316.
- D. Steel Sheet, Galvanized after Fabrication: ASTM A366/A366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A153.
- E. Stainless-Steel Sheet: ASTM A666, Type 304 or 316.
- F. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

2.7 BENT WIRE TIES

- A. Rectangular units with closed ends and not less than 4 inches (100 mm) wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 - 1. Where wythes are of different materials, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches (32 mm).
- B. Wire: Fabricate from 1/4 inch (6.4 mm) diameter, stainless-steel wire.

2.8 MISCELLANEOUS ANCHORS

- A. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
 - 1. Type: Chemical anchors.
 - 2. Type: Expansion anchors.
 - 3. Type: Undercut anchors.
 - 4. Corrosion Protection: hot-dipped galvanized components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A167 or ASTM A276, Type 304 or 316, for anchors.
 - 5. For Postinstalled Anchors in Concrete: See structural drawings
 - 6. For Postinstalled Anchors in Grouted Masonry Units: See structural drawings

2.9 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
 - 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cheney Flashing Company; Cheney Flashing (Dovetail).
 - 2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
 - 3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.
 - 4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 - 5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 6. Fabricate metal drip edges for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
 - 7. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees.
 - 8. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 3/8 inch to form a stop for retaining sealant backer rod.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
- 1. Rubberized-Asphalt Flashing: Manufacturer's standard composite flashing product consisting of 32 mil thick pliable and highly adhesive rubberized asphalt compound bonded completely and integrally to 8 mil thick, high density, cross laminated polyethylene film to produce an overall thickness of 40 mils. Provide termination mastic and accessories as recommended by membrane manufacturer.
 - 2. Products:
 - a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - b. Dayton Superior Corporation; Dur-O-Barrier-44.
 - c. Grace Construction Products; Perm-A-Barrier Wall Flashing.
 - d. Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
 - e. Hohmann & Barnard, Inc.; Textroflash
 - 3. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- C. Reglet and Counter Flashing System:
- 1. Stainless Steel: Type 304 alloy, meeting ASTM A666-96a, 0.020" thick, 2B finish.
 - 2. Construct with pre-fabricated corners.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Frye Reglet Corp.; MA Masonry Reglet

D. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use flexible flashing.

E. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
3. Elastomeric Sealant: ASTM C 920, chemically curing urethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

1. Provide one of the following or equal:
 - a. Rapid Expansion Joint; Dur-O-Wal, Inc.
 - b. No. 26020; National Wire Products Industries, Inc.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated

1. Provide one of the following or equal:
 - a. D/A 2001; Dur-O-Wall, Inc.
 - b. No. 26021; National Wire Products Industries, Inc.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use one of the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Building Products Inc.; Mortar Maze weep vent.
 - 2) Blok-Lok Limited; Cell-Vent.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 4) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 5) Hohmann & Barnard, Inc.; Quadro-Vent.
 - 6) Wire-Bond; Cell Vent.
- E. Cavity Drainage Material: Open polyethylene mesh thickness required to fill cavity space and shaped to ensure moisture drainage to cavity weeps.
 1. Advanced Building Products, Inc. – Mortar Break DT
 2. Mortar Net USA, Ltd. – MortarNet with Insect Barrier
 3. Approved Equal.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.187-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 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. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. ProSoCo, Inc.; Sure Klean 101 Lime Solvent
 - b. EaCo Chem, Inc.; NMD 80

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For reinforced masonry, use Type S.
 - 3. For exterior, above-grade, non-load-bearing walls and parapet walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 4. Mortar for setting cast stone, use Type S.
 - 5. Mortar for pointing cast stone, use Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.

- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

D. Grout all cells below grade, and cells as indicated, solid.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on the drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
 - 1. At exterior frames, insert extruded polystyrene board insulation around perimeter of frame in thickness indicated, but not less than 3/4 inch (19 mm) to act as a thermal break between frame and masonry.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Set cast-stone units and trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 - 1. For brick veneer and thin brick, install with grapevine mortar/grout joints.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- E. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. of wall area spaced not to exceed 36 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart

around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

- a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement to allow for differential movement regardless of whether bed joints align.
 3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than 8 inches clear horizontally and 16 inches clear vertically.
 4. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
1. On surfaces of concrete block backup walls facing cavities, strike joints flush to meet requirements for application of air barrier or other membrane.
 2. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.
- D. Install cavity drainage mesh material full depth of cavity.
- E. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.
- F. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
1. Provide continuity with joint reinforcement at corners by using prefabricated "L" units as well as masonry bonding.
- G. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
1. Provide individual metal ties not more than 8 inches (203 mm) o.c.
 2. Provide continuity with joint reinforcement by using prefabricated "T" units.

3. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
 1. Place joints as indicated on the drawings, or as directed by Architect. Where not indicated, joints are to be the lesser of: length to height ratio of 1.5, or 25' maximum on center.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick as follows:
 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 3. Build in compressible joint fillers where indicated.

4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches, and 1-1/2 inches into the inner wythe.
 3. At masonry-veneer walls, extend flashing from exterior face of veneer, through the veneer, up face of concrete block at least 8 inches (200 mm), and behind rigid foam insulation and air-infiltration barrier/building paper, lapping at least 4 inches.
 4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
 8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
 2. Space weep holes 16 inches o.c. unless otherwise indicated.
 3. Place cavity drainage mesh immediately above flashing in cavities.
 4. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
 5. Trim wicking material flush with outside face of wall after mortar has set.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections:
1. Level 1 special inspections according to the "International Building Code."

- a. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - b. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - c. Place grout only after inspectors have verified proportions of site-prepared grout.
 2. Site structural observation (not considered part of special inspections) of masonry work is required per ACI 530.1-08/ASCE 6-08/TMS 602-08
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.
- 3.12 REPAIRING, POINTING, AND CLEANING
- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
 - B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
 - C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
 - D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
 8. Clean stone trim to comply with stone supplier's written instructions.
 9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."
- E. Waste Water Control: Control waste water runoff from masonry cleaning methods, as required by local jurisdiction to prevent contamination of surface water and groundwater. Collect water and sample to determine appropriate method of disposal.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal: Refer to Specification 017419 Construction Waste Management and Disposal.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 04 21 00
CLAY UNIT MASONRY

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. Work Included:
 - a. Brick
 - b. Reinforcement, Anchorage, and Accessories
 - c. Flashing
- B. Related Sections:
 - 1. Section 05 12 00 - Structural Steel Framing: Product requirements for steel anchors for placement by this section.
 - 2. Section 05 50 00 - Metal Fabrications: Product requirements for loose steel lintels and fabricated steel items for placement by this section.
 - 3. Section 07 21 00 – Thermal Insulation: Board insulation for cavity spaces.
 - 4. Section 07 62 00 - Sheet Metal Flashing and Trim: Product requirements for reglets for flashings for placement by this section.
 - 5. Section 07 90 00 - Joint Protection: Rod and sealant at control and expansion joints.

1.3 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 530 - Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1 - Specifications for Masonry Structures.
- B. ASTM International:
 - 1. ASTM A153/A153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - 3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - 4. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
 - 5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 6. ASTM A951 - Standard Specification for Masonry Joint Reinforcement.
 - 7. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

8. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
 9. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 10. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
 11. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 12. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
 13. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- C. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- D. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

- A. Product Data:
1. Submit data for masonry units, wall ties, anchors and other accessories.
 2. Indicate initial rate of absorption for clay and shale brick.
- B. Samples: Submit four samples of face brick to illustrate color, texture and extremes of color range.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.
- B. Surface Burning Characteristics:
1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation insert.
- D. Perform Work in accordance with State of Kentucky and local county standards.
- E. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 MOCKUP

- A. Construct masonry wall mockup, as defined on the Masonry Mockup Exhibit at the back of this Specification Section, including masonry, mortar and accessories, structural backup, wall openings, flashings, copings, wall insulation and vapor retarder.
- B. Mockup shall be minimum 4'-0" wide x 6'-0" high and comprise the major components and material depicted on the drawings.
- C. Locate where directed by Architect/Engineer.
- D. Remove mockup when directed by Architect/Engineer.

1.8 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Accept units on site. Inspect for damage.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- B. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

1.11 COORDINATION

- A. Coordinate masonry work with installation of window and door anchors.

PART 2 PRODUCTS

2.1 BRICK

- A. Brick Veneer (Modular)
 - 1. Brick shall match existing administration building located at 10 North High Street, South Lebanon, Ohio.
 - 2. Size: 2-1/4" x 3-5/8" x 7-5/8"
 - 3. ASTM C216

4. Grade: SW
5. Type: FBS
6. Color: TBD
7. Series/Collection: TBD
8. Surface texture: TBD
9. Provide solid units where holes would otherwise occur on exposed faces.

2.2 MORTAR AND GROUT MATERIALS

- A. Manufacturers:
 1. Lehigh Portland Cement Company.
 2. The Riverton Corporation.
 3. Glen-Gery Brick.
 4. Substitutions per Section 01 25 00
- B. All mortar shall be Type N as defined by the Ohio Building Code.
- C. Pre-mixed mortar, if used, shall conform to ASTM C387, using gray cement.
- D. Portland Cement: ASTM C150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated. Grout must be Type I only.
- E. Hydrated Lime: ASTM C207, Type S.
- F. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C150, Type I or Type III, and hydrated lime complying with ASTM C207, Type S.
- G. Aggregate for Mortar: ASTM C144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or manufactured sand made from crushed stone.
 2. White-Mortar Aggregates: Natural white sand or crushed white stone.
- H. Aggregate for Grout: ASTM C404. (For course grout maximum size is 1/2 inch)
- I. Cold Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 1. Products:
 - a. Addiment Incorporated; Mortar Kick.
 - b. The Euclid Chemical Company; Accelguard 80.
 - c. Grace Construction Products; Morset.
 - d. Sonneborn; Trimix-NCA.
- J. Water: Potable.
- K. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
 2. Limit cementitious materials in mortar to Portland cement and lime.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- L. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- M. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For masonry below grade or in contact with earth, use Type S.
 2. For reinforced masonry, use Type S.
 3. For exterior and interior above-grade, load-bearing, use type S.
 4. For non load bearing exterior veneer, use Type N.
 5. For interior non-load-bearing partitions and for other non-load-bearing applications where another type is not indicated, use Type N.
- N. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

2.3 REINFORCEMENT

- A. Single Wythe Joint Reinforcement: ASTM A951; ladder type; steel; 0.148 inch diameter side rods with 0.148 inch diameter cross ties; hot dip galvanized.
- B. Multiple Wythe Joint Reinforcement: ASTM A951; ladder type; steel; without moisture drip; adjustable type; 0.148 inch diameter side rods with 0.148 inch diameter cross ties; hot dip galvanized.
- C. Reinforcing Steel: As shown on drawings.

2.4 TIES AND ANCHORS

- A. Manufacturers:
1. Hohmann & Barnard, Inc.
 2. Dur-O-Wall, Inc.
 3. Masonry Reinforcing Corporation of America.
 4. Substitutions per Section 01 2500
- B. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82; with ASTM A153/A153M, Class B-2 coating.
 2. Steel Plates, Shapes and Bars: ASTM A36/A36M.

- C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8 inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
 - 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 - 2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
 - 3. Wire: Fabricate from 3/16 inch diameter, hot-dip galvanized steel wire.
- E. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4 inch diameter, hot-dip galvanized steel wire.
 - 2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 1/4 inch diameter, hot-dip galvanized steel wire.
- F. Partition Top Anchors: 0.097 inch thick metal plate with 3/8 inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- G. Rigid Anchors: Fabricate from steel bars 1 1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins, unless otherwise indicated.
 - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

2.5 MISCELLANEOUS ANCHORS

- A. Manufacturers:
 - 1. Hohmann & Barnard, Inc.
 - 2. Dur-O-Wall, Inc.
 - 3. Masonry Reinforcing Corporation of America.
 - 4. Substitutions per Section 01 2500
- B. Anchor Bolts: Headed steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153/A153M, Class C; of dimensions indicated.

2.6 EMBEDDED FLASHING MATERIALS

- A. Flexible Flashing: For flashing not exposed to the exterior, use the following unless otherwise indicated:
 - 1. Rubberized-Asphalt Flashing: Manufacturer's standard composite flashing product consisting of 32 mil thick pliable and highly adhesive rubberized asphalt compound bonded completely and integrally to 8 mil thick, high density, cross

laminated polyethylene film to produce an overall thickness of 40 mils. Provide termination mastic and accessories as recommended by membrane manufacturer.

2. Products:

- a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
- b. Dayton Superior Corporation; Dur-O-Barrier-44.
- c. Grace Construction Products; Perm-A-Barrier Wall Flashing.
- d. Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
- e. Hohmann & Barnard, Inc.; Textroflash.
- f. Substitutions per Section 01 25 00

- B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Preformed Control Joints: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- B. Joint Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from urethane.
- C. Cavity Drain Material: Open polyethylene mesh thickness required to fill cavity space, and shaped to ensure moisture drainage to cavity weeps.
1. Advanced Building Products, Inc.
 2. Mortar Net USA, Ltd.
 3. Dur-O-Wal, Inc.
 4. Substitutions per Section 01 25 00
- D. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.
- E. Weeps: vents with sloping louvers.
- F. Cavity Vents: Aluminum; insect resistant.
- G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- H. Steel Lintels: size as indicated on Drawings, hot-dip galvanized.
1. All exposed steel lintels shall be painted per specification Division 09.

2.8 MASONRY CLEANERS

- A. Manufacturers:
1. Diedrich Technologies, Inc.

2. EaCo Chem, Inc.
 3. ProSoCo, Inc.
 4. Substitutions per Section 01 2500
- B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Test a 10 foot x 10 foot area and evaluate for 2 weeks prior to continuing.

2.9 SOURCE QUALITY CONTROL

- A. Test brick efflorescence in accordance with ASTM C67. Brick rated greater than "slightly effloresced" is not acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other sections of work are properly sized and located.
- C. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other sections.
- B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.
- C. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.
- C. Coursing of Brick Units:
 1. Bond: Running
 2. Coursing: Three units and three mortar joints to equal 8 inches.
 3. Mortar Joints: Concave.
- D. Placing and Bonding:

1. Lay solid masonry units in full bed of mortar, with full head joints.
 2. Lay hollow masonry units with face shell bedding on head and bed joints.
 3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
 4. Remove excess mortar as work progresses.
 5. Interlock intersections and external corners.
 6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
 7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
 8. Isolate masonry from vertical structural framing members with movement joint as indicated on Drawings.
 9. Isolate top of non-load-bearing masonry from horizontal structural framing members and slabs or decks with compressible joint filler.
- E. Weeps and Vents: Furnish weeps and vents in outer wythe at intervals indicated on drawings above through-wall flashings, lintels and at bottom of walls.
- F. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor retarder adhesive.
1. Install cavity drain material continuously at bottom of each cavity above through wall flashing.
- G. Masonry Flashings:
1. Extend flashings horizontally through outer wythe at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls and turn down on outside face to form drip.
 2. Turn flashing up minimum 8" and bed into mortar joint of masonry and seal to backing.
 3. Lap end joints minimum 6" and seal watertight.
 4. Turn flashing, fold, and seal at corners, bends, and interruptions.
 5. Provide complete end dam flashing at all jamb opening conditions.
- H. Lintels:
1. Install steel lintels over openings per drawings.
 2. Do not splice reinforcing bars.
 3. Support and secure reinforcing bars from displacement.
 4. Place and consolidate grout fill without displacing reinforcing.
 5. Maintain minimum bearing on each side of opening as shown on drawings.
- I. Control and Expansion Joints:
1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
 - a. Exterior Walls: 20 feet on center and within 24 inches on one side of each interior and exterior corner.

- b. Interior Walls: 30 feet on center.
 - c. At changes in wall height.
 - 2. Do not continue horizontal joint reinforcement through control and expansion joints.
- J. Built-In Work:
 - 1. As work progresses, install built-in frames, anchor bolts, plates and other items to be built-in the work and furnished by other sections.
 - 2. Install built-in items plumb and level.
 - 3. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout or mortar.
 - 4. Do not build in materials subject to deterioration.
- K. Cutting And Fitting:
 - 1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
 - 2. Obtain Architect/Engineer's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.4 FIELD QUALITY CONTROL

- A. Brick Units: Test each type in accordance with ASTM C67, 5 random units for each 50,000 units installed.
- B. Concrete Masonry Units: Test each type in accordance with ASTM C140.

3.5 CLEANING

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

3.6 PROTECTION OF FINISHED WORK

- A. Protect exposed external corners subject to damage.
- B. Protect base of walls from mud and mortar splatter.
- C. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.
- D. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

END OF SECTION

SECTION 04 72 00
CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast stone water tables and caps.
2. Anchors and supports.
3. Accessories.

B. Related Requirements:

1. Section 04 20 00 - Unit Masonry: Backup for cast stone veneer.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Product requirements for reglets for flashings for placement by this Section.
3. Section 07 90 00 - Joint Protection: Rod and sealant at control joints.

1.2 DEFINITIONS

A. Cast Stone: An architectural precast concrete building unit manufactured to simulate natural cut stone.

B. Quirk: A groove separating a bead or other molding from adjoining members.

C. Allowance Includes:

1. Furnishing cast stone.
2. Installation.

1.3 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures and Related Commentaries.

B. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
4. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

5. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
7. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
8. ASTM C33 - Standard Specification for Concrete Aggregates.
9. ASTM C150 - Standard Specification for Portland Cement.
10. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
11. ASTM C426 - Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units.
12. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
13. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
14. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
15. ASTM C666 - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
16. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
17. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
18. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.
19. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
20. ASTM C1194 - Standard Test Method for Compressive Strength of Architectural Cast Stone.
21. ASTM C1195 - Standard Test Method for Absorption of Architectural Cast Stone.
22. ASTM C1364 - Standard Specification for Architectural Cast Stone.
23. ASTM D1729 - Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials.
24. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

C. Cast Stone Institute:

1. Technical Manual.

1.4 COORDINATION

- A. Section 01 31 00 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with masonry backup, masonry veneer, wood-framed backup, installation of window and door anchors and embedded metals.

1.5 PREINSTALLATION MEETINGS

- A. Section 01 31 00 - Administrative Requirements: Requirements for preinstallation meeting.
- B. Convene minimum two weeks prior to commencing Work of this Section.

1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for cast stone units, wall ties, anchors, embedded metals and other accessories.
- C. Shop Drawings:
 - 1. Indicate cast stone layout, profiles, cross sections, reinforcement, exposed faces, joint arrangement, anchoring methods, and anchors.
 - 2. Indicate cast stone types and locations.
- D. Samples:
 - 1. Submit two of each cast stone item, 12" x 24" in size, illustrating profiles, finish, texture, and color range.
 - 2. Submit one of each anchor, illustrating material, configuration, and finish.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Test and Evaluation Reports: Indicate concrete mix design compressive strength and water absorption.
- G. Manufacturer's Instructions: Submit instructions for anchor attachment, cast stone cleaning, and special Project installation conditions.
- H. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
- I. Qualifications Statements:
 - 1. Submit qualifications for manufacturer and installer.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Requirements for maintenance materials.
- B. Extra Stock Materials:
 - 1. Furnish two of each type of cast stone units.

1.8 QUALITY ASSURANCE

- A. Perform Work according to ACI 530/530.1 and according to Cast Stone Institute Technical Manual.
- B. Maintain one copy of each standard affecting the Work of this Section on-site.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' documented experience.
 - 1. Manufacturing plant certified by the Cast Stone Institute.
- B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Mark cast stone units with same identification marks as shown on Shop Drawings.
- C. Inspection: Accept cast stone on-Site in manufacturer's protective packaging, and inspect for damage.
- D. Store materials according to manufacturer's instructions.
- E. Store cast stone on-Site covered and elevated above grade.
- F. Protect cast stone from damage, soiling, and staining.
- G. Provide ventilation to prevent condensation from forming on cast stone.

1.11 AMBIENT CONDITIONS

- A. Cold Weather Requirements: According to ACI 530/530.1, when ambient temperature or temperature of masonry units is less than 40 degrees F see structural general material notes for masonry construction.
- B. Hot Weather Requirements: According to ACI 530/530.1, when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph See structural general material notes for masonry construction.

PART 2 - PRODUCTS

2.1 CAST STONE

- A. Manufacturers:
 - 1. Furnish materials according to Cast Stone Institute and ACI 530/530.1 standards.
 - 2. Basis of Design: Custom Cast Stone. www.customcaststone.com
 - 3. Indiana Limestone.
 - 4. Rock Cast

B. Description:

1. Comply with ASTM C1364.
2. Architectural Cast Stone Units Fabrication Method: Dry casting or wet casting As recommended by manufacturer.
3. Finish: Fine-grained texture simulating natural cut stone.

2.2 PERFORMANCE AND DESIGN CRITERIA

- A. Color and Finish: Selected by architect from full range of colors and textures.

2.3 MATERIALS

A. Portland Cement:

1. Comply with ASTM C150, Type I – Normal or Type III - High Early Strength.
2. Color: White.

- B. Blended and Hydraulic Cement: Comply with ASTM C595 and ASTM C1157.

C. Coarse Aggregates:

1. Comply with ASTM C33, except grading requirements.
2. Granite, quartz, or limestone.

D. Fine Aggregates:

1. Comply with ASTM C33, except grading requirements.
2. Manufactured or natural sand.

E. Coloring Pigments:

1. Comply with ASTM C979.
2. Inorganic iron oxide.

F. Chemical Admixtures:

1. Air Entraining: Comply with ASTM C260.
2. Water Reducing, Retarding, and Accelerating: Comply with ASTM C494.

- G. Fly Ash: Comply with ASTM C618.

- H. Blast Furnace Slag: Comply with ASTM C989.

- I. Water: Potable.

- J. Reinforcing Steel: ASTM A615.

1. Description: Deformed billet bars.
2. Yield Grade: 60 ksi.

- 3. Finish: Per manufacturer preference

K. Welded Wire Fabric: ASTM A185.

L. Fiber Reinforcement: ASTM C1116.

2.4 FABRICATION

A. Thickness: As indicated on drawings.

B. Size:

- 1. As indicated on Drawings.
- 2. Edges as indicated on Drawings.

C. Use rigid molds, constructed to maintain cast stone units uniform in shape, size, and finish.

D. Forming:

- 1. Form units to length required for joint layout as indicated on Drawings.
- 2. Field cutting to length is not permitted.

E. Reinforce units according to ASTM C1364 for safe handling, and as indicated on Drawings, to resist structural loads.

- 1. Use epoxy-finished reinforcing, if concrete cover over reinforcing is less than 1-1/2 inches thick, including end conditions.

F. Embed anchors and other cast-in items.

G. Form external corners to square joint profile.

H. Slope exposed top surfaces of horizontal sill, coping and balustrade surfaces for natural wash.

I. Drip Slots:

- 1. Form drip slots in bottom surface of exterior units projecting more than 1/2 inch beyond face of wall or as indicated with profiles.
- 2. Size slots not less than 3/8 inch wide and 1/4 inch deep; full width of projection.

J. Curing: Cure units to develop concrete quality and to minimize appearance blemishes, including nonuniformity, staining, and surface cracking.

K. Acid-etch exposed-to-view surfaces to remove cement film and to achieve uniform appearance.

2.5 MIXES

A. Concrete:

1. Compressive Strength:
 - a. Comply with ASTM C1194.
 - b. Minimum 6,000 psi at 28 days.
2. Slump: As determined by manufacturer.
3. Absorption:
 - a. Comply with ASTM C1195.
 - b. Maximum 6 percent for cold water and 10 percent for boiling water, at 28 days.

2.6 ACCESSORIES

- A. Anchors and Supports:
 1. Material: Type 304 stainless steel, Type 316 stainless steel, Steel, or ASTM A36, galvanized after fabrication to ASTM A153, finish.
 2. Sizes and Configurations: As required for vertical and horizontal support of cast stone and resisting specified loads.
- B. Mortar: As specified in Section 040514 - Masonry Mortaring and Grouting.
- C. Cleaning Solution: Acidic detergent type and not harmful to cast stone or adjacent materials.

2.7 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.
- B. Records:
 1. Maintain plant records and quality control program during production of cast stone units.
 2. Make records available to Architect/Engineer and Owner upon request.
- C. Testing:
 1. Test and analyze three random specimens for each 500 cu. ft. of fabricated cast stone units:
 - a. Compressive Strength: Comply with ASTM C1194.
 - b. Cold Water Absorption: Comply with ASTM C1195.
 - c. Resistance to Freezing and Thawing:
 - 1) According to ASTM C666.
 - 2) Maximum Cumulative Percent Mass Loss: Comply with ASTM C1364 5 percent after 300 cycles.
- D. Linear Shrinkage:
 1. Comply with ASTM C426.
 2. Not more than 0.065 percent.

- E. Inspect and test for color variation.
- F. Visually inspect color differences between fabricated units and approved sample, according to ASTM D1729.
- G. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 - 1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 77 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that field conditions are acceptable and are ready to receive Work.
- C. Verify that items provided by other Sections of Work are properly sized and located.
- D. Verify elevations, dimensions, and alignment of foundations and other supporting construction prior to beginning Work.

3.2 PREPARATION

- A. Section 01 77 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Coordinate installation of anchors furnished to other Sections.
- C. Provide for erection procedures and induced loads during erection.
- D. Furnish temporary bracing during installation, and maintain temporary bracing in place until final support is provided.

3.3 INSTALLATION

- A. Establish indicated lines, levels, and coursing, and protect from displacement.
- B. Maintain cast stone courses to uniform dimension.
- C. Form bed and head joints of uniform thickness.
- D. Cast Stone Coursing:
 - 1. Joint Location: As indicated on Drawings.

2. Joint Width: 3/8 inches.
3. Joint Shape: Concave.

E. Placing and Bonding:

1. Install anchors to support and position cast stone.
2. Drench cast stone units with clear running water, just prior to setting.
3. Lay cast stone units in full bed of mortar, with full head joints.
4. Leave head and top joints in units with exposed top surfaces open to receive sealant.
5. Fill dowel holes and anchor slots with mortar.
6. Adjustments:
 - a. Do not shift or tap cast stone units after mortar has achieved initial set.
 - b. If adjustment is required, remove mortar and replace.
7. Mortar Joints:
 - a. Rake mortar joints 3/4 inches (18 mm) deep for pointing, and sponge face of each stone to remove excess mortar.
 - b. Tuck-point mortar joints.
 - c. Pack mortar tightly into joint.
 - d. Tool joint surface to specified shape.
8. Site cutting of cast stone units is not permitted.

F. Anchorage - Cast Stone Veneer:

1. Embed wall ties in masonry backing to bond veneer at maximum 16 inches o.c., vertically, and at maximum 24 inches o.c., horizontally.

G. Control Joints:

1. Form control joint by omitting mortar at sealing joint, as specified in Section 079000 - Joint Protection.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Maximum Variation of Joint Thickness:
 1. Plus 1/16 inch.
 2. Minus 1/8 inch.
- C. Maximum Offset from Adjacent Unit: 1/8 inch.
- D. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet (6 mm/3 m) and 1/2 inch in 20 feet (13 mm/6 m) or more.
- E. Maximum Variation from Plumb: 1/4 inch (6 mm) in each story noncumulative; 1/2 inch (13 mm) in two stories or more.

- F. Maximum Variation from Level Coursing: 1/8 inch in 3 feet (3 mm/m), 1/4 inch in 10 feet (6 mm/3 m), and 1/2 inch in 30 feet (13 mm/9 m).
- G. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.5 CLEANING

- A. Section 01 77 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Remove excess mortar and sealant as Work progresses.
- C. Replace defective mortar.
- D. Match adjacent Work.
- E. Wet cast stone, and clean soiled surfaces with cleaning solution.
- F. Use nonmetallic tools in cleaning operations.

3.6 PROTECTION

- A. Section 01 77 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect cast stone from contact with mortar, soil, and other materials capable of staining or discoloring cast stone.
- C. Coverings:
 - 1. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry.
 - 2. Provide coverings where masonry is exposed to weather when Work is not in progress.
 - 3. Maintain protection on tops of completed exterior walls until installation of permanent waterproof cap materials.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Section includes blocking in wall and roof openings; wood furring and grounds; concealed wood blocking for support of toilet and bath accessories, lavatories and wood trim; telephone and electrical panel back boards; and preservative treatment of wood.
- B. Related Sections:
 - 1. Section 06 61 16 – Solid Surfacing Fabrications: countertops.
 - 2. Section 08 41 13 – Aluminum Entrances and Storefronts: Openings to receive wood blocking.
 - 3. Section 08 51 13 – Aluminum Windows: Openings to receive wood blocking.

1.2 REFERENCES

- A. AWWA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- D. SPIB - Standard Grading Rules for Southern Pine Lumber.
- E. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- F. DOC PS 20 - American Softwood Lumber Standard.
- G. Forest Stewardship Council – FSC Guidelines – Forest Stewardship Council Guidelines.

1.3 SUBMITTALS

- A. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and application instructions.

1.4 QUALITY ASSURANCE

- A. Rough Carpentry Lumber: Visible grade stamp, of agency certified by National Forest Products Association (NFPA).

- B. Surface Burning Characteristics: Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84, NFPA 255 and UL 723.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver shop fabricated carpentry items until site conditions are adequate to receive the work. Protect items from weather while in transit.
- B. Store indoors, in ventilated areas with a constant, minimum temperature of 60 degrees F (16 degrees C), maximum relative humidity of 25 to 55 percent.

PART 2 PRODUCTS

2.1 ROUGH CARPENTRY MATERIALS

- A. Lumber: PS 20; graded in accordance with NFPA Grading rules; No. 2 Southern Pine or No. 2 Douglas Fir kiln dried to a maximum moisture content of 19%.
- B. Lumber fabricated from old growth timber is not permitted.
- C. Plywood:
 - 1. APA Rated Sheathing Exp. 2, kiln dried to a maximum moisture content of 15%. (this is an interior type with intermediate glue - i.e. one step above interior type).
 - 2. APA Rated Sheathing Exp. 1, kiln dried to a maximum moisture content of 15%. (this is "CDX" type, **BUT** it is not acceptable for permanent exposure to weather).
 - 3. Interior Composite Wood and Agrifiber Products: Contain no added urea-formaldehyde resins.
- D. Accessories
 - 1. Fasteners and Anchors:
 - a. Fasteners: Hot dipped or Electro galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - b. Nails and Staples: ASTM F1667.
 - c. Anchors: Expansion shield and lag bolt type for anchorage to concrete. Bolt or ballistic fastener for anchorages to steel.

2.2 WOOD TREATMENT

- A. All lumber and plywood shall be pressure treated with fire retardant chemicals to provide a flame-spread, fuel contributed and smoke developed classification of 25 or less when tested by Underwriters' Laboratories in accordance with ASTM E84:
 - 1. After pressure treatment, all lumber shall be kiln dried to a maximum moisture content of 19%.
 - 2. After pressure treatment, all plywood shall be kiln dried to a maximum moisture content of 15%.

3. Each piece of fire retardant treated lumber and plywood shall bear an Underwriters' Laboratories label or imprint attesting to this rating.
4. Provide the 40-year, non-prorated warranty for all fire retardant treated plywood.
5. Structural Panels: Maximum 15 percent.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 31 00 – Project Coordination: Verification of existing conditions before starting work.
- B. Verify substrate conditions are ready to receive blocking, curbing and framing.

3.2 PREPARATION

- A. Coordinate placement of blocking, curbing and framing items.

3.3 INSTALLATION

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Do not splice structural members between supports, unless otherwise indicated.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- E. Provide fire blocking in concealed cavities as indicated and as follows:
 1. Fire block concealed spaces, at each floor level, at ceiling, and at not more than 48 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- F. Sort and select lumber so that natural characteristics will 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.
- G. Comply with AWPAs 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.

- H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following.
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- I. Use screws, 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.

3.4 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.5 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.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Plastic-laminate-faced architectural cabinets
 - 2. Cabinet hardware.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.
 - 2. 06 10 00 Misc. Rough Carpentry: Wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
 - 3. 06 61 16 Solid Surface Fabrications: Countertop and Integral Backsplash

1.2 REFERENCE STANDARDS

- A. ANSI A 208.1: Particleboard.
- B. ANSI A 208.2: Medium Density Fiberboard (MDF) for Interior Applications.
- C. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. AWI: Architectural Woodwork Institute.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.
- F. BHMA A156.9: Cabinet Hardware.
- G. BHMA A156.18: Materials and Finishes.
- H. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.
- I. WI: Woodwork Institute.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site one week prior to install.

1.4 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards.
 - 2. Colors: submit full range of standard laminates for Architect's selection.
- C. Product Data: Provide data for hardware accessories.
- D. Samples for Initial Selection: Full range of manufacturer's standard plastic laminate materials and finishes.
- E. Samples for Verification: Submit minimum 8x10 inch size samples for each type, color, pattern, and surface finish selected in Project.
- F. Manufacturer's Letter: Stating that engineered wood products contain no added urea-formaldehyde.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with a minimum of five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.
- B. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL 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: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers:
 - a. Wilsonart
 - b. Formica
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade VGS.
 - 3. Edges: PVC T-mold matching laminate in color, pattern, and finish.
 - 4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces,

provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber.
 3. Drawer Bottoms: Hardwood plywood.
- H. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. See Finish Schedule and Legend in 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.
1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Medium-Density Fiberboard: ANSI A208.2, MD.
 2. Particleboard: ANSI A208.1, Grade M-2.
 3. Softwood Plywood: DOC PS 1, medium-density overlay.
 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

- C. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
- D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- E. Drawer Slides: BHMA A156.9.
 - 1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-over travel-extension type; zinc-plated-steel ball-bearing slides.
 - 2. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
 - 3. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
 - 4. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.
 - 5. For computer keyboard shelves, provide Grade 1HD-100.
- F. Door Locks: BHMA A156.11, E07121.
- G. Drawer Locks: BHMA A156.11, E07041.
- H. Door and Drawer Silencers: BHMA A156.16, L03011.
- I. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage. (Provide a total of 20 location to be coordinated with the Owner)
 - 1. Product: Subject to compliance with requirements, provide "EDP series" by Doug Mockett & Company, Inc.
- J. Countertop Supports: Steel countertop supports for workstations or other unsupported sections of countertop.
 - 1. Product: A&M Hardware, workstation brackets or equal.
 - a. Material: 1/8" steel.
 - b. Performance: Support up to 1000 lb load limit.
 - c. Size: As required for each application.
 - d. Finish: Powder coat.
 - e. Color: Black.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

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.
 - 1. 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 EXAMINATION

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

3.2 INSTALLATION

- A. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- B. 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.
- C. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

- F. 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 fastenings, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, box, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1 1/2" - inch penetration into the wood framing, blocking, or hanging strips.

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. Clean decorative plastic laminate surfaces according to manufacturer's written care and maintenance instructions.
- D. Protect completed work from damage for duration of construction period.

3.4 SCHEDULE

- A. See Drawings for cabinet location, layout and finish

END OF SECTION

**SECTION 06 41 00
FIBERGLASS COLUMNS**

1.0 General**1.1 Description:**

- A. Columns shall be Architectural Mall, Inc **FRP / FGP** fiberglass column covers
- B. Column Style: Round Non-Tapered
- C. Column Type: Plain
- F. Cap Style: Tuscan
- G. Base Style: Tuscan

1.2 Submittals

- A. Submit Architectural Mall, Inc literature and shop drawings
- B. Submit sample of column shaft.
- C. Field samples shall be capable of being incorporated into the actual construction.

1.3 Warranty

- A. The columns shall be guaranteed in writing against defects of materials or workmanship for a period of limited lifetime from date of Substantial Completion of the project.
- B. Columns must be installed following Architectural Mall, Inc guidelines.

1.4 Verification of Design

A. The components indicated on the drawings show dimensions established to accomplish the Architect's intended visual result and to conform to the building's configuration. The contractor shall verify that all components that will actually be provided for the work of this section will fit the building's structural elements and conform to the visual design criteria indicated on the drawings without materially altering profiles and alignments.

B. Any additional support or backing components shall be provided by the installing contractor as part of the work of this section.

2.0 Products**2.1 Acceptable Manufacturer**

Architectural Mall, Inc
323 St Paul Blvd
Carol Stream, IL 60188
T. 877-279-9993
F. 844-817-0480
www.columnsandbalustrades.com
sales@architecturalmall.com

2.2 Fiberglass and Resin Materials

- A. Glass cloth, matt and "chop" shall be equal to the products of PPG-Owens Corning.
- B. Polyester resins shall be Class A. The resin will be flame retardant promoted thixotropic polyester resin designed for use in hand lay-up and spray-up processes. This resin is specifically formulated for use in applications that require an ASTM-84, Class 1 flame spread rating, without the use of fillers or antimony trioxide, with an ASTM-84 flame spread rating of 10 unfilled.
- C. Final ratio of materials shall be 30% fiber 70% resin for the body of components.
- D. Shaft thickness shall be 1/4" to 1" depending on size.

E. Allowable Tolerances

1. Wind Load Resistance:
 - a. FRP Components when installed shall resist all wind loading.
 - b. Minimum wind loading requirements as per Standard Building Code.
2. Dimensional Tolerances of Finished Units
 - a. (1) Dimensions 10' or under: +/- 1/4".
 - (2) Dimensions 10' to 20': +/- 3/8".
 - b. Out of Square: 1/8" per 6.'

3.0 Material Properties**3.1 Physical Properties (1/8" Glass Mat Laminate)****Typical Properties**

- A. Flexural Strength, psi 77 degrees F
- B. Flexural Modulus, psi 77 degrees F
- C. Tensile Strength, psi 77 degrees F
- D. Tensile Modulus, psi 77 degrees F
- E. Barcol Hardness
- F. Glass Content 0/0
- G. Compression Strength, psi
- H. Water Absorption
- I. Thermal Expansion (in./in./ft.)

Typical Range

- 15,000 - 20,000
- 550,000 - 700,000
- 10,000 - 18,000
- 700,000 - 850,000
- 45 - 55
- 24% - 29.5%
- 15,000 - 20,000
- .04% - .05%
- .000011 - .000012

3.2 Flammability Properties (1/8" Glass Mat Laminate)

- A. ASTM E-84 Tunnel Test = 10 (unfilled)
- B. HLT-15 Rating = 100
- C. ASTM D-635-74 = AEB<1.0 CM, ATB<5 sec.
- D. ASTM D-2863-74 Oxygen Index = 36.5

4.0 Execution**4.1 Delivery**

A. Deliver Materials in original packages, containers, or bundles bearing brand name & identification of manufacturer or supplier. General Customer to unload and store materials onsite under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion, and damage from construction traffic and other causes.

- B. Handle materials and products to prevent damages to edges, ends, or surfaces

4.2 Installation

- A. Follow manufacturers detailed installation guidelines. They are available online or by calling 877-279-9993.
- B. Recommend Caulk for all joints is NP1 Sonolastic or equal
- C. Fiberglass Columns are recommended to be sanded, primed, and painted.
- D. Square Fiberglass Lite Columns have a marine grade gel coat.

End of Section

SECTION 06 61 16
SOLID SURFACE FABRICATIONS

1. GENERAL

1.1. SUMMARY

1.1.1. Section includes cast plastic fabrications as scheduled at the end of the section.

1.1.2. Related Sections:

1.1.2.1. Section 06 10 00 - Rough Carpentry: Wood blocking and supports for lavatory counter tops and front screen panel.

1.1.2.2. Section 07 92 00 - Joint Sealers: Perimeter sealant to adjacent construction.

1.2. REFERENCES

1.2.1. ASTM International:

1.2.1.1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.2.2. National Fire Protection Association:

1.2.2.1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

1.2.3. Underwriters Laboratories Inc.:

1.2.3.1. UL - Fire Resistance Directory.

1.2.3.2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3. DESIGN REQUIREMENTS

1.3.1. Design items with sufficient strength for handling and placement stresses.

1.4. SUBMITTALS

1.4.1. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, fabrication details, field jointing, adjacent construction, design load parameters, methods of support, integration of plumbing and electrical components, and anchorages.

1.4.2. Product Data: Submit data on specified component products, electrical characteristics and connection requirements.

- 1.4.3. Samples: Submit two samples representative of countertop and front panel illustrating color, texture, and finish.
- 1.4.4. Manufacturer's Installation Instructions: Submit preparation of opening required, rough-in sizes; furnish templates for cast-in or placed frames or anchors; tolerances for item placement, temporary bracing of components.
- 1.4.5. Operation and Maintenance Data: Submit list of approved cleaning materials and procedures required; list of substances harmful to component materials. Include instructions for stain removal, surface and gloss restoration.

1.5. FIELD MEASUREMENTS

- 1.5.1. Verify field measurements prior to fabrication.
- 1.5.2. Verify field measurements are as indicated on shop drawings.

1.6. SEQUENCING

- 1.6.1. Sequence Work to permit installation of adjacent affected construction, plumbing and electrical rough-in.

1.7. WARRANTY

- 1.7.1. Furnish five-year manufacturer warranty.

2. PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Corian
- 2.1.2. Wilsonart
- 2.1.3. Substitutions as permitted in section 01 25 00.

2.2. PRODUCTS

- 2.2.1. Solid Surface Countertop:
 - 2.2.1.1. Color/Style: From manufacturer's full range as selected by architect

2.3. COMPONENTS

- 2.3.1. Resin: Polyester type, with integral coloring, stain resistant to domestic chemicals and cleaners.
- 2.3.2. Polishing Cream: Compatible polishing cream to achieve specified sheen to gel coat.

2.4. FABRICATION

- 2.4.1. Fabricate components by mold to achieve shape and configuration.
- 2.4.2. Gel coat exposed finish surfaces smooth and polish to gloss sheen.
- 2.4.3. Radius corners and edges.
- 2.4.4. Cure components prior to shipment.

3. EXECUTION**3.1. EXAMINATION**

- 3.1.1. Verify joint preparation and affected dimensions are acceptable.

3.2. PREPARATION

- 3.2.1. Provide anchoring devices for installation.
- 3.2.2. Provide templates and rough-in measurements.

3.3. INSTALLATION

- 3.3.1. Align work plumb and level.
- 3.3.2. Rigidly anchor to substrate to prevent misalignment.
- 3.3.3. Seal to adjacent construction in accordance with Section 07 92 00.

3.4. ERECTION TOLERANCES

- 3.4.1. Maximum Variation from Indicated Dimension: 1/8 inch.
- 3.4.2. Maximum Offset from Indicated Position: 1/8 inch.

3.5. CLEANING

- 3.5.1. Clean and polish fabrication surfaces.

3.6. SCHEDULE

- 3.6.1. Counter Tops: 3/4 inch thick, 24 inches deep, one piece length, cored for plumbing accessories with 4-inch-high separate back and side splashes.
- 3.6.2. Window stools.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Rigid Insulation at perimeter foundation walls
 - 2. Rigid Insulation in masonry cavity walls
 - 3. Batt insulation and vapor retarder in exterior wall and roof construction.
 - 4. Sound Attenuation Insulation

1.2 RELATED REQUIREMENTS

- A. Section 07 26 20 – Fluid applied air and vapor barrier.
- B. Section 09 29 00 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.3 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2010a.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2010.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.
- E. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2011.
- F. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2011.

1.4 QUALITY ASSURANCE

- A. Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the work.
- B. Provide insulation and related materials with the fire test response characteristics specified elsewhere in this section as determined by testing identical products per test method indicated below by UL or another testing and inspection agency acceptable to

authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface Burning Characteristics: ASTM E 84
2. Fire-Resistance Ratings: ASTM E 119
3. Combustion Characteristics: ASTM E 136

C. Insulation Installed in Concealed Locations Surface Burning Characteristics:

1. Batt Insulation: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

D. Insulation Installed in Exposed Locations Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1. Attic Floor Insulation: Minimum 0.12 watt per sq cm critical radiant flux when tested in accordance with ASTM E970.

1.5 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.6 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation, per Manufacturer's Recommendations.

PART 2 PRODUCTS

2.1 Acceptable Manufacturers

A. Extruded-Polystyrene Board Insulation Acceptable Manufacturers:

1. Owens Corning
2. Dow Chemical Company
3. Tenneco Building Products
4. Substitutions per Section 01 25 00

B. Batt Insulation Acceptable Manufacturers:

1. CertainTeed Insulation.
2. Owens Corning Fiberglas.
3. Johns Manville.
4. Substitutions per Section 01 25 00

2.2 COMPONENTS

A. Extruded-Polystyrene Board Insulation:

- a. Perimeter insulation below slabs and at foundation walls - Basis of design shall be Owens Corning Foamular 250

- b. Rigid, cellular polystyrene thermal insulation with closed cells and integral high-density skin; formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV.
 - c. Board Size: As required.
 - d. Board Thickness: As per drawings.
 - e. Thermal Resistance: R-5 per inch
 - f. Compressive Strength: Minimum 25 psi.
- B. Extruded Polystyrene Board Insulation
 - a. Insulation in exterior wall cavities - Basis of Design: Dow – Styrofoam Cavitymate Insulation
 - b. ASTM C578 Type X; cellular type, conforming to the following:
 - c. Board Density: 1.60 lb/cu ft.
 - d. Board Size: 16” widths x 96”.
 - e. Board Thickness: As per drawings.
 - f. Thermal Resistance: R-5 per Inch.
 - g. Water Absorption: In accordance with ASTM D2842 0.3 percent by volume max.
 - h. Compressive Strength: Minimum 25 psi.
 - i. Board Edges: Square edges.
 - j. Not manufactured using Chlorofluorocarbons (CFCs).
 - k. Maximize use of recycled material.
- C. Thermal Batt Insulation
 - 1. Insulation at wall cavities and roof construction – Basis of Design: Owens Corning EcoTouch Pink Fiberglass
 - a. ASTM C665; preformed glass fiber batt; conforming to the following:
 - b. Thermal Resistance: R Values as per drawings.
 - c. Batt Size: As per drawings.
 - d. ASTM C665, friction fit
 - e. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - f. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - g. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - h. Formaldehyde Content: Zero.
 - i. Facing: Unfaced
 - j. Wire Mesh: Galvanized steel, hexagonal wire mesh.
- D. Sound Attenuation Batt Insulation
 - 1. Acoustic blanket insulation for interior partitions – Basis of Design: Owens Corning EcoTouch SAB
 - a. ASTM C665, Type 1; Unfaced glass acoustical insulation conforming to the following:
 - b. Batt Size: As per drawings.
 - c. ASTM C665, friction fit
 - d. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.

- e. Smoke Developed Index: 25 or less, when tested in accordance with ASTM E84.
- f. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
- g. Formaldehyde Content: Zero.
- h. Facing: Unfaced

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Apply adhesive to back of boards:
 - 1. Three continuous beads per board length.
- B. Install boards horizontally on foundation perimeter.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- D. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
 - 1. Apply adhesive in five continuous beads per board length.
 - 2. Install boards horizontally from base of foundation to top of insulation.
 - 3. Butt boards tightly, with joints staggered from insulation joints.

3.3 BOARD INSTALLATION UNDER CONCRETE SLABS

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

3.4 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

- B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- F. Tape insulation batts in place.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- H. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.
- I. Tape seal tears or cuts in vapor retarder.
- J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.5 PROTECTION

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

END OF SECTION

SECTION 07 24 13
EXTERIOR INSULATION & FINISH SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Exterior Insulation and Finish System (EIFS) with Moisture Drainage including:
 - a. An integral fluid applied air and water-resistive membrane barrier compatible with the substrate surface and adhesive application of the EIF system.
 - b. Accessory materials required for treating sheathing joints, fasteners, penetrations, rough openings, and material transitions compatible with substrate surfaces and the adhesive application of the EIF system.
 - c. Joint sealants compatible with specified EIFS for use in all exterior envelope joint waterproofing.
 - d. A comprehensive single source limited EIF system warranty inclusive of EIFS, fluid applied air and water-resistive membrane barrier, accessory materials, and sealants.

B. Related Requirements:

1. 03 30 00 Cast-in-place Concrete
2. 04 20 00 Unit Masonry
3. 06 11 00 Wood Framing
4. 07 27 00 Fluid-Applied Air Barriers
5. 07 62 00 Sheet Metal Flashing and Trim
6. 07 92 00 Joint Sealants
7. 08 41 10 Aluminum Storefronts and Windows

1.02 REFERENCES

A. Reference Standards:

1. ASTM Standards:
 - a. ASTM C 150 Standard Specification for Portland Cement
 - b. ASTM C 510 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
 - c. ASTM C 661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
 - d. ASTM C 679 Standard Test Method for Tack-Free Time of Elastomeric Sealants
 - e. ASTM C 719 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)1, 2
 - f. ASTM C 920 Standard Specification for Elastomeric Joint Sealants
 - g. ASTM C 1184 Standard Specification for Elastomeric Joint Sealants
 - h. ASTM C 1382 Standard Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints
 - i. ASTM C 1397 Standard Practice for Application of Class PB Exterior Insulation and Finish System (EIFS) and EIFS with Drainage

- j. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
- k. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
- l. ASTM E 119 Standard Method for Fire Tests of Building Construction and Materials
- m. ASTM E 2134 Test Method for Evaluating the Tensile-Adhesion Performance of Exterior Insulation and Finish Systems (EIFS)
- n. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials
- o. ASTM E 2273 Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies
- p. ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
- q. ASTM E 2430 Standard Specification for Expanded Polystyrene (EPS) Thermal Insulation Boards for use in Exterior Insulation and Finish Systems (EIFS)
- r. ASTM E 2485 Standard Test Method for Freeze-Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water-Resistive Barrier Coatings
- s. ASTM E 2486 Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
- t. ASTM E 2568 Standard Specification for PB Exterior Insulation and Finish Systems
- u. ASTM E 2570 Standard Test Method for Evaluating Water-Resistive Barrier (WRB) Coatings Used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage

1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Construction Meetings

1. The EIFS installer shall coordinate with the General Contractor to schedule, invite and administer a pre-construction meeting including but not limited to the architect of record, consultant(s), EIFS, sheathing board, accessory materials and sealant manufacturer's representatives and the owner to assure required integration of products selected as specified herein and for proper sequencing and installation detailing.

B. Coordinate for related specification and integration of Selected Materials as referenced in Section 2.02.B.1, 2.02.B.2 and 2.02.C herein below.

C. Sequencing

1. Provide jobsite grading prior to installation of Exterior Insulation and Finish System with Moisture Drainage so that the system may be terminated at 8 in above grade or as required by code.
2. Coordinate installation of sheathing board and accessory materials, flashing, foundation waterproofing, roofing membrane, windows, doors, and other penetrations of the exterior walls to provide a continuous air and water-resistive membrane barrier.
3. Provide protection of rough openings before installing windows, doors, and other penetrations of the exterior walls.

4. Coordinate installation of windows and doors so air and water-resistive membrane barrier accessory materials, transitions, flashings, etc. are connected to them to provide a continuous barrier.
5. Install window and door head flashings immediately after windows and doors are installed.
6. Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior.
7. Install copings and sealants immediately after installation of the Exterior Insulation and Finish System with Moisture Drainage and when EIFS coatings are dry.
8. Attach penetrations through Exterior Insulation and Finish System to structural support and provide water-tight seals at penetrations.

1.04 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

- A. Submit product data as required by Section 01 33 00, Administrative Requirements.
- B. Submit shop drawings for panelized EIFS with Moisture Drainage showing wall layout, connections, details, expansion joints, and installation sequence.
- C. Submit two (2) samples of the Exterior Insulation and Finish System with Moisture Drainage for each finish, texture, and color to be used on the project. Use the same tools and techniques proposed for the actual installation. Make the samples of sufficient size to accurately represent each color and texture being utilized on the project.
- D. Submit a current copy of the manufacturer's Trained Contractor Certificate for the EIF system specified.
Submit Owner/Architect-requested test results verifying the performance of the Exterior Insulation and Finish System with Moisture Drainage.
- E. Submit a copy of the manufacturer's installation details and application instructions.

1.05 CLOSEOUT SUBMITTALS

- A. Submit a copy of the manufacturer's recommended maintenance and repair manual.
- B. Submit a copy of the Exterior Insulation and Finish System with Moisture Drainage manufacturer's comprehensive single source limited warranty.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 1. A member in good standing of the EIFS Industry Members Association (EIMA).
 2. Manufacture Exterior Insulation and Finish System with Moisture Drainage materials at a facility covered by a current ISO 9001:2015 and ISO 14001:2015 certification. Certification of the facility is done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).

B. Contractor Qualifications:

1. Knowledgeable in the proper installation of the Exterior Insulation and Finish System with Moisture Drainage.
2. Possess a current copy of the manufacturer's Trained Contractor Certificate for the EIF system specified.
3. Successfully complete a minimum of three (3) projects of similar scope and scale to the specified project.

C Insulation Board Manufacturer Qualifications:

1. Listed by EIFS Manufacturer, and capable of producing the Expanded Polystyrene (EPS) in accordance with the current EIFS Manufacturer's Specification for Insulation Board.
2. Subscribe to the Dryvit Third Party Certification and Quality Assurance Program.

D. Panel Fabricator Qualifications:

1. Experienced and competent in the fabrication of architectural wall panels.
2. Possess a current Outsulation Plus MD System Trained Contractor Certificate* issued by Dryvit Systems, Inc.

E. Panel Erector Qualifications:

1. Experienced and competent in the installation of architectural wall panel EIF systems.
2. Shall be:
 - a. The panel fabricator or
 - b. An erector approved by the panel fabricator or
 - c. An erector under the direct supervision of the panel fabricator.

G. Regulatory Requirements:

1. Separate the EPS insulation board from the interior of the building by a minimum 15-minute thermal barrier.
2. Comply with local building codes for the use and maximum thickness of EPS insulation board.

H. Inspections:

1. Cooperate with independent, third-party inspectors when required by code or by contract documents.

1.07 DELIVERY, STORAGE AND HANDLING

1. Deliver all Exterior Insulation and Finish System with Moisture Drainage components and materials to the job site in the original, unopened packages with labels intact.

2. Inspect all Exterior Insulation and Finish System with Moisture Drainage components and materials upon arrival for physical damage, freezing or overheating. Do not use questionable materials.
3. Store all Exterior Insulation and Finish System with Moisture Drainage components and materials at the jobsite in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Maintain minimum and maximum storage temperature as stated in the product data sheets or specifications for the materials selected. **NOTE: Minimize exposure of materials to temperatures over 90 °F (32 °C). Finishes exposed to temperatures over the published maximum storage temperature for even short periods may exhibit skinning and increased viscosity and should be inspected prior to use.**
4. Protect all products from inclement weather and direct sunlight.

1.08 SITE CONDITIONS

A. Ambient Conditions

1. Do not apply wet materials during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.
2. Verify the minimum air and wall surface temperatures at the time of application as stated in the product data sheets or specifications for the materials selected.
3. Maintain these temperatures with adequate air ventilation and circulation for a minimum of 24 hours
(48 hours for specific Specialty Finishes) thereafter, or until the products are completely dry.

1.09 WARRANTY

A. Manufacturers' Limited EIF System Warranty

1. Manufacturer shall offer a limited material defect and labor to repair or replace defective material warranty stating the Products will be free from manufacturing defect and will perform as warranted in the manner specified for the stated term measured from the Date of Project Substantial Completion.
 - a. A pre-construction meeting, including representatives of the Manufacturer, the Applicator, the Owner, and the Consultant (if applicable), shall be required prior to installation of the Products.
 - b. The term of this warranty may be extended for an additional 2 years with involvement on the project of a Manufacturer-approved, third-party consultant ("Consultant") engaged by the Owner or its authorized representative, at the Owner's sole expense. Inspection reports generated by the Consultant shall be made available to the Manufacturer and the Owner.
 - c. The warranty is available upon written request.
2. The EIF system warranty shall additionally include the following for the term of the warranty or as specifically noted hereunder.
 - a. The EIF system warranty term shall be 10 years.

- b. The EIFS will remain in a watertight condition when the EIFS is used in conjunction with approved Company Joinery and Sealants.
- c. The EIFS will drain incidental moisture between the air/water-resistive barrier and the insulation board.
 - 1) Remedy includes repair or replacement of any sheathing or framing member that is damaged as a result of the EIF system failing to drain incidental moisture between the secondary weather barrier and the insulation board.
- d. Finish will be UV fade resistant for 10 years, except for specially produced colors.
 - 1) Specially produced colors will be UV fade resistant for 5 years when high-performance colorants are used to formulate.
- e. The EIFS shall be eligible to receive a renewal of the original warranty if the Owner satisfactorily completes the specific renovation requirements published by the Manufacturer.

B. Installer Warranty

- 1. EIF system Installer shall provide a separate minimum 1-year- warranty for all workmanship related to the proper installation and drainage performance of the EIFS application. Manufacturer shall not be responsible for workmanship associated with the installation of Exterior Insulation and Finish System with Moisture Drainage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers List:

- 1. Dryvit Systems, Inc., One Energy Way, West Warwick, RI 02893, 800-556-7752, www.dryvit.com.
- 2. Tremco, Inc., 3735 Green Road Beachwood, OH 44122 [800.321.7906](tel:800.321.7906), www.tremco.com.

B. Substitution Limitations:

- 1. All components of the Outsulation® Plus MD System® including EPS Insulation Board shall be supplied or obtained from Dryvit Systems, Inc., Tremco, Inc. or their authorized distributors. Substitutions or additions of materials manufactured or supplied by others will void the EIF system warranty.
- 2. Alternate EIFS manufacturers must demonstrate equivalency for all elements of EIF system such as but not limited to:
 - a. Material components, compatibility and testing
 - b. Standard and specialty finishes;
 - c. Color and texture matching; and,
 - d. Warranty criteria as specified herein.
- 3. Submit alternate EIFS manufacturer's complete data highlighting equivalency for review through Substitution Requirements as defined in Division 1.

2.02 DESCRIPTION

A. System Description:

1. The Dryvit Outsulation Plus MD System is an Exterior Insulation and Finish System (EIFS) with Moisture Drainage, consisting of:
 - a. An Air and Water-Resistive Membrane Barrier
 - b. Accessory Materials
 - c. Adhesive – installed in vertical ribbons to facilitate egress of incidental moisture
 - d. Expanded Polystyrene (EPS) insulation board
 - e. Base Coat
 - f. Reinforcing Mesh
 - g. Finish Coat
 - h. Joint Sealants as specified herein below

B. Materials:

1. Fluid-Applied Air and Water-Resistive Barrier:
 - a. Non-Permeable – See Section 07 26 20.
2. Accessory Materials for Fluid Applied Air and Water-Resistive Barrier:
 - a. Provide compatible accessory materials as required by project conditions for substrate, rough opening and penetration preparation, bridge expansion joints in substrate, material transitions and flashing integration to produce a complete air and water-resistant assembly.
 - 1) Dryvit Grid Tape™: An open weave fiberglass mesh tape with pressure sensitive adhesive. Used in combination with Backstop NT Texture for treating sheathing board joints and inside / outside corners and preparing rough openings and penetrations. Backstop NT Texture is used alone for spotting fastener heads.
 - 2) Dryvit AquaFlash®: Fluid-applied, water-based polymer transition membrane. Used in preparing rough openings and penetrations, bridging expansion joints in substrate, material transitions and flashing integration.
 - i. Dryvit AquaFlash Mesh and Corners: Polyester reinforcing mesh for use with AquaFlash.
 - 4) Tremco Dymonic 100: A high-performance, high-movement, single-component, medium-modulus, low-VOC, UV-stable, non-sag, gun applied polyurethane sealant. Used in substrate preparation, treating sheathing board joints and inside/outside corners and fastener heads, preparing rough openings and penetrations, bridging expansion joints in substrate, material transitions and flashing integration.
3. Drainage Components:
 - a. Dryvit Drainage Strip™ corrugated plastic strip.
 - b. Dryvit AP Adhesive™ urethane-based adhesive used to attach Drainage Track and Dryvit Drainage Strip to the sheathing.
4. Adhesives:
 - a. Liquid polymer-based adhesive field mixed with Portland cement.

- 1) Dryvit Primus®
- 2) Dryvit Genesis®
- b. Ready mixed dry blend cementitious, copolymer-based adhesive field mixed with water.
 - 1) Dryvit Primus® DM
 - 2) Dryvit Genesis® DM
 - 3) Dryvit Genesis® DMS
 - 4) Rapidry DM™ 35-50
 - 5) Rapidry DM™ 50-75
5. Insulation Board:
 - a. Expanded Polystyrene; minimum thickness 25 mm (1 in); meeting Dryvit Specification [DS131](#) and ASTM E 2430.
6. Pre-Coated Insulation Starter Boards, Corners and Shapes:
 - a. Machine Coated Starter Boards, Corners and Shapes: Shall be produced with materials approved by Dryvit Systems, Inc. and be supplied by a fabricator approved by Dryvit Systems, Inc.
 - b. Non-Machine Coated Starter Boards, Corners and Shapes: Shall be produced with materials approved by Dryvit Systems, Inc.
7. Base Coat:
 - a. Liquid polymer-based base coat field mixed with Portland cement.
 - 1) Dryvit Primus
 - 2) Dryvit Genesis
 - 3) Dryvit Dryflex
 - b. Ready mixed dry blend cementitious, copolymer-based base coat field mixed with water.
 - 1) Dryvit Primus DM
 - 2) Dryvit Genesis DM
 - 3) Dryvit Genesis DMS
 - 4) Rapidry DM 35-50
 - 5) Rapidry DM 50-75
 - 6) Dryvit NCB – Non-cementitious
8. Reinforcing Mesh:
 - a. Open-weave, glass fiber fabric treated for compatibility with other EIF system materials.
 - b. Provide Standard Plus mesh assembly for all EIFS clad wall areas.

Reinforcing Mesh ¹ /Weight oz/yd ² (g/m ²)	Minimum Tensile Strengths	EIMA Impact Classification	EIMA Impact Range in-lbs (Joules)		Impact Test Results in-lbs (Joules)	
Standard - 4.3 (146)	150 lbs/in (27 g/cm)	Standard	25-49	(3-6)	36	(4)
Standard Plus - 6 (203)	200 lbs/in (36 g/cm)	Medium	50-89	(6-10)	56	(6)
Intermediate™ - 12 (407)	300 lbs/in (54 g/cm)	High	90-150	(10-17)	108	(12)

Panzer® 15 ¹ - 15 (509)	400 lbs/in (71 g/cm)	Ultra High	>150	(>17)	162	(18)
Panzer 20 ¹ - 20.5 (695)	550 lbs/in (98 g/cm)	Ultra High	>150	(>17)	352	(40)
Detail Mesh® Short Rolls - 4.3 (146)	150 lbs/in (27 g/cm)	n/a	n/a	n/a	n/a	n/a
Corner Mesh™ - 7.2 (244)	274 lbs/in (49 g/cm)	n/a	n/a	n/a	n/a	n/a
* It shall be colored blue and bear the Dryvit logo for product identification						
1. Shall be used in conjunction with Standard Mesh (recommended for areas exposed to high traffic)						

9. Finish:

- a. Water-based, acrylic coating with integral color and texture; formulated with Dirt Pickup Resistance (DPR) chemistry.
 - 1) Texture:
 - a) Sandpebble® Fine – fine pebble texture

13. Coatings, Primers, and Sealants:

- a. Demandit® Smooth
- b. Demandit® Sanded
- c. Demandit® Advantage™
- d. HDP Water-Repellent Coating
- e. Weatherlastic® Smooth
- f. Tuscan Glaze™
- g. Color Prime
- h. Prymit®
- i. SealClear™

C. Joint Sealants:

- 2. Polyurethane Sealant:
 - a. Tremco Dymonic FC: A one component hybrid polyurethane sealant. Where deemed necessary, use TREMprime Silicone Porous Primer for porous surfaces and TREMprime Silicone Metal Primer for metals or plastics. Coordinate for primer use as indicated.

D. Jobsite-Mixed Materials:

- 1. Portland cement: verify is Type I or II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.
- 2. Water: verify is clean and free of foreign matter.

E. Reference Documentation for Outsulation Plus MD System:

- 1. Data Sheet – DS929
- 2. Details – DS944
- 3. Application Instructions – DS934

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Verify access to electric power, clean water and a clean work area at the location where the Dryvit materials are to be applied.
2. Verify the deflection of the substrate does not exceed 1/240 times the span. Verify substrate is flat within 1/4 in (6.4 mm) in a 4 ft (1.2 m) radius.
3. Verify substrate is sound, dry, connections are tight; has no surface voids, projections, or other conditions that may interfere with the Exterior Insulation and Finish System with moisture drainage installation or performance.
4. Verify the slope of inclined surfaces are not less than 6:12 (27 °) where the length of the slope does not exceed 12 in (305 mm) or 3:12 (14 °) where the length of the slope does not exceed 4 in (102 mm).
5. Verify metal roof flashings have been installed in accordance with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) standards.
6. Verify all rough openings are flashed in accordance with the Exterior Insulation and Finish System with Moisture Drainage manufacturer's installation details, or as otherwise necessary to prevent water penetration. Verify chimneys, balconies and decks have been properly flashed as necessary to prevent water penetration.
7. Verify windows and doors are installed and flashed per manufacturer's requirements and installation details.
8. Notify general contractor of all discrepancies prior to the installation of the Exterior Insulation and Finish System with moisture drainage.
9. Verify that expansion joints are installed:
 - a. Where expansion joints occur in the substrate system.
 - b. Where building expansion joints occur.
 - c. At floor lines in wood frame construction.
 - d. At floor lines of non-wood framed buildings where significant movement is expected.
 - e. Where the Exterior Insulation and Finish System with moisture drainage abuts dissimilar materials.
 - f. Where the substrate type changes.
 - g. Where prefabricated panels abut one another.
 - h. In continuous elevations at intervals not exceeding 75 ft (23 m).
 - i. Where significant structural movement occurs, such as changes in roof line, building shape or structural system.
10. Vapor Retarders: The use and location of vapor retarders within a wall assembly is the responsibility of the project designer and shall comply with local building code requirements. The type and location shall be noted on the project drawings and specifications. Vapor retarders may be inappropriate in certain climates and can result in condensation within the wall assembly.

3.02 PREPARATION

- A. Protect the Exterior Insulation and Finish System with Moisture Drainage materials by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.
- B. Protect adjoining work and property during installation of the Exterior Insulation and Finish System with Moisture Drainage.
- C. Prepare the substrate to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion.

3.03 INSTALLATION

- A. Install the EIF system in accordance with ASTM C1397 and the Dryvit Outsulation Plus MD System Application Instructions, DS934. Apply base coat sufficient to fully embed the reinforcing mesh. The recommended method is to apply the base coat in two (2) passes.
- B. Apply sealant to base coat surface prepared in accordance with [DS153](#).
- C. Install high impact reinforcing mesh as specified at ground level, high traffic areas and other areas exposed to or susceptible to impact damage as designated on contract drawings.
- D. Install Machine Coated Dryvit EPS Shapes in accordance with Dryvit Publication [DS854](#).

3.04 SITE QUALITY CONTROL

- A. Exterior Insulation and Finish System with Moisture Drainage manufacturer assumes no responsibility for on-site inspections or application of its products.
- B. EIFS sub-contractor to certify in writing the quality of work performed relative to the substrate system, details, installation procedures, and as to the specific products used.
- C. EPS supplier, if requested, to certify in writing that the EPS meets the Exterior Insulation and Finish System with Moisture Drainage manufacturer's specifications.
- D. The sealant contractor, if requested, to certify in writing that the sealant application is in accordance with the sealant manufacturer's and the Exterior Insulation and Finish System with Moisture Drainage manufacturer's recommendations.

3.05 CLEANING

- A. Remove all excess Exterior Insulation and Finish System materials from the job site by the contractor in accordance with contract provisions and as required by applicable law.
- B. Leave all surrounding areas, where the Exterior Insulation and Finish System with Moisture Drainage has been applied, free of debris and foreign substances resulting from the EIFS sub-contractor's work.

End of Section

SECTION 07 26 20

FLUID-APPLIED AIR AND VAPOR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies a water-based air/liquid moisture barrier that cures to form a seamless, elastomeric membrane on building exterior masonry or Densboard surface.

1.2 RELATED SECTIONS:

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

1.3 REFERENCES

- A. Air Barrier Association of America (ABAA)
- B. ASTM E 2357
- C. ASTM E 2178

1.4. PERFORMANCE REQUIREMENTS

- A. Material Performance: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/m² @ 75 Pa.) when tested according to ASTM E 2178.
 - 1. Assembly shall be capable of withstanding combined positive and negative design wind, fan and stack pressures on the envelope without damage or displacement and shall transfer the load to the structure.
 - 2. Assembly shall not displace adjacent materials under full load.
 - 3. Assembly shall be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated seismic movement.
- C. Connections to Adjacent Materials: Provide connections to prevent air leakage and vapor migration at the following locations:
 - 1. Walls, including penetrations, ties and anchors.
 - 2. Walls, windows, curtain walls, storefronts, louvers or doors.
 - 3. Different wall assemblies, and fixed openings within those assemblies.
 - 4. Wall and roof connections and penetrations.
 - 5. Walls control and expansion joints.
 - 7. Walls utility, pipe and duct penetrations.
 - 8. Seismic and expansion joints.
 - 9. All other leakage pathways in the building envelope.
 - 10. Exposed exterior wall areas to be painted not included

1.4. SUBMITTALS

- A. Submittals: Submit in accordance with 01 33 00 Submittal Procedures.
- B. Quality Assurance Program: Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification number of installers.
- C. Product Data: Submit manufacturer's product data, installation instructions, and manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
 - 1. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
 - 2. Include statement that materials are compatible with adjacent materials proposed for use.
 - 3. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.
- D. Samples: Submit clearly labeled samples, 3 by 4 inch (75 mm by 100 mm) minimum size of each material specified.
- E. Shop Drawings of Mock-Up: Submit shop drawings of proposed mock-ups showing plans, elevations, isometric details, installation sequence, and connections to the test apparatus.
- F. Field Test Results of Mock-Up: Submit test results of air leakage test and water leakage test of mock-up in accordance with specified standards, including retesting if initial results are not satisfactory.
- G. Shop Drawings: Submit shop drawings showing locations and extent of air and vapor barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the air and vapor barrier are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.
 - 1. Include VOC content of each material, and applicable legal limit in the jurisdiction of the project.
 - 2. Include statement that materials are compatible with adjacent materials proposed for use.
 - 3. Include recommended values for field adhesion test on each substrate.
- H. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.

1.2 QUALITY ASSURANCE

- A. Air Barrier Installer Qualifications: Currently accredited by the Air Barrier Association of America (ABAA) whose applicators are certified in accordance with the ABAA Quality Assurance Program.
- B. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing air and vapor barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.
- C. Accredited Laboratory Testing for Materials: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).
- D. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.
- E. Field Quality Assurance: Implement the ABAA Quality Assurance Program requirements. Cooperate with ABAA inspectors and independent testing and inspection agencies engaged by the Owner. Do not cover air and vapor barrier until it has been inspected, tested and accepted.
- F. Mock-Ups: Build mock-up representative of primary exterior wall assemblies and glazing assemblies including backup wall and typical penetrations as acceptable to the Architect. Mock-up shall be approximately 8 feet long by 8 feet high and include the materials proposed for use in the exterior wall assembly. Mock-up shall be suitable for testing as specified in the following paragraph.
- G. Mock-Up Tests for Air and Water Infiltration: Test mock-up for air and water infiltration in accordance with ASTM E 1186 (air leakage location) or ASTM E 783 (air leakage quantification), and ASTM E 1105 (water penetration). Use smoke tracer to locate sources of air leakage. If deficiencies are found, repair or modify mock-up and retest until satisfactory results are obtained. Deficiencies include air leakage beyond values specified, uncontrolled water leakage, unsatisfactory workmanship.
 - 1. Perform the air leakage tests and water penetration test of mock-up prior to installation of cladding and trim but after installation of all fasteners for cladding and trim and after installation of other penetrating elements. For fasteners which would normally only be installed with cladding, install representative fasteners without cladding; intent is to perform testing with all types of penetrations in place.
- H. Mock-Up Tests for Adhesion: Test mock-up of fluid-applied and sheet applied materials for adhesion in accordance with ASTM D 4541 using a Type 1 pull tester except that the disk used shall be 100mm in diameter and the membrane shall be cut through to separate the material attached to the disk from the surrounding material. Perform test after curing period recommended by the manufacturer. Record mode of failure and area which failed in accordance with ASTM D 4541. When the air barrier material manufacturer has established a

minimum adhesion level for the product on the particular substrate, the inspection report shall indicate whether this requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product/substrate combination, then the inspector shall simply record the value.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air and vapor barrier membrane manufacturer. Protect stored materials from direct sunlight.
- C. Handle materials in accordance with manufacturer's recommendations.

1.4 PROJECT CONDITIONS

- A. Temperature: Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer.
- B. Field Conditions: Do not install air and vapor barrier in snow, rain, fog, or mist without temporary protection and supplemental heat as required. Do not install air and vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer. Apply membrane to a surface dry substrate, or in accordance with manufacturer's recommendations.

1.5 WARRANTY

- A. Material Warranty: Provide manufacturer's standard product warranty, for a minimum 3 years from date of Substantial Completion.
- B. Installation Warranty: Provide air barrier subcontractor's 2 year warranty from date of Substantial Completion, including all components of the air and vapor barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fluid-Applied Air and Vapor Barrier: Fluid-applied proprietary materials as specified. Use regular or low-temperature formulation depending on site conditions, within temperature ranges specified by manufacturer. Provide related accessories including primer, seam tape, mastic, fluid and sealant recommended by manufacturer. Subject to compliance with requirements, provide one of the following:

1. Rubber Polymer Corporation:
 - a. Fluid-Applied Air and Vapor Barrier: Rub-R-Wall Airtight, 40 mils thick (dry) (20 to 25 square feet per gallon).
 - b. Solvent-Based Primer: Rub-R-Wall SA Primer.
 - c. Transition Strip, Counter flashing for Masonry Through-Wall Flashings: Rub-R-Wall SA.
 - d. Mastics: Rub-R-Wall Mastic.
 - e. Website: www.rpcinfo.com.
2. Grace Construction Products:
 - a. Fluid-Applied Air and Vapor Barrier: Perm-A-Barrier Liquid, 60 mils thick (wet).
 - b. Water-Based Primer for Flashing, Transition Strip and Detail Membrane: Perm-A-Barrier WB Primer.
 - c. Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane: Bituthene Primer B-2 and Bituthene Primer B2 LVC.
 - d. Through-Wall Flashings or Shelf Angle Flashings: Perm-A-Barrier Wall Flashing.
 - e. Mastics, Adhesives and Tapes: As recommended by Grace Construction Products.
 - f. Transition Strip: Perm-A-Barrier Detail Membrane and Perm-A-Barrier Wall Flashing.
 - g. Termination Mastic: Bituthene Liquid Membrane and as recommended by Grace Construction Products.
 - h. Window Flashing and Detail Membrane: Perm-A-Barrier Detail Membrane and Perm-A-Barrier Wall Flashing.
 - i. Website: www.na.graceconstruction.com.
3. W. R. Meadows, Inc.:
 - a. Fluid-Applied Air and Vapor Barrier: Air-Shield LM P and Air-Shield LM All Season (for cold temperature applications), 60 mils (wet), 45 mils (dry).
 - b. Detailing Strips: Air-Shield Self-Adhering Air Barrier.
 - c. Water-Based Primer: Mel-Prime WB.
 - d. Solvent-Based Primer: Mel-Prime VOC and Mel-Prime NE.
 - e. Counterflashing for Masonry Through-Wall Flashings: Air-Shield Thru-Wall Flashing.
 - f. Mastics, Adhesives and Tapes: Pointing Mastic.
 - g. Website: www.wrmeadows.com.
4. Substitutions per Section 01 2500

2.2 AUXILIARY MATERIALS

- A. Membrane at Transitions in Substrate and Connections to Adjacent Elements: Neoprene, ASTM D 2000 Designation 2BC415 to 3BC620, 50 to 65 mils (1.3 mm to 1.6 mm) thick with non-corrosive termination bars and fasteners. Adhesive and lap sealant as recommended by manufacturer.
- B. Transition Membrane between Air and Vapor Barrier Membrane and Roofing and Other Adjacent Materials: Comply with both air and vapor barrier manufacturer's recommendations and roofing material manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions under which air and vapor barrier assemblies will be applied, with Installer present, for compliance with requirements.
 - 1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 2. Do not proceed with installation until after minimum concrete curing period recommended by air and vapor barrier manufacturer.
 - 3. Ensure that the following conditions are met:
 - a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
 - b. Concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
 - c. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
 - 4. Verify substrate is surface dry. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test. Surface dry is an acceptable substrate condition if acceptable to the manufacturer.
 - 5. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
 - 6. Notify Architect in writing of anticipated problems using air and vapor barrier over substrate prior to proceeding.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air and vapor barrier application. Mask off adjoining surfaces to prevent overspray and spillage
- B. Prime substrate for application of sheet membrane transition strips as recommended by manufacturer and as follows:
 - 1. Prime masonry, concrete substrates with conditioning primer.
 - 2. Prime wood, metal, and painted substrates with primer.
 - 3. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air and vapor barrier and at protrusions.
- C. Prime substrate for application of fluid-applied air and vapor barrier if recommended by manufacturer based on project conditions and as follows.

3.3 INSTALLATION

- A. Air and Vapor Barrier Installation: Install transition strip materials and fluid-applied air and vapor barrier to provide continuity throughout the building envelope. Install materials in

accordance with manufacturer's recommendations and as follows, unless manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials:

1. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.
2. Apply primer for fluid-applied air and vapor barrier as recommended by fluid-applied air and vapor barrier manufacturer. Based on manufacturer's recommendation, no primer may be required for the fluid-applied materials.
3. Apply fluid-applied air and vapor barrier using equipment and methods recommended by manufacturer, to achieve a dry film thickness as recommended by the manufacturer.
4. Apply fluid-applied air and vapor barrier and transition strips to shed water naturally without interception by a sheet edge, unless that edge is sealed with permanently flexible termination mastic.
5. Position subsequent sheets of transition strips applied above so that membrane overlaps the membrane sheet below by a minimum of 2 inches (50 mm), unless greater overlap is recommended by manufacturer. Roll into place with roller.
6. Overlap horizontally adjacent pieces of transition strips a minimum of 2 inches (50 mm), unless greater overlap is recommended by manufacturer. Roll seams with roller.
7. Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure in accordance with manufacturer's recommendations.
8. Connect air and vapor barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing of penetrations, using accessory materials and in accordance with the manufacturer's recommendations.
9. At changes in substrate plane, provide transition material (bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.
10. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Membrane shall be continuously supported by substrate or as recommended by the manufacturer.
11. At through-wall flashings, provide an additional 6 inch wide strip of manufacturer's recommended membrane counterflashing to seal top of through-wall flashing to membrane or as recommended by manufacturer. Seal exposed top edge of strip with bead of mastic or as recommended by manufacturer.
12. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
13. At expansion and seismic joints provide transition to the joint assemblies.
14. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and as recommended by the manufacturer.
15. At end of each working day, seal top edge of the self-adhered membrane to substrate with termination mastic.
16. Do not allow materials to come in contact with chemically incompatible materials.
17. Do not expose membrane to sunlight longer than as recommended by the manufacturer.
18. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Owner's Inspection and Testing/ABAA Audits: Cooperate with Owner's testing agency and ABAA auditors. Allow access to work areas and staging. Notify Owner's testing agency/ABAA auditor in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this Section until testing and inspection is accepted.

3.5 PROTECTING AND CLEANING

- A. Protect air and vapor barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Coordinate with installation of materials which cover air and vapor membrane, to ensure exposure period does not exceed that recommended by the air and vapor barrier manufacturer.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION

SECTION 07 31 13
ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt shingles.
2. Underlayment.
3. Metal flashings and accessories.

B. Related Requirements:

1. Section 06 10 00 - Rough Carpentry: Roof sheathing.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Edge and cap flashings.
3. Section: Plumbing Work projecting through roof.
4. Section: HVAC Work projecting through roof.
5. Section: Electrical Work projecting through roof.

1.2 REFERENCE STANDARDS

A. 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 A755 - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
5. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
6. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
7. ASTM D225 - Standard Specification for Asphalt Shingles (Organic Felt) Surfaced With Mineral Granules.
8. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
9. ASTM D2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
10. ASTM D3018 - Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules.

11. ASTM D3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).
12. ASTM D3462 - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
13. ASTM D7158 -- Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method).
14. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
15. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
16. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
17. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
18. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

B. Underwriters Laboratories Inc.:

1. UL 790 - Standard Test Methods for Fire Tests of Roof Coverings.

1.3 COORDINATION

- A. Section 01 30 00 - Administrative Requirements specifies requirements for coordination.
- B. Coordinate Work of this Section with products and materials that penetrate roof surfaces, overlap flashing systems specified herein.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for shingles, underlayments, and prefinished flashing materials.
- C. Shop Drawings: Indicate metal flashings, jointing methods and locations, fastening methods and locations, and installation details.
- D. Samples: Submit manufacturer's sample board for each shingle color, indicating full color range and finish texture/pattern for color and texture selection.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Instructions: Submit installation criteria and procedures.

1.5 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements specifies requirements for transporting, handling, storing, and protecting products.
- B. Deliver materials in manufacturer's unopened packaging. Do not deliver until roof deck is prepared for installation.
- C. Store materials on roof deck and evenly distribute weight of bundles.

1.7 AMBIENT CONDITIONS

- A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient-condition control facilities for product storage and installation.
- B. Do not install ice dam membrane and shingles when ambient air temperatures are below 45 degrees F.

1.8 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish 30-year manufacturer's warranty for asphalt shingles.

PART 2 - PRODUCTS

2.1 ASPHALT SHINGLES

- A. Manufacturers:
 - 1. Owens Corning
 - 2. Certaineed
 - 3. GAF
 - 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Description: ASTM D3018, UL 790 Class A, Type I, self-sealing; glass-fiber mat base, mineral-granule-surface type; 95 lb./100 sq. ft. weight; square staggered-edge butt type; color and texture as selected by Owner.

2.2 MATERIALS

- A. Underlayment: ASTM D2178, Type IV, asphalt-saturated glass-fiber felts.

2.3 FABRICATION

- A. Form flashings to profiles indicated on Drawings, and to protect roofing materials from physical damage and shed water.
- B. Form eave edge and gable edge flashing to extend minimum 2 inches onto roof and minimum 1/4 inch below sheathing.
- C. Form flashing sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
- D. Hem exposed edges of flashings minimum 1/4 inch on underside.
- E. Apply bituminous paint on concealed surfaces of flashings.

2.4 ACCESSORIES

- A. Nails: According to ASTM F1667; standard round-wire roofing nails, hot-dip-galvanized-steel type; minimum 0.105-inch-diameter shank, minimum 0.375-inch-diameter head; of sufficient length to penetrate through plywood roof sheathing.
- B. Flashing Materials:
 - 1. Sheet Flashings: As specified in Section 07 62 00 - Sheet Metal Flashing and Trim.
- C. Bituminous Paint: Acid- and alkali-resistant type; black color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
- C. Verify that roof openings are correctly framed.
- D. Verify that deck surfaces are dry and free of ridges, warps, or voids.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Broom-clean deck surfaces under ice dam membrane and underlayment.

3.3 INSTALLATION

A. Underlayment Installation:

1. Place one ply of underlayment over substrate with ends and edges weather lapped 2 inches. Stagger end laps of each consecutive layer. Nail underlayment in place.
2. Place second ply of underlayment over first layer, lapping first layer 19 inches. Lap ends minimum 2 inches. Stagger end laps of each consecutive layer. Nail underlayment in place.
3. Install underlayment according to manufacturer's instructions without distortions capable of preventing shingles from sealing. Nail underlayment overlap at 36 inches o.c.
4. Weather-lap and seal items projecting through or mounted on roof watertight with plastic cement.

B. Metal Flashing and Accessories Installation:

1. Weather-lap joints minimum 2 inches and seal weathertight with plastic cement.
2. Secure in place with nails. Conceal fastenings.
3. Flash and seal Work weathertight, projecting through or mounted on roofing with plastic cement.

C. Asphalt Shingles Installation:

1. Install shingles according to manufacturer's instructions, using no less than minimum number of fasteners per shingle than required for wind-load rating.
2. Place shingles in straight coursing pattern with manufacturer required weather exposure to produce double thickness over full roof area. Install double course of shingles at eaves.
3. Project starter course and first course of shingles 3/4 inch beyond eave flashing and fascia boards.
4. Extend shingles 1/2 inch beyond face of gable edge flashing and fascia boards.
5. Cap ridges with individual shingles, maintaining 5-inch weather exposure. Place to avoid exposed nails.
6. After installation, place two daubs of plastic cement, 1-inch diameter, under each individual shingle tab exposed to weather to prevent lifting.
7. Coordinate installation of roof-mounted components or items projecting through roof with weathertight placement of counterflashings.
8. Complete installation to provide weathertight service.

3.4 PROTECTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Do not permit traffic over finished roof surfaces.

END OF SECTION 07 31 13

SECTION 07 42 93
SOFFIT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Concealed-fastener, lap-seam metal soffit panels.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 3" = 1'-0".
- C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
 - 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Manufacturer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Manufacturer Qualifications: Company specializing in Architectural Sheet Metal Products.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Remove strippable protective covering on metal panels as panels are being installed. Do not leave the film on installed panels.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Galvalume Substrate Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing or perforating.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: 20 years and 6 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Deflection Limits: For wind loads, no greater than 1/240 of the span.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile, Concealed-Fastener Metal Soffit Panels: Formed with vertical panel edges and a flat pan vented between panel edges; with flush joint between panels.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company; FW-12 or comparable product by one of the following:
 - a. Substitutions per 01 25 00.
 - 2. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.024 inch.
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Two-coat fluoropolymer
 - d. Color: As selected by Architect from manufacturer's full range.
 - 3. Panel Coverage: 12 inches.

4. Panel Height: 1.5 inches.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM A 792 Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat applied by panel manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.75 ± 0.05 mil (0.019 ± 0.0013 mm) over 0.2 ± 0.05 mil (0.05 ± 0.0013 mm) primer coat, to provide a total dry film thickness of 0.95 ± 0.10 mil (0.024 ± 0.0025 mm). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine soffit framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

2. Aluminum Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use stainless-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Flash and seal panels with weather closures at perimeter of all openings.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal soffit panel installation, including accessories.

- B. Remove and replace metal soffit panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes: sheet metal work in conjunction with roofing including copings, flashings and counterflashings, and fabricated sheet metal items.
 - 1. Provide reglets and accessories as required
- B. Related Sections:
 - 1. Section 03 30 00 – Cast-in-Place Concrete.
 - 2. Section 06 10 00 – Rough Carpentry: Wood blocking for metal roofing substrate profiles.
 - 3. Section 07 54 00 – Thermoplastic Membrane Roofing.
 - 4. Section 07 92 00 – Joint Sealers.

1.2 REFERENCES

- A. American Architectural Manufacturers Association:
 - 1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - 3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - 4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. ASTM International:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 4. ASTM B32 - Standard Specification for Solder Metal.
 - 5. ASTM B101 - Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction.
 - 6. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 7. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - 8. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.

- 9. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- 10. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- 11. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
- 12. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- C. Copper Development Association Inc.:
 - 1. CDA - Copper in Architecture - Handbook.
- D. Federal Specification Unit:
 - 1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- E. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - Architectural Sheet Metal Manual.
- F. SMACNA – Architectural Sheet Metal Manual

1.3 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- B. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.
- C. Samples:
 - 1. Submit samples, illustrating typical material and finish.
 - 2. Submit samples illustrating metal finish color.

1.4 QUALIFICATIONS

- A. Fabricator and Installer: Company specializing in sheet metal work with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

- A. Manufacturers:
 - 1. Metal Panel Systems Inc. 11506 Reading Road, Cincinnati, Ohio 45241, 1-800-554-6126

2. Cheney Flashing Co.
3. Keystone Flashing Co.
4. Substitutions: Per Section 01 25 00

- B. Pre-Finished Galvanized Steel Sheet: ASTM A924/A924M, Grade A, or ASTM A653/A653M, G90 (Z275) zinc coating; 24 gage core steel, shop pre-coated. Coating; color as selected from manufacturer's standard color.

2.2 COPINGS

- A. High quality, corrosion-resistant rain removal systems designed to perform in commercial application shall be used.
- B. Copings shall be of a full snap-on design allowing attachment to treated wood nailer directly atop masonry or framed walls with continuous 20 gauge galvanized anchor clips.
- C. Material: 24 gauge galvanized steel with a kynar finish, color to be selected by Architect from a full range of manufacturer's available colors.

2.3 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal.
- B. Slip Sheet: Rosin sized building paper.
- C. Protective Backing Paint: Zinc molybdate alkyd.
- D. Sealant: sealant specified in Division 07 Section Joint Sealers.
- E. Plastic Cement: ASTM D4586, Type I.
- F. Reglets: Recessed type, galvanized steel.

2.4 FABRICATION

- A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet metal, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Tin edges of copper sheet to be soldered. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.

- G. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- H. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- I. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.
- J. Seal metal joints.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets to lines and levels indicated on Drawings. Seal top of reglets with sealant.
- C. Paint concealed metal surfaces with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Insert flashings into reglets to form tight fit. Secure in place with wedges. Seal flashings into reglets with sealant.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.

END OF SECTION

SECTION 07 92 00

JOINT SEALERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Exterior weatherseal in vertical walls
- B. Exterior seals in non-traffic horizontal or sloped surfaces as follows:
 - 1. Canopies
 - 2. Soffits
 - 3. Features or components of vertical walls
 - 4. Ledges
- C. Internal component seals relied on to manage infiltrated water
- D. Interior seals at perimeter of window systems
- E. Structural silicone seal/adhesive applications
- F. Sealant at junctures of dissimilar materials.
- G. Sealant as required at concrete wall/metal building wall junctures.
- H. Sealant at juncture of gypsum bd. and plumbing fixtures.
- I. Sealant in any other locations as shown on working drawings
- J. Sealant backers required for proper joint configuration and as bond breaker.

1.2 RELATED SECTIONS

- A. Section 03 30 00 – Cast-in-Place Concrete.
- B. Section 06 10 00 –Rough Carpentry.
- C. Section 07 62 00 – Sheet Metal Flashing and Trim.
- D. Section 08 11 13 – Steel Doors and Frames.
- E. Section 08 51 13 – Aluminum Entrances and Storefronts.
- F. Section 09 21 16 – Gypsum Board Assemblies.
- G. Section 09 30 00 – Ceramic Tile Floor and Wall Finish.
- H. Section 09 90 00 – Painting.

- I. Divisions 15 & 16 – Mechanical and Electrical Work.

1.3 REFERENCES

- A. American Society for Testing and Material (ASTM)
1. C719 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement
 2. C794 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
 3. C920 Standard Specification for Elastomeric Joint Sealants
 4. C1248
 5. C1087 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
 6. C1193 Standard Guide for Use of Joint Sealants
- B. Flat Glass Marketing Association (FGMA)
1. Glazing Manual
 2. Sealant Manual

1.4 PERFORMANCE REQUIREMENTS

- A. Conformance with the requirements of this Article shall be demonstrated, where applicable, by submitting appropriate manufacturer's test reports, product technical data, and certification letters.
- B. Sealed Joint Design
1. Design and install joint widths to accommodate expected movements, without failure of joint sealant.
 2. In no case shall a sealed joint, susceptible to movement, be installed at less than 1/4".
 3. Sealant and backer shall be installed of proper configuration to maximize compression/extension of sealant capability and to minimize stress at bond line on substrates.
- C. Adhesion
1. When tested in conformance to ASTM C794, joint sealant shall not fail in adhesion.
- D. Compatibility
1. When tested in conformance to ASTM C1087, sealants shall be shown to be compatible with project materials coming in contact with the sealant such as backers, gaskets, and setting blocks.
- E. Staining
1. When tested in conformance to ASTM C1248, porous substrates shall show no permanent staining.
- F. Structural Silicone Applications
1. Allowable stress of silicone shall not exceed 20 psi when subjected to design windload pressure.
 2. Structural silicone seal/adhesive shall not be considered to support deadload of glass.

1.5 SUBMITTALS

- A. Samples
 - 1. Submit 12" samples of cured sealant between two representative project substrates. Submit for each color of sealant required.
- B. Product Data
 - 1. Submit manufacturer's published product data sheets for confirmation of intent of products to be provided on project.
 - 2. Bids proposing substitute products must be accompanied by manufacturer's literature showing conformance to all performance criteria.
- C. Test Reports
 - 1. Submit test reports, utilizing project specific substrate materials, upon completion of testing.
- D. Certifications
 - 1. Provide certification that Installer is qualified as specified under "Quality Assurance".
- E. Warranties
 - 1. Properly executed warranties are to be provided prior to final acceptance of work.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Installer shall be able to demonstrate not less than five (5) years successful experience in the installation of comparable projects.
 - 2. Manufacturer shall be capable of providing the following:
 - a. Field service representation during construction
 - b. Performing laboratory tests as specified herein
 - c. Review and comment of contractor's shop drawings, as requested, relating to sealant details
 - 3. All sealant for the work of this section shall be provided by one manufacturer.
- B. Pre-Installation Conference
 - 1. Before substantially commencing work on site, the sealant installer, Contractor, and sealant manufacturer shall meet with the Architect and Construction Manager to address the following as a minimum:
 - a. Coordinate installation of sealants with installation of substrates. Specifically coordinate schedule with window perimeter trim, if any.
 - b. Verify understanding of approved shop drawings as relative to this work.
 - c. Verify minimum joint widths expected to accommodate sealant capability.
 - d. Review laboratory and field test results for direction on required priming.
 - e. Review proper substrate cleaning procedure as recommended by manufacturer.
 - f. Coordinate mobility, storage, use of lifts or scaffolding.
 - g. Review limitations of product application with manufacturer.

- C. Mock-up
 - 1. If requested by Construction Manager or Architect, install sealant samples to project materials for review. This may also serve as location for field tests.
- D. In addition to manufacturer's recommendations, conform to guidelines of the FGMA Sealant and Glazing Manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store all materials in a manner to prevent damage or deterioration, in conformance with manufacturer's instructions.
- B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Batch numbers and expiration date shall be clearly marked on manufacturer's packaging.
- E. Provide Material Safety Data Sheet for each product.

1.8 SITE CONDITIONS

- A. Do not install sealants or other materials in environmental conditions (temperature, humidity, ventilation, wind) that are beyond the limitations set by the manufacturer.

1.9 WARRANTY

- A. Manufacturer shall warrant for 10 years from date of substantial completion, that the installed sealants will perform as watertight weatherseals and will not change colors when used with back-up materials and substrates that have been approved for compatibility.
- B. Glazing Contractor and Sealant Installer (if different than Glazing Contractor) shall jointly warrant for two (2) years from date of substantial completion, that the installation is not defective in workmanship or materials.
 - 1. This warranty applies to both patent and latent defects.
 - 2. Responsibility of the Contractor/Installer during the two (2) year warranty period shall be to repair or replace defective work. No cost of remedial work shall be borne by the Owner.
- C. Defects may be defined as follows, however, this list is not inclusive of all potential problems:
 - 1. Adhesive or cohesive failure
 - 2. Staining of substrates beyond samples as tested for project
 - 3. Color change of sealants or adjacent materials
 - 4. Failure of sealant to cure

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Sealant Manufacturers:

1. Dow Corning Corp.- 1255 Northmeadow Parkway, Suite 104, Roswell, GA 30076, (751-7979).
2. Pecora Corporation - 165 Wambold Road, Harleysville, PA 19438 (523-6688).
3. Sonneborn, Division of ChemRex, Inc. - 889 Valley Park Drive, Shakopee, MN 55379, (800) 433-9517.
4. Tremco - 3735 Green Road, Beachwood, OH 44122, (800) 321-7906.
5. General Electric Co. - 260 Hudson River Rd., Waterford, NY 12188, (255-8886).

2.2 MATERIALS: Contractor should choose best sealant for specific application relative to: joint size, primer requirements, color availability, and substrate materials

A. Single-Component Low to Medium Modulus, Neutral-Cure Silicone Elastomeric Sealant:

1. Dow Corning 795 (+/- 50% movement)
2. Dow Corning 791 - (+/- 50% movement)
3. Dow Corning 790 (+ 100%, - 50% movement)
4. General Electric Silpruf (+/- 50% movement)
5. General Electric Silglaze II (+/- 50% movement)
6. Pecora 864 (+/- 50% movement)
7. Pecora 890 (+ 100%, -50% movement)
8. Pecora 895 (+/- 50% movement)
9. Tremco Spectrem 1 (+100%, -50% movement)
10. Tremco Spectrem 2 (+/- 50% movement)
11. Applications: Use for exterior weatherseals, rain-screen seals, and internal frame assembly seals

B. Single-Component Medium to High Modulus, Neutral-Cure Silicone Sealant/Adhesive:

1. Dow Corning 795
2. Dow Corning 995
3. General Electric Ultraglaze SSC4000
4. Pecora 895
5. Applications: Use for structural silicone glazing applications.

C. Single-Component, Neutral-Cure, Polyurethane Sealant:

1. Pecora Dynatrol I (+/- 25% movement)
2. Sonneborn Sonolastic 150 (silyl-terminated polyether elastomeric)
3. Sonneborn NPA (+/- 25% movement)
4. Sonneborn Ultra (+/- 25% movement)
5. Tremco DyMonic (+/- 25% movement)
6. Applications: Use for exterior weatherseals, aesthetic seals, and internal frame assembly.

D. Multi-Component, Neutral-Cure, Polyurethane Sealant:

1. Pecora Dynatrol II (+/- 50% movement)
2. Sonneborn NP2 (+/- 50% movement)
3. Tremco Dymeric (+ 40/- 25% movement)
4. Applications: Use for exterior weatherseals, rain-screen seals.

- E. Exterior Foam Expansion Joint Sealer: Precompressed foam sealer; Polyurethane with water-repellent:
 - 1. Size: As required to provide weathertight seal when installed.
 - 2. Applications: Use for exterior wall expansion joints.
- F. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.
 - 1. Applications: Use for concealed sealant bead in sheet metal work and concealed sealant bead in siding overlaps.
- G. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
 - 1. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.
- H. Tile Sealant: White silicone; ASTM C920, Uses M and A; single component, mildew resistant.
 - 1. Applications: Use for joints between plumbing fixtures and floor and wall surfaces, and joints between toilet room counter tops and wall surfaces.
- I. Acoustical Sealant: Butyl or acrylic sealant; ASTM C920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
 - 1. Applications: Use for concealed locations only at acoustically rated construction.
- J. Sealant Backers
 - 1. Provide backers as recommended by sealant manufacturer and as passed on project compatibility tests. Closed cell gassing rods are not acceptable.
 - 2. Provide sufficient sizes and diameters of backers to accommodate varying joint widths on project, such that backers are compressed about 25% for all installations.
- K. Primers, Cleaning, Masking Supplies
 - 1. Provide primer for specific sealant/substrate conditions as recommended by sealant manufacturer and as determined by project sample testing.
 - 2. Provide solvents, cloths, and other supplies as recommended or acceptable by sealant manufacturer for proper joint preparation.
 - 3. Do not use solvents that are harmful to paint finishes or other components that will be contacted.
 - 4. Masking tape shall not leave residue when removed.
- L. Bond Breaker Tape
 - 1. Provide polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant bond that would result in joint failure.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Before commencing sealant installation in any assigned area, examine substrates' condition and joint width which may affect sealed joint performance. Correct deficiencies before proceeding.
- B. Compare shop drawings with actual conditions. Advise Architect of discrepancies.

3.2 PREPARATION

- A. Cleaning
 - 1. Clean joint surfaces just prior to sealant installation to remove all laitance and surface dirt.
 - a. Non-porous substrates shall be cleaned with a solvent as recommended or acceptable by sealant manufacturer, and as required depending upon contaminants to be removed. Use "two-cloth" cleaning method as described herein.
 - b. Porous substrates shall be cleaned by dusting, or solvent, or both as dictated by field testing and as recommended or acceptable to sealant manufacturer. Abrasion cleaning may be required to remove surface treatments or coatings.
 - 2. "Two-Cloth" Cleaning Method
 - a. Use clean, soft, absorbent, lint-free cloths. This method consists of a solvent cloth wipe followed by a dry cloth wipe.
 - b. Thoroughly clean all surfaces of loose debris.
 - c. Pour or dispense acceptable cleaning solvent onto the cloth. A plastic squeeze bottle works best for organic cleaning solvents. Do not dip cloth into solvent container, as this will contaminate the cleaning agent.
 - d. Wipe vigorously to remove surface contaminants. Rotate the cloth to clean area before re-wiping.
 - e. Immediately wipe the cleaned area with a separate clean, dry cloth. Organic solvent must be removed with the dry cloth before the solvent evaporates.
- B. Priming
 - 1. If primer is required per project substrate adhesion testing, mask adjacent surfaces where aesthetics is a consideration to keep excess primer or sealant off these surfaces.
 - 2. Apply primer (if required) to cleaned, dry substrates using a clean, dry cloth or brush. Do not apply too thick of coat. A white, powdery film will form if primer has been applied too thick. Remove excess primer with clean cloth.
 - 3. Allow primer to dry until all solvent is evaporated, this may take 5 to 30 minutes, depending on weather conditions.
 - 4. After inspecting for dryness, the joint is ready for backer and sealant installation. Sealant must be installed same day as joint preparation.

3.3 INSTALLATION

- A. Comply with the requirements of ASTM C1193 for proper sealant and backer installation.

- B. Sealant Backers
 - 1. Install proper diameter or size backer to depth in joint to develop a proper sealant bead configuration.
 - 2. Do not stretch, twist, or puncture sealant backers.
 - 3. If backers become wet due to exposure, remove and replace with dry material.
 - 4. Install bond breaker tape where required to prevent three-sided adhesion in moving joints.
- C. Installation of Sealants
 - 1. Completely fill voids in joints to ensure full adhesion and proper joint profile.
 - 2. Tool sealant concave, pushing sealant into void. Do not wet tooling aids as this may interfere with sealant cure and adhesion.
 - 3. Structural silicone applications require that the sealant be fully cured and adhered before the adhesive is stressed. Temporary support of substrates must be used during cure time. Follow written instructions by sealant manufacturer for duration criteria of temporary support. Do not move shop sealed units until fully cured.

3.4 FIELD QUALITY CONTROL

- A. Do not allow excess sealant to contact adjacent surfaces if aesthetics is a consideration. However, should this occur, remove immediately by method of solvent, abrasion, or both as applicable. Solvents will not fully remove sealants or primers from porous surfaces.
- B. Remove masking tape before sealant cures.
- C. Dispose of all trash and solvent wipe rags in non-combustible containers.

3.5 PROTECTION

- A. Protect the installed sealants from damage or contamination during course of construction

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS & 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. Standard and custom hollow metal doors and frames.
- 2. Steel sidelight, borrowed lite and transom frames.
- 3. Louvers installed in hollow metal doors.
- 4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

- 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
- 2. Division 08 Section "Flush Wood Doors".
- 3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
- 4. Division 08 Section "Door Hardware".
- 5. Division 08 Section "Access Control Hardware".
- 6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
- 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
- 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
- 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
- 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. FEMA P-361 2015 – Design and Construction Guidance for Community Safe Rooms.
15. ICC 500 - 2014 ICC/NSSA Standard for the Design and Construction of Storm Shelters.
16. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
17. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
18. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 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 anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) 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. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are 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. Provide labeled glazing material.
- E. Severe Storm Shelter Openings: Provide complete door systems for hurricane or tornado storm shelters, and other areas of refuge, complying and tested according to FEMA P-361, Third Edition (2015), Design and Construction Guidance for Community Safe Rooms; and ICC 500 (2014), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
 - 1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Pioneer Industries (PI).
 - 4. Steelcraft (S).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Manufacturers Basis of Design:
1. Curries Company (CU) - Polystyrene Core - 707 Series.
 2. Curries Company (CU) - Energy Efficient - 797 Mercury Series.

2.4 HOLLOW METAL DOORS FOR SEVERE STORM SHELTERS

- A. General: Provide complete tornado or hurricane resistant door and frame shelter assemblies constructed to resist the design wind pressures for components and cladding and missile impact loads as described in ICC 500 - 2014, ICC/NSSA Standard for the Design and Construction of Storm Shelters. Only single opening and paired opening doors and their frames constructed to resist calculated design wind pressures and laboratory tested missile impacts are acceptable.

1. Door systems, both single doors and paired openings, tested and complying with ICC 500 - 2014 and FEMA P-361 (2015), Design and Construction Guidance for Community Safe Rooms and supported by third party test results.
2. Sheets fabricated on exterior openings from commercial quality hot dipped zinc coated steel complying with ASTM A924 A60. Gauges to be in accordance with manufacturers tested assemblies.
3. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
4. Top Edge: Reinforce top of doors with a continuous steel channel extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached and welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".

B. Manufacturers Basis of Design:

1. Curries Company (CU) - StormPro Series.

2.5 HOLLOW METAL FRAMES

- A. General:** Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Thermal Break Frames:** Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.
- C. Exterior Frames:** Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Manufacturers Basis of Design:
 - a. CECO Door Products (C) – Thermal Break TQB Series.
 - b. Curries Company (CU) – M CM Series.
 - c. Curries Company (CU) – Thermal Break TQ Series.
- D. Interior Frames:** Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M Series.
- E. Fire rated frames:** Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

- F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.6 FRAMES FOR SEVERE STORM SHELTERS

- A. General: Subject to the same compliance standards and requirements as standard hollow metal frames, provide complete tornado or hurricane resistant door and frame assemblies, for both single doors and paired openings, tested and labeled as complying with ICC 500 - 2014 and FEMA P-361 (2015) and supported by third party test results.
 - 1. Fabricate exterior frames from 14 gauge hot dipped zinc coated steel that complying with ASTM designations A924 A60.
 - 2. Manufacturers Basis of Design:
 - a. Curries Company (CU) - StormPro Series.

2.7 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
 - 1. Blade Type: Vision proof inverted V or inverted Y.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
 - 1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.9 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.10 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.11 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 thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:

1. Shipping Limitations: 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.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight 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.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 - c. Severe Storm Shelter Openings: Provide jamb, head, and sill anchors in accordance with manufacturer's tested and approved assemblies.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
 11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.12 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. 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. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

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 and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION

SECTION 08 31 13
ACCESS DOORS & 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 access doors and frames for ceilings.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURER

Nystrom
9300 73rd Avenue North
Minneapolis, MN 55428
Phone: 800.547.2635
www.nystrom.com

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors Model: NT Architectural with Exposed Flanges Non-Rated General-Purpose Access Door.
 - 1. Description: Face of door flush with frame, with 1-inch exposed flange and flush, continuous piano hinge.
 - 2. Locations: Ceiling.
 - 3. Door Size: 22" x 30".
 - 4. Steel Sheet:
 - a. Door Material: Nominal 0.062-inch 16 gauge. Fold on all four sides for structural rigidity.
 - b. Frame Material: Nominal 0.062 inch, 16 gauge. Provide 1/4-inch mounting holes and easy install tabs.
 - c. Finish: Paintable White; powder-coat.
 - 5. Latch and Lock: Cam latch, key operated.
 - 6. Options: Gasketing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

SECTION 08 41 10
ALUMINUM STOREFRONTS & WINDOWS

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.
- B. Section Includes:
 - 1. Aluminum windows and storefront systems, complete with reinforcing, fasteners, anchors, and attachment devices.
 - 2. Accessories necessary to complete work.
- C. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry.
 - 2. Section 07 90 00 - Joint Sealers.
 - 3. Section 08 71 00 - Door Hardware.
 - 4. Section 08 80 00 - Glazing.

1.02 REFERENCES

- A. Aluminum Association (AA):
 - 1. DAF-45 Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association (AAMA):
 - 1. 501 Methods of Test for Exterior Walls.
 - 2. 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
 - 3. 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 - 4. 611 Voluntary Specification for Anodized Architectural Aluminum.
 - 5. 701 Voluntary Specifications for Pile Weatherstripping and Replaceable Fenestration Weatherseals.
 - 6. 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
 - 7. 1801 Voluntary Specification for the Acoustical Rating of Windows, Doors, and Glazed Wall Sections.
 - 8. CW-10 Care and Handling of Architectural Aluminum From Shop to Site.
 - 9. SFM1 Aluminum Storefront and Entrance Manual.
- C. American Society for Testing and Materials (ASTM):
 - 1. A36 Structural Steel.
 - 2. A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. B209 Aluminum and Aluminum - Alloy Sheet and Plate.
 - 4. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - 5. E283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
 - 6. E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
 - 7. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

- D. Glass Association of North America (GANA):
 - 1. Glazing Manual
- E. Federal Specifications (FS):
 - 1. TT-P-641G(1) Primer Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces).
 - 2. TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.
- F. Steel Structures Painting Council (SSPC):
 - 1. Cold-Applied Asphalt Mastic (Extra Thick Film).

1.03 SYSTEM REQUIREMENTS

A. Design Requirements:

- 1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage, or moisture disposal.
- 2. Requirements shown by details are intended to establish basic dimensions of units, sight lines and profiles of members.
- 3. Provide concealed fastening.
- 4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
- 5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
- 6. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.
- 7. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
- 8. Stresses placed on structural silicone sealants shall be kept within sealant manufacturer's recommended maximum.

B. Performance Requirements:

- 1. Wind loads: Provide framing system capable of withstanding wind load design pressures based on the 2024 Ohio Building Code.
- 2. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
- 3. Water infiltration: No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 10 psf as defined in AAMA 501.
- 4. Deflection:
 - Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures for spans up to and including 13'-6" shall be limited to [1/175] of its clear span and for spans greater than 13'-6" deflection shall be limited to [1/240] of its clear span + 1/4", except that maximum deflection of members supporting plaster surfaces shall not exceed 1/360 of its span.
- 5. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
 - a. Glass to Exterior – 0.54 (clear)
 - b. Glass to Center – 0.56 (clear)
 - c. Glass to Interior – 0.51 (clear)

6. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
 - a. Glass to Exterior – 69frame and 60glass (clear)
 - b. Glass to Center – 58frame and 54glass (clear)
 - c. Glass to Interior – 57frame and 57glass (clear)
7. Sound Transmission Class (STC): When tested to AAMA Specification 1801, the STC Rating shall not be less than:
 - a. Glass to Exterior – 38 (laminated)
 - b. Glass to Center – 37 (laminated)
 - c. Glass to Interior – 38 (laminated)
- C. Testing Requirements: Provide components that have been previously tested by an independent testing laboratory.

1.04 SUBMITTALS

- A. General: Submit in accordance with Section 01300.
 - B. Product Data:
 1. Submit manufacturer's descriptive literature and product specifications.
 2. Include information for factory finishes, hardware, accessories, and other required components.
 3. Include color charts for finish indicating manufacturer's standard colors available for selection.
 - C. Shop Drawings:
 1. Submit shop drawings covering fabrication, installation and finish of specified systems.
 2. Include following:
 - a. Fully dimensioned plans and elevations with detail coordination keys.
 - b. Locations of exposed fasteners and joints.
 3. Provide detailed drawings of:
 - a. Composite members.
 - b. Joint connections for framing systems and for entrance doors.
 - c. Anchorage.
 - d. System reinforcements.
 - e. System expansion and contraction provisions.
 - f. Glazing methods and accessories.
 - g. Internal sealant requirements.
 - h. Thermal improvements.
 4. Schedule of finishes.
 - D. Samples:
 1. Submit manufacturers standard samples indicating quality of finish.
 2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
 - [3. Submit samples for each type of glass, 12 x 12 inch size.]
 - E. Test Reports:
 1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting. Include other supportive data as necessary.
 - F. Qualification Data:
 1. Submit installer qualifications verifying years of experience.
- Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility:

1. To ensure quality of appearance and performance, obtain materials for systems from either a single manufacturer or from manufacturer approved by systems manufacturer.
 - B. Installer Qualifications: Certified in writing by system manufacturer as qualified for installation of specified systems.
 - C. Perform Work in accordance with AAMA SFM1 and manufacturer's written instructions.
- 1.06 DELIVERY, STORAGE, AND HANDLING
- A. Comply with requirements of Section 01 60 00.
 - B. Protect finished surfaces as necessary to prevent damage.
 - C. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.
 - D. Do not leave coating residue on any surfaces.
 - E. Replace damaged units.
- 1.07 WARRANTY
- A. Provide warranties in accordance with Section 01 77 00.
 - B. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.
 - C. Warranty shall cover following:
 1. Complete watertight and airtight system installation within specified tolerances.
 2. System is structurally sound and free from distortion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

- A. Subject to compliance with requirements indicated, provide products by one of the following:
 1. **Oldcastle BuildingEnvelope®**, Terrell, TX.
- B. Substitutions: Submit under provisions of Section 01630, a minimum of 10 days prior to bid date.
- C. Acceptable Storefront Framing System:

Series 3000 Thermal MultiPlane, glass set to the [front, center, back, or in multiple planes], thermally broken, [exterior, or interior] loaded 2" x 4-1/2" mullion profile. For the thermal break, this system uses a two-part polyurethane polymer poured in place into a mechanically altered aluminum pocket to provide enhanced adhesion between the dissimilar materials and improved shear strength of the composite section. This system accommodates 1" glass thickness, with 1/4" as an option.
[SSG – Structural Silicone Glazed Mullion]

2.02 FRAMING MATERIALS AND ACCESSORIES

- A. Aluminum:
 1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.
- B. Internal Reinforcing:
 1. ASTM A36 for carbon steel.
 2. Shapes and sizes to suit installation.

3. Steel components factory coated with alkyd type zinc chromate primer complying with FS TT-P-645.
 - C. Anchorage Devices:
 1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
 2. Hot-dip galvanize steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.
 - D. Fasteners:
 1. Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
 2. Provide concealed fasteners wherever possible.
 3. For exposed locations, provide Phillips flathead screws with finish matching item fastened.
 4. For concealed locations, provide manufacturer's standard fasteners.
 - E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.
 - F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.
 - G. Touch-Up Primer for Galvanized Components: Zinc oxide conforming with FS TT-P-641.
 - H. Glazing Gaskets:
 1. Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
 2. Profile and hardness as required to maintain uniform pressure for watertight seal.
 - I. Weatherstripping:
 1. Wool pile conforming to AAMA 701.2.
 2. Provide EPDM or vinylblade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.
 - J. Internal Sealants and Baffles.
- 2.03 GLASS AND GLAZING ACCESSORIES
- A. Refer to Section 08 80 00.
- 2.04 FABRICATION
- A. Coordination of Fabrication:
 1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
 2. Fabricate units to withstand loads that will be applied when system is in place.
 - B. General
 1. Conceal fasteners wherever possible.
 2. Reinforce work as necessary for performance requirements, and for support to structure.
 3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators, which will prevent contact and corrosion.
 4. Comply with Section 08810 for glazing requirements.
 - C. Aluminum Framing:
 1. Provide members of size, shape and profile indicated, designed to provide for glazing from [exterior] [interior].
 2. Provide manufacturer's standard thermal break between exterior and interior aluminum surfaces.
 3. Fabricate frame assemblies with joints straight and tight fitting.
 4. Reinforce internally with structural members as necessary to support design loads.

5. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
 6. Seal horizontals and direct moisture accumulation to exterior.
 7. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
 8. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without detrimental to appearance or performance.
- D. Welding:
1. Comply with recommendations of the American Welding Society.
 2. Use recommended electrodes and methods to avoid distortion and discoloration.
 3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.
- E. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".
- 2.05 FINISHES
- A. Clear Anodized:
1. Conforming to AA-M12C22A31 and AAMA 611.
 2. Architectural Class II, etched, medium matte, clear anodic coating, 0.4 mil minimum thickness.]

PART 3 - EXECUTION

- 3.01 EXAMINATION
- A. Examine conditions and proceed with Work in accordance with Section 01400.
- 3.02 INSTALLATION
- A. Erection Tolerances:
1. Limit variations from plumb and level:
 - a. 1/8 inch in 10'-0" vertically.
 - b. 1/8 inch in 20'-0" horizontally.
 2. Limit variations from theoretical locations: 1/4 inch for any member at any location.
 3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4 inch.
- B. Install doors and hardware in accordance with manufacturer's printed instructions.
- C. Set units plumb, level and true to line, without warp or rack of frame.
- D. Anchor securely in place, allowing for required movement, including expansion and contraction.
- E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or preformed separators to prevent contact and corrosion.
- F. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weather-tight construction.
- G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07920.
- H. Glazing: Refer to requirements of Section 08810.
- 3.03 ADJUSTING
- A. Test door operating functions. Adjust closing and latching speeds and other hardware in

accordance with manufacturer's instructions to ensure smooth operation.

3.04 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
- B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

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 commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Door Hardware Schedule".
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. Division 08 Section "Flush Wood Doors".
 - 4. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 5. Division 08 Section "Access Control Hardware".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
 - 3. FEMA P-361 2015 - Design and Construction Guidance for Community Safe Rooms.
 - 4. ICC 500-2014, ICC/NSSA Standard for the Design and Construction of Storm Shelters.
 - 5. ICC/IBC - International Building Code.
 - 6. NFPA 70 - National Electrical Code.
 - 7. NFPA 80 - Fire Doors and Windows.
 - 8. NFPA 101 - Life Safety Code.
 - 9. NFPA 105 - Installation of Smoke Door Assemblies.
 - 10. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access

control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

- a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of Windstorm assemblies.
- E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- F. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during

the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- D. Windstorm Assembly Installer Qualifications: Installers are to be factory trained for shop and field installation prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project. A pre-installation site inspection of the frame and floor conditions shall be conducted by the factory trained installer prior to any Windstorm assembly hardware applied to the opening.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Severe Storm Shelter Openings: Provide complete door systems for hurricane or tornado resistant storm shelters and other areas of refuge complying and tested according to FEMA P-361 (2015), Design and Construction Guidance for Community Safe Rooms; and ICC 500 (2014), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
- G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.

- 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
1. Ten years for mortise locks and latches.
 2. Five years for exit hardware.
 3. Twenty five years for manual surface door closer bodies.
 4. Twenty five years for manual surface door closer bodies.
 5. Twenty five years for manual surface door closer bodies.
 6. Five years for motorized electric latch retraction exit devices.
 7. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - c. Tornado Resistant Assemblies: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a Severe Storm Shelter Opening meeting ICC 500 and FEMA 361.
4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
 - a. Hager Companies (HA) - CB Series.
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
 - c. Stanley Hardware (ST) - CB Series.

- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

- a. Hager Companies (HA).
- b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. Hager Companies (HA) - ETW-QC (# wires) Option.
- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC (# wires) Option.

- B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
- b. Securitron (SU) - EL-CEPT Series.

- C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. Hager Companies (HA) - Quick Connect.

- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.
- c. Stanley Hardware (ST) – WH Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

- 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
- 2. Furnish dust proof strikes for bottom bolts.
- 3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
- 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
- 5. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

- 1. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

- 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
- 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
- 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
- 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
- 5. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 5. Keyway: Match Facility Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Key locks to Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) – ML2000 Series.

- b. Sargent Manufacturing (SA) – 8200 Series.
 - B. Mortise Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified.
 - 1. Manufacturers:
 - a. Sargent Manufacturing (SA) - 7900 Series.
 - C. Multi-Point Locksets, FEMA: Three-point locking system device engineered for in-swinging and out-swinging door applications on windstorm safe shelter rooms. Extra heavy duty steel component construction securing the door to the frame at top, bottom and center latch positions. All three latching points are automatically activated when the device is locked. Multi-Point Deadlocking System shall be used only with doors, frames and associated hardware that have been engineered, tested and approved for a complete opening assembly system.
 - 1. Severe Storm Shelter Components: Multi-point locking system devices engineered for in-swinging and out-swinging door applications on tornado or hurricane resistant safe shelter rooms. The multi-point latching integrated device is approved for usage as part of a complete ICC 500 (2014) and FEMA P-361 (2015) door, frame and hardware assembly.
 - 2. ANSI-BHMA listed to A156.37 Grade 1 for multi-point locks:
 - a. Lever torque to retract all bolts less than 28 in.lb.
 - b. Cycle tested to 800,000 cycles.
 - 3. NFPA 80 and NFPA 101 life safety requirements.
 - 4. UL10B or UL10C, 3-hour fire rated openings.
 - 5. Latchbolt Construction:
 - a. Center Bolt to be one piece, ¾” throw anti-friction stainless steel latch and one piece, 1” throw, hardened stainless steel deadbolt; 2-¾” standard backset.
 - b. Top and Bottom Bolts to be ¾” x ¾” stainless steel square latchbolt with ¾” projection.
 - 6. Independent top and bottom bolt projection shall be field adjustable:
 - a. From the center mortise pocket.
 - b. Ability to make field adjustments while the door is in the hung position without the removal of the door.
 - c. Top and Bottom Bolts and the Center Mortise Case shall be factory installed into the door assembly.
 - 7. Bottom strike shall be offset and reversible to accommodate alignment issues due to rough opening tolerances.
 - 8. Devices must be able to accommodate sectional rose and lever trim to match the design style and architectural finishes of the balance of the lockset and latches as specified.

9. Devices must be available with electronic access control options for higher or everyday use and traceability.
10. Devices must be available with rod-dogging indicator options:
 - a. Operated by single-point latching for non-emergency or normal use of the space.
 - b. Ability to hold rods in a retracted state.
 - c. Day-to-day operations with mortise lock only.
 - d. Indicator to show status.
11. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - FE6600 Series.
 - b. Sargent Manufacturing (SA) - FM7300 Series.

2.7 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.
 1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
 2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 3. High Security Monitoring: Provide lock bodies which have built-in request to exit monitoring and are provided with accompanying door position switches. Provide a resistor configuration which is compatible with the access control system.
 4. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML20900 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
- B. Electromechanical Multi-Point Locks: Vertical rod locking devices designed for openings requiring multiple latching points within one locking mechanism. Rods are retracted by dual mounted outside lever trim controls available in a variety of ANSI/BHMA operational functions. Option for single top latching only eliminates the need for bottom strikes. Electromechanical options include solenoid activated trim, electric latch retraction, and inside and outside lever monitoring.

1. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) MP9800 Series.
 - b. Sargent Manufacturing (SA) – 7000 Series.

2.8 AUXILIARY LOCKS

- A. Cylindrical Deadlocks: ANSI/BHMA A156.36, Grade 1, cylindrical type deadlocks to fit standard ANSI 161 preparation and 1 3/8" to 1 3/4" thickness doors. Provide tapered collars to resist vandalism and 1" throw solid steel bolt with hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other locksets.
 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DL3200 Series.
 - b. Sargent Manufacturing (SA) - 480 Series.

2.9 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
7. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
8. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
11. Rail Sizing: Provide exit device rails factory sized for proper door width application.
12. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
- b. Sargent Manufacturing (SA) - 80 Series.

2.11 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:

- 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
- 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
- 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
- 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
- 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
- 6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
- 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - DC6000 Series.

- b. Sargent Manufacturing (SA) - 351 Series.
- c. Norton Door Controls (NO) - 7500 Series.
- d. Corbin Russwin (CR) – DC8000 Series.

2.12 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.13 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:

- a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 - 1. Manufacturers:
 - a. Rixson Door Controls (RF).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Sargent Manufacturing (SA).

2.14 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Hurricane and Tornado Resistance Compliance: Architectural seals to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- G. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

2.15 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:
 - a. Security Door Controls (SD) - DPS Series.
 - b. Securitron (SU) - DPS Series.

2.16 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.17 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.18 ACCESS CONTROL SYSTEM:

- A. *** It is the responsibility of the Div 08 bidder to subcontract an authorized RS2 dealer for supply, install, terminations, program, etc... for a turnkey card access system under the Div 08 bid.
- B. This document includes a general description, functional requirements, operational characteristics, and criteria for the Access Control System (ACS).
- C. General Requirements:

1. This shall document the general description, functional requirements, operational characteristics, and criteria for the Access Control System (ACS).
 2. The Codes and Regulations listed below form a part of this specification to the extent referenced. Work shall be performed in accordance with the applicable international, federal, state, and local codes or standards current at the commencement of installation. The following list summarizes applicable standards:
 - a. UL 294, UL 1076, ULC
 - b. CE
 - c. FCC – Part 15, Part 68
 - d. NFPA 70, NEC
 - e. IEEE, RS 170 variable standard
 - f. Microsoft® Open Database Connectivity (ODBC) interface)
 - g. ISO Software Coding Standards
 - h. RoHS
 3. Where more than one code or regulation is applicable, the more stringent shall apply.
 4. Cable installation, identification and termination shall be performed in addition to the applicable codes above.
- D. Access Control Software and Database Management: Access Control Software:
1. Access Control System shall be Access It! Universal.NET from RS2 Technologies LLC no substitutions shall be accepted. This RS2 system equipment referenced in these Div 08700 specifications will tie into the existing Cincinnati Public Schools card access platform for seamless integration being managed under one system. Div 08 Bidder will subcontract an authorized RS2 Dealer for all card access system needs for a turnkey system.
 2. Upgrades or expansion of the ACS to a larger size system in scale shall not require installation of a different and or new ACS application or require the administrator / operator to learn a different and or new interface from the previous version.
 3. The ACS shall be written using recognized standard software coding techniques. The ACS shall be written to support multiple languages without re-engineering. The ACS software shall be written to Microsoft's published standards for User Interface Design, Secure Coding Practices and Database Implementation Guidelines.
 4. The ACS software developer shall be a Microsoft Certified Independent Software Vendor.
 5. The ACS shall support N-Tier architecture where the expansion of the system architecture will allow for end-user deployment based upon their system architectural needs. The ACS shall allow but not require the separation of the database, application server, web server, and client interface. The ACS shall require that all connections to the database are performed through a trusted link from the client or internet browser interface.
 6. The ACS shall support Centralized distribution (publishing) of applications using Windows Terminal Server, Citrix, or utilizing IIS for the web client using a standard internet browser such as Internet Explorer, Mozilla Firefox, Google Chrome, Apple Safari, and/or by means of a mobile computing platform using a Tablet PC, PDA device, or Smart Phone.
 7. The ACS architecture shall support Microsoft Windows Clustering, Hot-Standby, Fault Tolerant Servers, Fault Tolerant Hot Standby Servers, and Virtual Servers.
 8. The ACS shall only be able to connect to and interface with data sources utilizing a Windows Service.

9. The ACS shall be capable of importing or updating Cardholder data using the following source types.
 - a. Microsoft Access
 - b. Microsoft Excel
 - c. Microsoft SQL Server
 - d. ASCII Text (delimited file)
10. ACS Software and Field Hardware Warranty. The ACS Software shall be warranted for a period of 90 Days from the date of shipment from the manufacturer to be free of defects and will function in substantial accordance to the published specification.
 - a. ACS Field Hardware shall be warranted for a period of three (3) years from the date of shipment from the manufacturer, will be free from defects and will function in general accordance with the product specifications.
 - b. ACS Third Party Device warranties are transferred from the manufacturer to the contractor, which may then transfer third party warranties to the owner. Specific third party warranty details, terms and conditions, remedies and procedures, are either expressly stated on, or packaged with, or accompany such products. The warranty period may vary from product to product. These products include but are not limited to devices that are directly interconnected to the SMS field hardware or computers and are purchased directly from the SMS manufacturer. Examples may include but not be limited to; Credential Printers, Reader Heads, Biometric Devices, Computers etc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 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.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glazing aluminum storefronts, aluminum windows, hollow metal windows, and glazing in doors.
- B. Related Sections:
 - 1. Section 07 92 00 – Joint Sealers.
 - 2. Section 08 51 13 – Aluminum Windows.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.
- B. American Society of Civil Engineers:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International:
 - 1. ASTM C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
 - 2. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 4. ASTM C1036 - Standard Specification for Flat Glass.
 - 5. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 - 6. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
 - 7. ASTM C1193 - Standard Guide for Use of Joint Sealants.
 - 8. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
 - 9. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 10. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 11. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
 - 12. ASTM E1425 - Standard Practice for Determining the Acoustical Performance of Exterior Windows and Doors.
 - 13. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

- D. Consumer Products Safety Commission:
 - 1. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing.
- E. Glass Association of North America:
 - 1. GANA - Sealant Manual.
 - 2. GANA - Glazing Manual.
 - 3. GANA - Laminated Glass Design Guide.
- F. National Fenestration Rating Council Incorporated:
 - 1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.
 - 2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
 - 3. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.
- G. South Coast Air Quality Management District:
 - 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Glass Strength
 - 1. Provide glass thickness capable of resisting an equivalent design load, as defined by ASTM E1300, with a probability of failure of approximately 8 lites per thousand.
 - 2. For monolithic annealed lites determine glass thickness per ASTM E1300.
 - 3. For heat treated, tempered, laminated, and insulating glass units, determine per manufacturer's method.
- B. Glass Deflection
 - 1. Using ASTM E1300, Appendix X1, provide glass having sufficient thickness to limit center deflection, relative to glass edges, per following criteria.
 - 2. At 50% design windload, deflection shall not exceed 1% of least glass dimension, and not more than 1".
 - 3. At 150% design windload, deflection shall be limited to prevent glass disengagement from frame.
- C. Heat Treatment
 - 1. Provide heat treated glass when thermal stress analysis determines a solar absorption of 60 % or more, or where unfavorable shadow patterns occur on glass.
 - 2. Provide heat treated glass as further required for strength to resist windload.
 - 3. Provide fully tempered glass or other approved glazing for "safety glazing" applications. Heat strengthened glass is not an approved product.

1.4 SUBMITTALS

- A. Section 01 33 00 –Submittal Procedures.
- B. Product Data

1. Submit manufacturer's published product data sheets for confirmation of intent of products/systems to be provided on project.
 2. Bids proposing substitute products must be accompanied by manufacturer's literature showing conformance to all performance criteria.
- C. Samples
1. Submit 12" x 12" samples. Samples shall have finished edges.
 2. Submit 12" long samples of all gaskets and spacers integral with glazing.
 3. Submit samples of all glazing blocks.
- D. Certificates
1. Provide certification from glass fabricator of acceptance of results of all required analysis and shop drawing checks as specified under "Quality Assurance".
 2. Provide certifications that installer's and glass fabricator's experience meets criteria specified under "Quality Assurance".
- E. Shop Drawings
1. On shop drawings submitted for Architectural approval, show and describe the following as a minimum:
 2. Glass thickness
 3. Description of glass, including manufacturer, coatings, tint, heat treatment, special edge seal/adhesive, laminate, pattern, and frit, as applicable.
 4. Nominal glass bite at framing
 5. On elevations, indicate which lites are tempered.
- F. Warranties
1. Properly executed warranties are to be provided prior to final acceptance of work.

1.5 QUALITY ASSURANCE

- A. Qualifications
1. Installer shall be able to demonstrate not less than five (5) years successful experience in the installation of comparable projects.
 2. Glass fabricator shall be able to demonstrate not less than ten (10) years successful experience in the fabrication of specified glass products, and capable of providing the following:
 - a. Review and comment of glazing shop drawings and installation instruction as relating to:
 - b. Proper system drainage, and protection of insulation glass unit seals.
 - c. Proper glass edge bite and support
 - d. Other conditions that affect warranty
 - e. Thermal stress analysis
 - f. Glass strength and deflection checks
 3. All glass shall be provided by a single manufacturer and fabricated by a single fabricator.
- B. In addition to manufacturer's recommendations, conform to guidelines of the FGMA Glazing Manual.

- C. Safety Glazing
 - 1. Conform with CPSC 16 CFR 1201 for requirements of safety glazing, or as superseded by local governing code.
 - 2. Tempered glass shall be permanently marked with certification label of Safety Glass Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
- D. Pre-Installation Conference
 - 1. Before substantially commencing the glazing work on site, the Glazing Contractor shall meet with the Architect and Construction Manager to address the following as a minimum:
 - 2. Verification of acceptance of mock-up samples
 - 3. Coordinate glazing with related window framing and sealing work
 - 4. Verification of review and acceptance of glazing details by glass manufacturer
 - 5. Verification of understanding of approved shop drawings, relative to glazing
 - 6. Coordinate mobility, storage, use of lifts or scaffolding
 - 7. Review safety and protection procedures while moving, storing, installing, and post installation of glass
- E. Perform Work in accordance with Hamilton County and State of Ohio standards.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Product storage and handling requirements.
- B. Deliver, handle, and store all materials to prevent damage or deterioration, in conformance with manufacturer's instructions.
- C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install glazing when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
- C. Do not install glazing products in environmental conditions that are beyond the limitations set by the manufacturer.
- D. Glazing channels shall be clear of water or ice and construction debris before installing glass.

1.8 WARRANTY

- A. Product warranties and product bonds.
- B. Insulating Glass Units

1. Fabricator shall warrant to the Owner that the edge seal will not fail in adhesion or moisture vapor seal for a period of ten (10) years from date of substantial completion, when handled and installed in accordance with good industry practices and fabricator's instructions. Fogged or de-laminated I.G. units constitute failure.
- C. Coated Glass
 1. Manufacturers of reflective coated glass shall warrant to the Owner that the coating will not fail or be defective for a period of ten (10) years from the date of substantial completion.
- D. Spandrel Glass
 1. Manufacturers of spandrel glass shall warrant to the Owner that the opacifier or ceramic frit will not fail by deterioration or adhesion loss for a period of ten (10) years from date of substantial completion.

PART 2 PRODUCTS

2.1 PRIMARY GLASS PRODUCTS

- A. Manufacturers of primary glass shall be one of the following:
 1. PPG Industries
 2. AFG Industries
 3. Guardian Industries Corp.
 4. LOF/Pilkington
 5. Approved Equals
- B. Provide primary glass products that meet the requirements of ASTM C 1036.
- C. Clear Float Glass - Provide, Class I clear, Quality q3 (glazing select).
- D. Glass lites shall not be less than ¼" nominal thickness.

2.2 GLASS FABRICATORS

- A. Fabricators providing reflective sputter coatings, insulating glass units, laminating glass, ceramic frit spandrel, screen printed glass, tempered, and heat strengthened glass shall be one of the following or other certifying conformance to qualifications criteria:
 1. American Flat Glass Distributors (AFGD)
 2. Guardian Industries
 3. Interpane
 4. Viracon
 5. Tempglass

2.3 HEAT-TREATED FLAT GLASS PRODUCTS

- A. Provide heat-treated glass products that meet the requirements of ASTM C 1048.

- B. Manufacture heat-treated glass by horizontal (roller hearth) process, with roll wave distortion parallel with bottom edge of glass as installed, unless otherwise indicated.
- C. Tempered glass (Kind FT) shall have a minimum surface compression of 10,000 psi.
- D. Heat Strengthened glass (Kind HS) shall have a minimum surface compression of 3500 psi, and a minimum edge compression of 5500 psi.
- E. Tempered glass shall be permanently identified with the Safety Glazing Certification Council (SGCC) label, located inconspicuously at a corner, indicating certification of the product.

2.4 INSULATING GLASS UNITS

- A. Provide pre-assembled units sealed with an organic sealant, enclosing a desiccated air space.
- B. Performance classification shall be Class “A” as determined by testing in accordance with specification ASTM E774.
- C. Spacer shall be aluminum with manufacturer’s standard keyed or bent corner.
- D. Desiccant shall be manufacturer’s standard silica gel, molecular sieves, or silica gel/molecular sieve blend.
- E. Provide dual-seal assembly consisting of polyisobutylene primary seal and silicone secondary seal.
- F. For structural silicone applications utilizing sealed insulating units, the silicone seal/adhesive shall be designed to withstand 50% of the design negative windload pressure.

2.5 GLAZING ACCESSORIES

- A. Dense Elastomeric compression Seal Gaskets.
- B. Provide molded or extruded gaskets of material compatible with interfacing sealants, complying with ASTM C 864, Option I, of profile and hardness required to maintain watertight seal. Color black.
- C. EPDM
- D. Neoprene
- E. Silicone - Comply with ASTM C 1115, classification CH7S3
- F. Cellular Elastomeric Preformed Gaskets

- G. Provide extruded or molded closed cell, integral-skinned EPDM, Neoprene, or silicone of profile and hardness required to maintain watertight seal, complying with ASTM C 509, Option I, Type II, color black.

2.6 Setting Blocks

- A. Provide setting blocks of material which has been tested to be compatible with interfacing glazing sealants and insulating glass unit seals. Hardness shall be Shore 'A' durometer of 85 +/-5.
 - 1. EPDM
 - 2. Neoprene
 - 3. Silicone - Comply with ASTM C 1115, classification CH9S3.
- B. Provide blocks of sufficient width to transfer the deadload of the glazing to the framing. Block shall be sized to support both lites of an insulating unit without inducing stress at edge seal.
- C. Provide blocks of sufficient length as recommended by FGMA Glazing Manual and as further required by glass fabricator. In no case (excluding door glazing) shall less than two (2) blocks be used to support deadload, or less than 4" long per block. Cutting blocks down from size supplied and intended, whether in length or profile, is not allowed.
- D. Spacing of setting blocks shall be at 1/4 points typically, and in no case closer to ends of supporting horizontal than 1/8 points.
- E. Profile of setting blocks shall allow water to flow past, even if block is inadvertently set diagonally in glazing pocket.

2.7 Anti-Walk Edge Blocks

- A. Provide solid edge blocks at vertical edges of glass of material and size as intended by framing manufacturer. Further comply with recommendations of glass fabricator and FGMA Glazing Manual.
- B. Provide "W" type anti-walk blocks at vertical glass edges where solid blocks cannot be installed.

2.8 Spacers for Structural Glazing Systems

- A. Spacer blocks, tapes, or extrusions adjacent to structural silicone shall be compatible as tested in accordance with ASTM C 1087 and complying with ASTM C 1115.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3100 – Project Management and Coordination: Coordination and project conditions.

- B. Glazier shall inspect framing prior to commencing glass installation. He shall report deficiencies and proceed only after such deficiencies are corrected. Items to inspect include, but are not limited to the following:
- C. Compare framing openings to shop drawings for size and squareness.
- D. Check that glazing channels are free of debris
- E. Inspect weep system for conformance to shop drawings and that holes are not clogged. Check that weep pathways are open.
- F. Ensure all necessary blocks and gaskets are in place.
- G. Inspect internal joinery seals and splices that they are watertight. Check that corner seals do not interfere with glazing.

3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

- A. Pre-Installation Meeting
 - 1. Construction Manager, Contractor, and Glazier shall meet to coordinate glazing work. Include other trades as affected and applicable. Ensure that stored and in-place glass will not be susceptible to damage by adjacent trades. Coordinate such that once glazing channels are cleaned and inspected, work from adjacent trades do not contaminate areas ready for glazing.
- B. Protection
 - 1. Protect surrounding areas from potential falling or breaking glass during installation or handling. Comply with applicable safety codes.
 - 2. Use rolling blocks when rotating glass. Protect insulating glass edge seals from damage.

3.4 GLAZING

- A. Conduct final inspection of framing and glass for defects just prior to glazing.
- B. Comply with recommendations from FGMA Glazing Manual.
- C. Install necessary blocks, gaskets, baffles, water deflectors, and sealant per shop drawings and as required by framing manufacturer.
- D. Install and seal glazing stops per framing manufacturer's instructions and shop drawings.

- E. Prepare glass surfaces per sealant manufacturer's instructions prior to installing weatherseal and structural sealants.
- F. Install wedge gaskets per good industry practices, being careful not to stretch gasket while installing. Run gaskets long and crowd slightly into corners.
- G. Install temporary clips to allow structural silicone sealant to cure without being moved out of plane.

3.5 CLEANING

- A. Final cleaning.
- B. Promptly remove cork separator buttons from glass.
- C. Clean harmful contaminants from glass immediately.
- D. Remove glazing materials from finish surfaces.
- E. Remove labels after Work is complete.
- F. Clean glass and adjacent surfaces.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

- A. Protecting installed construction.
- B. Glazier shall advise Construction Manager of procedures required by interfacing trades to maintain a protected glazing installation.
- C. Trades causing spills, caustic rundown or splatter, or breakage shall notify the Construction Manager immediately so that replacement or repair can be made by the Glazier.

3.7 SCHEDULE

- A. **Type 'G-1'** – Typical exterior window unless noted otherwise – 1" Insulated units
 - 1. Glass
 - a. Outboard Pane: Solexia Glass as Manufactured by PPG Industries
 - b. Inboard Pane: Clear glass, with Sungate 500 Low-E on the #3 surface, or equivalent.
 - 2. Performance Data – (Unit make-up ¼" – ½" – ¼")
 - a. Light Transmittance: 19%
 - b. Solar Energy Transmittance: 13%
 - c. U-V Transmittance: 5.5%
 - d. Visible Light Reflectance Exterior: 6%

- e. Visible Light Reflectance Interior: 13.9%
- f. Solar Energy Reflectance: 8%
- g. Winter U-Value: .35
- h. Summer U-Value: .35
- i. Shading Coefficient: .28
- j. Solar Heat Gain Coefficient: .24
- k. Relative Heat Gain: 58

B. **Type 'G-2'** – Clear float glass PPG - interior

END OF SECTION

SECTION 09 29 00

GYP SUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes metal stud wall framing; metal channel ceiling framing; shaft wall systems; gypsum board and joint treatment; predecorated gypsum board; gypsum sheathing; cementitious backer board; acoustic insulation; and textured finish.
- B. Related Sections:
 - 1. Section 06 10 53 – Miscellaneous Rough Carpentry: Wood blocking.
 - 2. Section 07 21 00 – Insulation Work: Acoustic insulation.
 - 3. Section 09 30 00 – Ceramic Tile Floor and Wall Finish: Wall tile.
 - 4. Section 10 28 00 – Toilet Room Accessories: Semi-recessed toilet accessories.
 - 5. Section 10 44 00 – Fire Extinguishers, Cabinets and Accessories: Semi-recessed fire extinguisher cabinets.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 2. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
 - 3. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - 4. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
 - 5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 6. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - 7. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
 - 8. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - 9. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
 - 10. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
 - 11. ASTM C1178 - Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
 - 12. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
 - 13. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
 - 14. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

15. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
16. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. Gypsum Association:
 1. GA 214 - Recommended Levels of Gypsum Board Finish.
 2. GA 216 - Application and Finishing of Gypsum Board.
 3. GA 600 - Fire Resistance Design Manual Sound Control.
- C. Intertek Testing Services (Warnock Hersey Listed):
 1. WH - Certification Listings.
- D. National Fire Protection Association:
 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- E. South Coast Air Quality Management District:
 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.
- F. Underwriters Laboratories Inc.:
 1. UL - Fire Resistance Directory.
 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 01 33 00 – Shop Drawings, Product Data & Samples: Submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Submit data on metal framing, gypsum board, joint tape and acoustic accessories.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840.
- B. Fire Rated Wall and Floor Construction: Rating as indicated on Drawings.
 1. Tested Rating: Determined in accordance with ASTM E119.
- C. Perform Work in accordance with Hamilton County and State of Ohio standards.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01 31 00 – Project Meetings: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Manufacturers:
 - 1. CertainTeed.
 - 2. G-P Gypsum Corp.
 - 3. National Gypsum Co.
 - 4. United States Gypsum Co.
 - 5. Substitutions per Section 01 2500

2.2 COMPONENTS

- A. Framing Materials:
 - 1. Studs and Tracks: ASTM C645; GA-216 and GA-600; galvanized sheet steel.
 - 2. Furring, Framing, and Accessories: ASTM C645, GA-216 and GA-600.
 - 3. Fasteners: ASTM C1002; Type S, GA-216; length to suit application.
 - 4. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
 - 5. Adhesive: ASTM C557, GA-216.
 - a. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- B. Gypsum Board Materials: ASTM C1396/C1396M; Type X fire resistant where indicated on Drawings.
 - 1. Standard Gypsum Board: Thickness as indicated on drawings, maximum available length in place; ends square cut, tapered and beveled square edges.
 - 2. Moisture Resistant Gypsum Board: Thickness as indicated on drawings, maximum available length in place; ends square cut, tapered and beveled square edges.
 - 3. Exterior Gypsum Board: Thickness as indicated on drawings, maximum available length in place; ends square cut, tapered and beveled square edges.

2.3 ACCESSORIES

- A. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
 - 1. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- B. Gypsum Board Accessories: ASTM C1047; metal; corner beads, edge trim, and expansion joints.
 - 1. Metal Accessories: Galvanized steel.

- C. Joint Materials: ASTM C475; GA-216; reinforcing tape, joint compound, and water.
- D. Gypsum Board Screws: ASTM C954 and/or ASTM C1002; length to suit application.
 - 1. Screws for Steel Framing: Type S.
 - 2. Screws for Wood Framing: Type W.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 31 00 – Project Coordination: Coordination and project conditions.
- B. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Metal Stud Installation:
 - 1. Install studs in accordance with ASTM C754.
 - 2. Metal Stud Spacing: As indicated on drawings.
 - 3. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
 - 4. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
 - 5. Blocking: Nail wood blocking to studs. Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, wood frame opening, toilet accessories, and hardware.
- B. Furring For Fire Ratings: Install furring as required for fire resistance ratings indicated.
- C. Ceiling Framing Installation:
 - 1. Install in accordance with ASTM C754.
 - 2. Coordinate location of hangers with other work.
 - 3. Install ceiling framing independent of walls, columns, and above ceiling work.
 - 4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 past each end of openings.
 - 5. Laterally brace entire suspension system.
- D. Acoustic Accessories Installation:
 - 1. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
 - 2. Install acoustic sealant within partitions.
- E. Gypsum Board Installation:
 - 1. Install gypsum board in accordance with ASTM C840, GA-216, and GA-600.

2. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.
3. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
4. Erect exterior gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
5. Use screws when fastening gypsum board to metal furring or framing.
6. Double Layer Applications: Use gypsum base for first layer, placed perpendicular to framing or furring members. Use fire rated gypsum base for fire rated partitions and ceilings.
7. Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.
8. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.
9. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.
10. Place control joints consistent with lines of building spaces as indicated on Drawings.
11. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
12. Provide Level 4 finish – typical all gypsum board walls, unless noted otherwise.

F. Joint Treatment:

1. Finish in accordance with GA-214 Level 5.

G. Install Work in accordance with Hamilton County and State of Ohio standards.

3.3 ERECTION TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 30 00

CERAMIC TILE FLOOR AND WALL FINISH

1. GENERAL

1.1. WORK INCLUDED

- 1.1.1. Ceramic wall tile.
- 1.1.2. Bullnose trim to match ceramic wall tile.
- 1.1.3. Sealing of all grout.

1.2. RELATED WORK

- 1.2.1. 09 29 00 – Gypsum Board Assemblies

1.3. REFERENCES

- 1.3.1. ANSI/TCA A108.5. Ceramic tile installed with Dry Set Portland Cement Mortar or Latex-Portland Cement Mortar.
- 1.3.2. ANSI/TCA A118.4. Latex-Portland Cement Mortar.
- 1.3.3. ANSI/TCA A136.1. Organic adhesives for installation of ceramic tile.
- 1.3.4. ANSI/TCA A137.1 - Specifications for Ceramic Tile.
- 1.3.5. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.4. QUALITY ASSURANCE

- 1.4.1. Conform to ANSI - American National Standard Specifications for the Installation of Ceramic Tile.
- 1.4.2. Conform to ANSI - Recommended Standard Specifications for Ceramic Tile - TCA 137.1.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- 1.5.2. Product Data: Submit instructions for using grouts and adhesives.
- 1.5.3. Samples: Submit sample illustrating pattern, color variations, and grout joint size variations.

- 1.5.4. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.6. DELIVERY, STORAGE, AND HANDLING

- 1.6.1. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

2. PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS:

- 2.1.1. Dal Tile
- 2.1.2. Florida Tile
- 2.1.3. Crossville Tile
- 2.1.4. American Olean

2.2. Floor and Wall Tile:

- 2.2.1. Ceramic Floor Tile – Dal Tile – Natural Hues Series - 12” x 12”
- 2.2.2. Ceramic Wall Tile – Dal Tile – Natural Hues - 4” x 4”
- 2.2.3. Ceramic Cove Base – 4” High

2.3. Cove base shall match floor tile. Bullnose trim shall match wall tile.

2.4. Colors and patterns for floor and wall tile to be selected at later date by Architect.

2.5. Grout for floor and wall tile shall be Latex Portland Cement type. Color to be selected at later date by the Architect.

2.6. ACCESSORIES

- 2.6.1. Transition strips at changes in flooring materials.
- 2.6.2. Inside and outside corner pieces for cove base tile.
- 2.6.3. Sealant at Control Joints - shall be equivalent to Dow-Corning #795 Silicone Building Sealant - Color to be selected by the Architect/Engineer.

2.7. MORTAR MIX AND GROUT MATERIALS

- 2.7.1. Portland Cement - ASTM C-150 Type 1.
- 2.7.2. Sand - ASTM C-144.
- 2.7.3. Water - potable.
- 2.7.4. Latex-Portland cement mortar - conforming with ANSI A118.4.
- 2.7.5. Mix and proportion grout materials in accordance with manufacturer's instructions.

2.8. SEALER

2.8.1. Equivalent to “Penetrating Sealer” as manufactured by Stone Tech

2.9. EXTRA STOCK

2.9.1. Deliver to Owner extra stock of ceramic tile as follows:

2.9.1.1. Twenty (min.) sq. ft. of floor tile.

2.9.1.2. Twenty (min.) sq. ft. of wall tile.

3. EXECUTION

3.1. Preparation of self-leveling underlayment over floor slabs:

3.1.1. All methods and materials used shall be in accord with Procedures for Attaching Finished Floor Goods to Gyp-Crete Underlayments - published by the Gyp-Crete Corporation.

3.1.2. Check for dryness.

3.1.3. Check for any rough and/or chalky spots.

3.1.4. Repair Gouges, nicks and/or low spots.

3.1.5. Apply floor primer.

3.1.6. Install an elastomeric membrane.

3.2. INSTALLATION OF TILE

3.2.1. Beginning of installation means acceptance of substrate. If substrate is not acceptable, notify Architect/Engineer in writing at once and do not begin work until any deficiencies have been eliminated.

3.2.2. Immediately prior to installing tile, clean substrate thoroughly and allow it to dry.

3.2.3. Floor tile shall be “thin-set” installed in accord with ANSI A108.5 using latex/Portland cement mortar.

3.2.4. Wall tile shall be installed using latex/Portland cement mortar bond coat in accord with ANSI A108.5.

3.2.5. Care shall be taken to keep surfaces adjacent to the ceramic tile free of mortar and grout from the tile installation.

3.2.6. Provide transition strips at wall or frame openings to other building areas not receiving ceramic tile floor finish.

- 3.2.7. Cut and fit tile tight to protrusions and vertical interruptions. Form corners neatly.
- 3.2.8. Work tile joints uniform in width, subject to variance in tolerance allowed in tile size. Joints: Watertight, without voids, cracks, excess mortar, or grout.
- 3.2.9. Sound tile after setting. Replace hollow sounding units.
- 3.2.10. Allow tile to set for a minimum of 48 hours prior to grouting.
- 3.3. SEALING
 - 3.3.1. All grout shall be sealed.
 - 3.3.2. The timing of grout sealing, in relation to the time when the grout has been installed, shall be as directed by the manufacturer of the sealer.
 - 3.3.3. The sealing material shall be installed in accord with the directions of the manufacturer of the material.
- 3.4. PROTECTION
 - 3.4.1. Prohibit traffic from floor finish for 7 days after installation.

END OF SECTION

SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Carpet tile
 - 2. Accessories.

1.2 REFERENCE STANDARDS

- A. ASTM International:
 - 1. ASTM D2859 - Standard Specification for Ignition Characteristics of Finished Textile Floor Covering Materials.
- B. California Department of Health Services:
 - 1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.
- C. Carpet and Rug Institute:
 - 1. CRI Carpet Installation Standard - Standard for Installation of Commercial Carpet.
 - 2. CRI Green Label Plus Testing Program.
 - 3. CRI Model Specifications for Commercial Carpets.
- D. Consumer Products Safety Commission:
 - 1. CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.
- E. National Fire Protection Association:
 - 1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.
- F. South Coast Air Quality Management District:
 - 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

1.3 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.4 SUBMITTALS

- A. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- B. Shop Drawings: Indicate layout of joints, direction of carpet pile, and location of edge moldings.

- C. Samples:
 - 1. Submit carpet tiles illustrating color and pattern design for each carpet color selected. Matching roll carpet samples.
- D. Manufacturer's Instructions: Submit special procedures, and perimeter conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Materials:
 - 1. Furnish 15 SF of carpet tiles of each color and pattern selected.

1.7 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Floor Finishes: Comply with one of the following:
 - a. Class II, minimum 0.22 watts/sq cm when tested in accordance with NFPA 253.
 - b. CPSC 16 CFR 1630 and ASTM D 2859.
- B. Fire-Test Response Characteristics: Provide products with the critical radiant flux classifications indicated in Part 2, as determined by testing identical products per ASTM E648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Texture Appearance Retention Rating: Rating classifications as determined by CRI Model Specifications for Commercial Carpets.
 - 1. Greater than or equal to 3.0 TARR for Heavy Traffic Level Classification.
- D. Perform Work in accordance with State of Ohio and Warren County Standards.

1.8 AMBIENT CONDITIONS

- A. General: Comply with CRI 104, Section 6.1: "Site Conditions, Temperature and Humidity". Contractor to inspect the locations of all carpet installation prior to commencing with the work.
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.
- C. Do not install carpet over concrete slabs until concrete patch areas have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by manufacturer.
- D. Analysis of existing conditions: The correction of the deficiencies in the floor substrate based on the analysis of the existing conditions shall be performed by the carpet contract and shall be done prior to installation.

- E. Provide a carpet cut plan for approval prior to order and installation of carpet.

1.9 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet tile does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, runs, and delamination.
- C. Warranty Period: 20 years from date of substantial completion.

PART 2 PRODUCTS

2.1 CARPET TILE

- A. Manufacturers:
 - 1. Shaw Contract, Basis of Design
 - 2. Mohawk Group
 - 3. Mannington Commercial
 - 4. Interface
 - 5. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

- A. Carpet Tile:
 - 1. Basis of Design: Shaw Contract
 - 2. Pattern: Quarter Turn
 - 3. Styles and Patterns: Poured Tile – 5T206
 - 4. Size: 24 inches
 - 5. Color: To be selected by Owner
 - 6. Gauge: 1/10 inch
 - 7. Stitches: 10 per inch.
 - 8. Yarn to be Type 6.6 hollow filament nylon or Type 6 solid filament nylon, with permanent inherent stain resistance within the chemical composition of the nylon.
 - 9. Yarn weight shall be minimum of 16 oz / yd. Yarn Pile Density should be a min. of 6000 per cu. yd. when measuring with pile thickness.
 - 10. Static resistance of carpet construction to provide a minimum of 3.0 Kv resistance at 20% R.H. at 70 degrees F. AATCC134.
 - 11. Carpet to have a gray scale rating of 4 or better on products darkest colors after 180 standard fading hours as compared to AATCC 16-E 1982.
 - 12. Primary and secondary backings to be thermal plastic or vinyl compositions.
 - a. Non water soluble.

- b. Provide liquid barrier.
- 13. Carpet must have a minimum 20 year warranty provided by the manufacturer against edge ravel, backing delamination, excessive surfaces wear, and zippering.

ACCESSORIES

- B. Sub-Floor Filler: Type recommended by flooring material manufacturer.
- C. Moldings and Edge Strips: Rubber edge strips and or reducer of height required to protect exposed edge of carpet between carpet and resilient flooring or carpet and other flooring materials and of maximum lengths to minimize running joints. Color to be selected by Architect from manufacturer's full range of standard colors.
- D. Contact Adhesive: Recommended by carpet manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify floor surfaces are smooth and flat within tolerances specified by manufacturer's recommendations and are ready to receive work.

3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Clean substrate of dust, dirt, solvents, oil, grease, paint, plaster, and other substances detrimental to proper performance of adhesive and carpet. Allow floors to thoroughly dry.
- D. Ensure concrete floors are free from scaling and irregularities and exhibit neutrality relative to acidity and alkalinity.
- E. Ensure floors are level, with maximum surface variation of ¼ inch in 10 feet non-cumulative. Repair gouges, nicks, and/or low spots. Use the Carpet Manufacturer's approved cementitious filler to patch cracks, small holes, and for leveling.

3.3 INSTALLATION

- A. Install carpet tile in accordance with CRI Carpet Installation Standard.
- B. Do not mix carpet from different cartons unless from same dye lot.
- C. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

- D. Install carpet tile pattern as indicated by Architect.
- E. Fully adhere carpet tile to substrate.
- F. Trim carpet tile neatly at walls and around interruptions.
- G. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints, stains, varnishes and other coatings.
- B. Related Sections:
 - 1. Section 01 35 46 – Indoor Air Quality Management.
 - 2. Section 07 62 00 – Sheet Metal Flashing and Trim.
 - 3. Section 08 11 13 – Standard Steel Doors and Frames.
 - 4. Section 09 21 16 – Gypsum Board Assemblies.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
 - 2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
- B. Green Seal:
 - 1. GC-03 - Anti-Corrosive Paints.
 - 2. GS-11 - Product Specific Environmental Requirements.
- C. Painting and Decorating Contractors of America:
 - 1. PDCA - Architectural Painting Specification Manual.
- D. South Coast Air Quality Management District:
 - 1. SCAQMD Rule 1113 - Architectural Coatings.
- E. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.

1.3 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS

- A. Section 01 3300 –Submittal Procedures.
- B. Product Data: Submit data on finishing products and any special coating.

- C. Submit paper chip samples, illustrating range of colors available for each surface finishing product scheduled.
- D. Manufacturer's Installation Instructions: Submit special surface preparation procedures and substrate conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with Campbell County, and State of Kentucky requirements.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Applicator: Company specializing in performing work of this section with minimum three years experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.
- D. Take precautionary measures to prevent fire hazards and spontaneous combustions.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

- B. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.11 SEQUENCING

- A. Sequence application to the following:
 - 1. Do not apply finish coats until paintable sealant is applied.
 - 2. Back prime wood trim before installation of trim.

1.12 WARRANTY

- A. Product warranties and product bonds.
- B. Furnish one-year manufacturer warranty for interior paints and coatings.
- C. Furnish seven-year manufacturer warranty for exterior paints and coatings

1.13 EXTRA MATERIALS

- A. Supply 1 case of each color, type, and surface texture; store where directed.
- B. Label each container with color, type, texture, and room locations in addition to manufacturer's label.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

- A. Manufacturers:
 - 1. Sherwin Williams.
 - 2. Porter Paint Company.
 - 3. Kelly-Moore Paint Co. (Kelly-Moore).
 - 4. PPG
 - 5. Substitutions: 01 2500 Substitution Procedures.

2.2 COMPONENTS

- A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:

1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
 2. For good flow and brushing properties.
 3. Capable of drying or curing free of streaks or sags.
 4. Interior Flat and Non-Flat Paints: Maximum volatile organic compound content in accordance with GS-11.
 5. Interior Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.
 6. Interior Clear Wood Finishes: Maximum volatile organic compound content in accordance with SCAQMD Rule 1113.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.
1. Interior Clear Wood Finishes: Maximum volatile organic compound content in accordance with SCAQMD Rule 1113.
- C. Patching Materials: Latex filler.
- D. Fastener Head Cover Materials: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify surfaces are ready to receive Work as instructed by product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application in writing.
- C. Test shop applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Plaster and Gypsum Wallboard: 12 percent.
 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 5. Concrete Floors: 8 percent.

3.2 PREPARATION

- A. Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.
- B. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

- C. Place cotton waste, cloths, and material which may constitute a fire hazard in closed metal containers and remove daily from site.
- D. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces for finishing. These items are to be carefully stored, cleaned and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.
- E. Surfaces: Correct defects and clean surfaces capable of affecting work of this section.
- F. Marks: Seal with shellac those which may bleed through surface finishes.
- G. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- H. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- I. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.
- J. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- K. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- L. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- M. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- N. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- O. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

- P. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- Q. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.
- R. Wood Doors Scheduled for Painting: Seal wood door top and bottom edge surfaces with tinted primer.
- S. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- B. Apply each coat at proper consistency.
- C. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- D. Sand surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- G. Prime concealed surfaces of interior woodwork which is to receive painted finish with primer paint.
- H. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.
- I. Back prime hollow metal frames with same material as specified herein for spot priming of hollow metal doors and frames. Coordinate with hollow metal supplier and installer as required.

3.4 FIELD QUALITY CONTROL

- A. Section 01 45 23 – Testing and Inspection Services: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test questionable coated areas.

3.5 CLEANING

- A. Final cleaning.
- B. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.
- C. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials, and debris.
- D. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.
- E. Upon completion of work leave premises neat and clean, to the satisfaction of Architect.

3.6 SCHEDULE - EXTERIOR SURFACES

- A. Metal-Ferrous (Semi Gloss: Acrylic Latex System)
 - 1. Primer: 100% Acrylic, Waterborne, Corrosion Resistant Primer, 3.0 mils/coat.
 - 2. Finish Coats: 100% Acrylic, Waterborne, Semi-Gloss (340-40 units at 60 degrees F.), 3.0 mils DFT/coat.
 - 3. Surfaces: Miscellaneous ferrous metal.
- B. Metal – Ferrous (Gloss) (Acrylic Latex System)
 - 1. Primer: 100% Acrylic, Waterborne, Corrosion Resistant Primer, 3.0 mils/coat.
 - 2. Finish Coats: 100% Acrylic, Waterborne, Gloss (60-80 units at 60 degrees F.) 3.0 mils DFT/coat.
 - 3. Surfaces: Miscellaneous ferrous metal.
- C. Metal – Galvanized (Semi Gloss) (Acrylic Latex System)
 - 1. Finish Coats: 100% Acrylic, Waterborne, Semi-Gloss (30-40 units at 60 degrees F., 3.0 mils DFT/coat.
 - 2. Surfaces: Exterior lintels, hollow metal doors and frames.
- D. Metal – Galvanized (Gloss): (Acrylic Latex System)
 - 1. Finish coats: 100% Acrylic, Waterborne, Gloss (60-80 units at 60 degrees F.), 3.0 mils DFT/coat.
 - 2. Surfaces: Exterior lintels, hollow metal doors and frames.
- E. Metal-Heat Resistant (Maximum Temperature 1,000 degrees F. (VOC 650))
 - 1. Primer: Silicone Alkyd, .75 mils DFT/coat
 - 2. Finish Coats: Silicone Alkyd, Aluminum Bright, .75 – 1.0 mils DFT/coat.
 - 3. Surfaces: Stacks with temperature above 200 degrees F.

3.7 SCHEDULE - INTERIOR SURFACES (Basis of Design: Sherwin Williams)

- A. Concrete Surfaces (Semi-Gloss) (Latex)
 - 1. Primer: Latex Wall Primer, PrepRite Masonry wall primer B28W300.
 - 2. Finish Coats: Latex Semi-Gloss Enamel ProGreen 200 Semi-gloss B28W600.

3. Surfaces: Concrete walls.
- B. Concrete Surfaces (Gloss) (Water Based Epoxy System)
 1. Primer: Latex Wall Primer, Heavy Duty Block Filler B42W46.
 2. Finish Coats: Water Based Catalyzed Epoxy (Gloss).
 3. Surfaces: Masonry walls, exposed concrete.
- C. Metal – Ferrous (Semi Gloss): (Alkyd Enamel System, Maximum VOC content 450 grams/liter)
 1. Primer: Modified Alkyd Resin Primer, Pro-Cryl Universal Primer B66-310.
 2. Finish Coats: Alkyd Enamel, Semi-Gloss ProClassic XP semi-gloss B34W551.
 3. Surfaces: Hollow metal doors, frames, door mullions, and ferrous metal surfaces.
- D. Metal – Ferrous (Gloss): (Acrylic-Latex System)
 1. Primer: 100% Acrylic, Waterborne, Corrosion Resistant Primer, Pro-Cryl Universal Primer B66-310.
 2. Finish Coats: 100% Acrylic, Waterborne, Gloss Pro-Industrial Enamel 100 B54WZ211.
 3. Surfaces: Hollow metal doors, frames, door mullions, and ferrous metal surfaces.
- E. Metal – Galvanized (Semi-Gloss): (Acrylic Latex System)
 1. Finish Coats: 100% Acrylic, Waterborne, Semi Gloss ProClassic Waterborne Semi-Gloss B31.
 2. Surfaces: Hollow metal doors, frames, door mullions, and ferrous metal surfaces.
- F. Metal – Galvanized (Gloss): (Acrylic Latex System)
 1. Finish Coats: 100% Acrylic, Waterborne, Gloss ProClassic Waterborne Gloss B21.
 2. Surfaces: Hollow metal doors, frames, door mullions, railings, and ferrous metal surfaces.
- G. Wood – Painted (Gloss): (Acrylic Latex System)
 1. Primer: Pigmented Interior Modified Alkyd Primer, PrepRite Cbonding primer Latex B51W50.
 2. Finish Coats: Vinyl Acrylic Gloss Enamel ProClassic Waterborne Gloss B21.
 3. Surfaces: Wood trim, etc.
- H. Wood – Painted (Semi-Gloss): (Acrylic Latex System)
 1. Primer: PrepRite Bonding primer Latex B51W50.
 2. Finish Coats: Vinyl Acrylic Gloss Enamel ProClassic Waterborne Gloss B21.
 3. Surfaces: Wood trim, etc.
- I. Gypsum Board (Flat): (Acrylic Latex System)
 1. Primer: Vinyl Acrylic Latex, ProGreen 200 Primer B28W600.
 2. Finish Coats: Vinyl Acrylic Flat ProGreen 200 Flat B30-600.
 3. Surfaces: Ceilings, bulkheads.

- J. Gypsum Board (Satin): (Modified Alkyd System – Low V.O.C.)
 - 1. Primer: Vinyl Acrylic Latex, ProGreen 200 Primer B28W600.
 - 2. Finish Coats: ProClassic Waterborne Satin B20.
 - 3. Surfaces: Gypsum board wall surfaces.

- K. Exposed Structure – Ferrous (Egg-Shell): (Waterborne)
 - 1. Primer
 - 2. Finish Coats: Waterbased Dryfall egg-shell B42W2.
 - 3. Surfaces: Exposed metal decking, trusses, structural steel, metal joists.

- L. Exposed Structure – Galvanized (flat): (Waterborne)
 - 1. Primer: Pro-cryl universal Primer.
 - 2. Finish Coats: Waterbased Dryfall Egg-shell B42W2.
 - 3. Surfaces: Exposed metal decking, trusses, structural steel.

END OF SECTION

SECTION 10 28 00

TOILET & BATH ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes accessories for toilet rooms, showers, locker rooms and utility rooms.
- B. Grab Bars
- C. Related Sections:
 - 1. Section 06 10 00 –Rough Carpentry
 - 2. Section 09 21 16 – Gypsum Board Assemblies.
 - 3. Section 09 91 00 – Painting.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A269 – Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - 2. ASTM A666 – Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. ASTM C1036 – Standard Specification for Flat Glass.
 - 4. 36 CFR 1191 – Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; 2010 (ADA Standards for Accessible Design)
- B. Federal Specification Unit:
 - 1. FS A-A-3002 – Mirrors, Glass.
- C. Forest Stewardship Council:
 - 1. FSC Guidelines - Forest Stewardship Council Guidelines.
- D. Green Seal:
 - 1. GC-03 - Anti-Corrosive Paints.
 - 2. GS-11 - Product Specific Environmental Requirements.
- E. South Coast Air Quality Management District:
 - 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

1.3 DESIGN REQUIREMENTS

- A. Design grab bars and attachments to resist minimum 250 lb concentrated load applied at any point in any direction.

1.4 SUBMITTALS

- A. Section 01 33 00 –Submittal Procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.
- C. Samples: Submit two samples of each accessory, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Submit special procedures and conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Hamilton County and State of Ohio standards.

1.6 COORDINATION

- A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.
- B. Coordinate the Work with placement of internal wall reinforcement to receive anchor attachments.

PART 2 PRODUCTS

2.1 TOILET AND BATH ACCESSORIES

- A. Manufacturers:
 - 1. Bobrick
 - 2. Bradley Corp
 - 3. Kimberly Clark
 - 4. Substitutions: Section 01 25 00 – Substitutions Procedures.
- B. All items of each type to be made by same manufacturer.

2.2 COMPONENTS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Furnish 2 keys for each accessory to Owner; master key all lockable accessories
- C. Stainless Steel Sheet: ASTM A666, Type 304.

- D. Stainless Steel Tubing: ASTM A269, stainless steel.
- E. Mirror Glass: Float glass, Type I, Class 1, Quality q2 (ASTM C 1036), with silvering, copper coating, and suitable protective organic coating to copper backing in accordance with FS A-A-3002.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized.

2.3 TOILET ACCESSORIES

- A. Grab Bars
 - 1. Stainless Steel Type: Provide grab bars with wall thickness not less than 0.05” and as follows:
 - a. Mounting: concealed, manufacturer’s standard flanges and anchors.
 - b. Clearance 1 ½” clearance between wall surface and inside face of bar
 - c. Gripping Surfaces: Peened, satin finish. Unless noted otherwise.
 - d. Bar Size: Outside diameter of 1 ¼” minimum.
 - e. See drawings for grab bar lengths and locations.
 - 2. Bobrick model # B-5806-XX.99 Basis of Design
- B. Toilet Paper Dispenser
 - 1. Surface mounted multi-roll toilet paper dispenser shall be stainless steel with welded construction. All exposed surfaces shall have satin finish. Units shall dispense 2 standard toilet paper rolls. Spare roll shall automatically drop into place, after bottom roll is used. Unit shall be equipped with 2 theft resistant, heavy duty, one piece molded polyethylene spindles.
 - 2. Basis of design shall be Bobrick model #B-2888
- C. Automatic Foam Soap Dispenser
 - 1. Wall mounted, 304 stainless steel with satin finish
 - a. Corrosion resistant valve shall dispense foaming hand soap solution
 - b. Valve shall be sensor activated and shall not require contact with the dispenser to function
 - c. Lockable housing with clear acrylic refill window
 - d. Hinged for refilling and maintenance
 - e. 27 oz. capacity
 - 2. Basis of design shall be Bobrick #B-2013
- D. Manual Soap Dispenser
 - 1. Wall mounted, 304 stainless steel with satin finish
 - a. Valve dispenses all-purpose hand soaps
 - b. Hinged filler-top with special key
 - c. Soap refill window
 - 2. Basis of design shall be Bobrick #B-2111
- E. Framed Mirrors
 - 1. Mirror shall be 430 stainless steel channel frame with polished finish.
 - a. #1 quality glass mirror
 - b. guaranteed for 15 years against silver spoilage.

- c. Galvanized steel back
 - d. Secured to concealed wall hanger with theft-resistant mounting.
 - e. See drawings for mirror sizes.
 - 2. Basis of design shall be Bobrick B-165
- F. Sanitary Napkin Disposal Unit
 - 1. Surface mounted satin-finish stainless steel
 - a. Cover is drawn, one-piece construction
 - b. Cover is secured to cabinet with full-length stainless steel piano hinge
 - c. Capacity: 1.0 gal.
 - 2. Basis of Design shall be Bobrick model # B-270
- G. Paper Towel Dispenser
 - 1. Surface mounted high-capacity automatic towel dispenser
 - a. Touchless operation
 - b. Key-activated spring lock
 - c. 1.75" roll towel core size
 - 2. Basis of Design shall be Kimberly-Clark model # 48856
- H. Recessed Trash Receptacle
 - 1. Recessed satin-finish stainless steel
 - a. Seamless beveled flange
 - b. Removeable receptacle locks into cabinet
 - c. Capacity: 12 gal.
 - 2. Basis of Design shall be Bobrick model # B-3644
- I. Clothing Hooks
 - 1. Surface mounted satin stainless steel
 - a. Concealed wall plate for mounting
 - 2. Basis of Design shall be Bobrick model # B-6827
- J. Baby Changing Station
 - 1. Surface mounted stainless steel clad
 - a. Horizontal changing station with polyethylene interior
 - b. Full length steel on steel hinges
 - c. Gas spring assist open/close mechanism
 - d. Built-in liner cavity and (2) bag hooks
 - 2. Basis of Design shall be Koala Kare model # KB110-SSWM
- K. Shower Seat
 - 1. Reversible Folding Shower Seat
 - a. ½" thick solid phenolic seat
 - b. Left- or right-hand field installation
 - c. Frame & mounting brackets are stainless steel
 - d. Supports up to 360 pounds
 - 2. Basis of Design shall be Bobrick model # B-5181
- L. Shower Curtain Rod, Curtain and Hooks
 - 1. Heavy-duty shower curtain rod – Bobrick model # B-6107 x width

- a. Type 304 stainless steel with satin finish
 - b. 20-gauge 1" diameter rod
- 2. Shower Curtain – Bobrick model # B-204 x width + 6"
 - a. 72" high x width needed
 - b. Nickel-plated brass grommets 6" O.C. along top
 - c. Hemmed bottom and sides
- 3. Curtain Hooks – Bobrick model # 204-1
 - a. Type 304 stainless steel
 - b. Quantity equal to grommets on curtain

2.4 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder; 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
 - 1. Holders: 3 spring-loaded rubber cam holders.
 - 2. Length: Manufacturer's standard length for number of holders.
 - 3. Provide at Janitor's Closet Mop Sink

2.5 FINISHING

- A. Stainless Steel: No. 4 satin brushed, unless noted otherwise.
- B. Chrome / Nickel Plating: ASTM B 456, SC 2, satin finish, unless noted otherwise.
- C. Galvanizing for Items Other than Sheet: ASTM A123/A123M; galvanize after fabrication.
- D. Galvanizing for Nuts, Bolts and Washers: ASTM A153/A153M.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3100 – Project Management and Coordination: Coordination and project conditions.
- B. Verify exact location of accessories for installation.
- C. Verify field measurements are as indicated on product data.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.

- B. Coordinate with Contractor as required concerning rough openings, reinforcing blocking, etc. as may be necessary for items of work within this section of the specifications. Provide templates as required and rough-in measurements as required.
- C. Coordinate with Subcontractor providing toilet compartments as required in conjunction with accessories to be installed in panel of compartment provided by others.

3.3 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturer's instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Use tamper-proof fasteners.
- D. Mounting Heights and Locations: As indicated on Drawings.
- E. Provide all necessary blocking as required in walls for attachment of accessories.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fire extinguishers, fire extinguisher cabinets and brackets for wall mounting.
- B. Related Sections:
 - 1. Section 06 10 00 – Rough Carpentry
 - 2. Section 09 21 16 – Gypsum Board Assemblies.
 - 3. Section 07 92 00 – Joint Sealers.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 10 - Standard for Portable Fire Extinguishers, 2010

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10.

1.4 SUBMITTALS

- A. Section 01 33 00 – Shop Drawings, Product Data & Samples: Submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements and location.
- C. Product Data: Submit extinguisher operational features, color and finish, and anchorage details.
- D. Manufacturer's Installation Instructions: Submit special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 77 00 – Contract Closeout: Closeout procedures.
- B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.
- C. Perform Work in accordance with Campbell County and State of Kentucky standards.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 – Storage and Protection: Environmental conditions affecting products on site.
- B. Do not install extinguishers when ambient temperature is capable of freezing extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fire Extinguisher Cabinets and Accessories:
 - 1. Larsen's Manufacturing Co.
 - 2. Kidde.
 - 3. JL Industries, Inc.
 - 4. Potter-Roemer
 - 5. Substitutions: Section 01630 – Substitutions and Product Options.

2.2 FIRE EXTINGUISHERS

- A. General: Comply with product requirements of NFPA 10 and all applicable codes.
- B. Dry Chemical Type Fire Extinguishers: Carbon Steel Tank with Pressure Gage
 - 1. Class A, B and C fires.
 - 2. Size: 10 pound.

2.3 FIRE EXTINGUISHER CABINETS

- A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.
- B. Cabinet Configuration: Surface-mounted and Semi-Recessed
 - 1. Sized to accommodate fire extinguisher and accessories.
 - 2. Trim: Flat, 1-1/2 inch wide face.
- C. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.
- D. Door Glazing: Plastic, clear, 1/8 inch thick acrylic. Set in resilient channel gasket glazing.
- E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
- F. Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: White Enamel
- H. Finish of Cabinet Interior: White Enamel

2.4 FIRE EXTINGUISHER WALL MOUNTED BRACKET

- A. Basis of design to be Model B-2 by Larsen

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 31 00 – Project Coordination: Coordination and project conditions.
- B. Verify rough openings for cabinet are correctly sized and located.
- C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Secure rigidly in place in accordance with manufacturer's instructions.
- B. Secure wall brackets, where required, to wall/structure with fasteners of type and size required to support the weight of the extinguisher.
- C. Place extinguishers in cabinets and on wall brackets.
- D. Install wall brackets, maximum 48 inches from finished floor to top of extinguisher handle.
- E. Install cabinets plumb and level in wall openings, maximum 48 inches from finished floor to top of extinguisher handle.

END OF SECTION

SECTION 22 01 00 - OPERATION AND MAINTENANCE OF PLUMBING SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

- A. This Contractor shall thoroughly instruct and supervise the Owner's Maintenance Personnel in the proper operation and maintenance of the plumbing system equipment. This Contractor shall be responsible for arranging for the instruction and supervision at a time convenient to the Owner or their representative and for notifying the Construction Manager of the time at least 48 hours in advance. The Owner shall be permitted to video tape these training sessions.

Instructions shall include the following:

1. Location of equipment and explanation of what it does.
 2. Reference to "Operating Instruction Manuals" for record and clarity.
 3. Coordination of written and verbal instruction so that each is understood by all personnel.
 4. Specific maintenance to be performed by Owner.
- B. Furnish electronic copies of the printed Operating and Maintenance Instructions for the plumbing System for review. After final approval, provide electronic copies of Operation and Maintenance Instructions in PDF format for submittal to Owner. Instructions shall consist of the following items:
 1. Title Page: Title of Project, address, date of submittal, name and address of Contractor, name of Architect, name of Engineer.
 2. Second Page: Index of Manual Contents.
 3. First Section: A copy of each approved shop drawing and submittal with an index at the beginning of the section.
 4. Second Section: A list of all equipment used on the project, together with supplier's name and address.

5. Manufacturer's maintenance manuals for each item of equipment furnished under this contract. Manuals shall include such items as parts list, detailed lubrication instructions, procedures for performing normal maintenance functions, preliminary trouble shooting procedures and wiring diagrams.
6. Complete wiring diagrams for the plumbing system as actually wired including control and interlock wiring.
7. Brief but complete instructions for start-up, shut- down and routine maintenance of each system.
8. Routine and 24-hour emergency information:
 - a. Name, address and telephone number of servicing agency.
 - b. Include names of personnel to be contacted for service arrangements.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION 22 01 00

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer to Division 26 - Electrical, sections that apply to wiring, conduit, etc.

1.02 SUMMARY

- A. This section includes the following items:
 - 1. General requirements
 - 2. Drawings
 - 3. Permits and fees
 - 4. Ohio Energy Code
 - 5. Utilities
 - 6. Record documents
 - 7. Deliverable items
 - 8. Service and maintenance
 - 9. Coordination
 - 10. Supervision
 - 11. Unacceptable work and observation reports
 - 12. Final inspection
 - 13. Guarantee
 - 14. Sleeves and collars
 - 15. Firestopping
 - 16. Installation of piping
 - 17. Painting
 - 18. Lubrication
 - 19. Cutting and Patching
 - 20. Electrical Work
 - 21. Test and adjustments
 - 22. Manufacturer's drawings
 - 23. Protection and cleaning
 - 24. Flushing and Sterilization
 - 25. Substitutions

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1.03 SCOPE

- A. Furnish all labor, materials, tools, incidentals and details necessary to provide a complete plumbing system, ready to operate, including but not limited to the items listed under the Plumbing Specification Index.

B. Rough-Ins

1. Rough-in waste, vent, gas, tempered water, hot and cold water piping to all equipment furnished by others requiring same and for all future fixtures and equipment requiring same.
2. All rough-ins shall terminate with a short nipple and cap except gas outlets shall have cocks adjacent to nipple and cap.

1.04 GENERAL REQUIREMENTS

- A. Include any minor details essential to successful operation and any other items specified or shown on the Drawings.
- B. If the Contractor has any questions concerning the Plans and Specifications or notices any discrepancies or omissions in either Plans or Specifications, they shall feel free to contact the Engineer for clarification before Bids, to fully understand the extent and responsibilities of their work.
- C. The Contractor is required to visit the site and fully inform themselves concerning all conditions affecting the scope of their work. Failure to visit the site shall not relieve the Contractor from any responsibility in the performance of their Contract.
- D. Other than minor adjustments shall be submitted to the Construction Manager for approval before proceeding with the work.
- E. Scheduling of all work performed by this Contractor shall be completely coordinated with the Construction Manager.
- F. All material hoisting by trade involved.
- G. The Contractor, insofar as this Contract is concerned, shall at all times keep the premises and the building in a neat and orderly condition. This includes using a vacuum cleaner.
- H. At the completion of the project, this Contractor shall promptly clean up and remove from the site, all debris and excess materials.

1.05 DRAWINGS

- A. Consult all Contract Drawings which may affect the locations of any equipment, apparatus and piping and make minor adjustments in location to secure coordination.
- B. Piping layout is schematic and exact locations shall be determined by structural and other conditions and verified in the field. This shall not be construed to mean that the design of the system may be changed, it refers only to the exact location of piping to fit into the building as constructed, and to coordination of all work with piping and equipment included under other Divisions of the Specifications.

- C. The layout shown on the Drawings is based on a particular make of equipment. If another make of equipment is used which requires modifications or changes of any description from the Drawings or Specifications, this Contractor shall be responsible for making all such modifications and changes, including those involving other trades, as a part of this Contract and the cost thereof shall be included in their Bid. In such case, the Contractor shall submit Drawings and Specifications showing all such modifications and changes prior to starting work, which shall be subject to the approval of the Construction Manager.
- D. The Construction Manager reserves the right to make minor changes in the location of piping and equipment up to the time of rough-in without additional cost to the Owner.
- E. Where certain grades and/or elevations are given on the Drawings, they have been obtained from the best information available; however, they are not guaranteed. This Contractor MUST assume the full responsibility of verifying present elevations in the field and making any adjustments as may be necessary, all of which must be included in their Bid Price.
- F. Due to the scale of the Drawings, it is impossible to show all offsets and transitions which may be required. This Contractor shall carefully investigate the conditions affecting all work and shall furnish all elbows, fittings, transitions, etc., required to accomplish the desired result at no additional cost to the Owner.
- G. Install all work as close as possible to walls, structural, members, etc., consistent with the proper space for covering, access, etc., so as to occupy the minimum of space and allow as much space as possible between ductwork, piping, etc. and the ceiling.
- H. Actual dimensions shown on the Drawings and field dimensions shall take precedence over scaled dimensions.
- I. Working Clearances: At least 6'-6" clear headroom must be maintained in front of all electrical equipment. Provide at least 3'-6" for 480/277 volt and 3'-0" for 208/120 volt clear space in front of all electrical equipment as wide as the equipment with a minimum of 2'-6" wide. The same clearance shall be required at the rear of rear access equipment.

1.06 PERMITS AND FEES

- A. This Contractor shall file all Drawings, pay all necessary charges and fees, and obtain all necessary permits and certificates of inspection relative to their work.
- B. All acreage and front foot fees, system capacity charges or assessments shall be paid by the Owner.
- C. Submit Qualification Certificate for each welder to the Construction Manager before such welder starts work.

- D. Completed installations shall conform with all applicable Federal, State and Local Laws, Codes and Ordinances, including but not limited to the latest editions of the following:
 - 1. Ohio Building Code.
 - 2. A.S.M.E. Pressure Piping Code - Section B31.1
 - 3. A.S.M.E. Boiler and Pressure Vessel Code - Section IV - Heating Boilers, Section VIII - Unfired Pressure Vessels.
 - 4. National Electrical Code, Bulletin No. 70, National Fire Protection Association.
 - 5. Reduction of Lead in Drinking Water Act.
 - 6. Local Building Code.
- E. Nothing contained in the Plans and Specifications shall be construed to conflict with these laws, codes and ordinances and they are hereby made a part of these Specifications.
- F. When the work is completed, the Contractor shall furnish the Construction Manager a Certificate of Inspection and Approval from the Board of Health before final payment of the Contract will be allowed.

1.07 OHIO ENERGY CODE

- A. The Plumbing System must comply with all requirements of the State of Ohio "Code for Energy Conservation". This includes, but is not limited to, efficiencies, power factors, insulation thickness, etc.
- B. All motors 1 HP or more shall be "premium efficient" motors meeting all requirements of ASHRAE Standard 90.1 – 2019 and latest version of EPA Act by the federal government.

1.08 UTILITIES

- A. The Contractor shall investigate and locate all utilities prior to construction.
- B. Each Contractor is responsible for rerouting or replacing existing utilities where necessary to permit installation of their work.
- C. The identity and location of the existing underground utility facilities known to be located in the construction area have been shown on the plans as accurately as provided by the Owner of the underground utility. The Architect and/or Engineer assumes no responsibility as to the accuracy or the depths of the underground facilities shown on the plans.

- D. Support, protection and restoration of all existing utilities and appurtenances shall be the responsibility of the Contractor. The cost of this work shall be included in the price bid for the various items.
- E. The Contractor shall cause notice to be given to the Ohio Utilities Protection Service (telephone 800-362-2764 - toll- free) and to the Owners of underground utility facilities shown on the plans who are not members of a registered underground protection service in accordance with Section 153.64 of the Revised Code. The above mentioned notice shall be given at least 48 hours, excluding Saturdays, Sundays and legal holidays, prior to commencing work.
- F. The Contractor shall alert immediately the occupants of nearby premises as to any emergency that they may create or discover on or near such premises of the underground facility, any break or leak on its lines or any dent, gouge, groove or other damage.

1.09 RECORD DOCUMENTS

- A. Maintain at the site, one copy of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders and other modifications, in good order. The Drawings shall be marked to record all changes made during construction especially deviations made necessary to incorporate equipment different from base equipment specified. These shall be available to the Owner's Representative. The Drawings marked to record all changes made during construction shall be delivered to the Owner's Representative for the Owner upon completion of the work. Loose sheets or details will not be accepted. Only full sized drawing sheets shall be submitted. An additional set of Drawings will be furnished by the Construction Manager for this purpose upon request.
- B. At the completion of project and before final approval, make any final corrections to Drawings and certify to the accuracy of each print by signature and deliver same to Construction Manager.
- C. Furnish electronic copies of plumbing as-built drawings in PDF format to the Construction Manager for review.
- D. All pressure tests shall be documented by the Contractor to confirm that the piping systems have been tested properly and completely. All tests shall be witnessed and signed by the Construction Manager. Electronic copies of this final test document in PDF format shall be furnished to the Construction Manager for review.

1.10 DELIVERABLE ITEMS

- A. Refer to the specifications for tools, equipment, spare parts, etc. to be provided by the Contractor. Deliverable items to be provided to the Construction Manager/Owner.

1.11 SERVICE AND MAINTENANCE

- A. Refer to specifications for maintenance requirements after completion of work but as part of this contract.

1.12 COORDINATION

- A. The Contractor is required to read the Specifications covering all branches of the work and will be held responsible for coordination of their work with work performed under all other Contracts.

1.13 SUPERVISION

- A. This Contractor shall have in charge of the work, on the job as required, during construction, a competent superintendent experienced in the work installed under this Contract.

1.14 UNACCEPTABLE WORK AND OBSERVATION REPORTS

- A. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.
- B. The Contractor shall promptly correct all work found unacceptable by the Construction Manager whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such unacceptable work, including compensation for the Construction Manager's additional services made necessary thereby.
- C. During the course of construction, the Engineer will prepare "Observation Reports" with a list of items found to be in need of correction. All items listed shall be corrected by the Contractor. A space is provided on the form for the Contractor to note the completion of each item. All prior "Observation Report" items must be completed, the lists signed and returned to the Engineer prior to making the final inspection. After the final list is issued, the same procedure will apply.

1.15 FINAL INSPECTION

- A. When the Contractor determines all work is completed and working properly per the Contract Documents, they shall request a "final" inspection by the Construction Manager in writing. If more than one reinspection is required after this final inspection, the Contractor shall bear all additional costs including compensation for the Engineer's additional services made necessary thereby. A final inspection will not be made until Operating and Maintenance Manuals are submitted and approved and all prior "Observation Report" punch lists completed, signed and returned to the Engineer.

1.16 GUARANTEE

- A. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after approval of the Certificate of Contract Completion.

1.17 SLEEVES AND COLLARS

- A. This Contractor shall furnish sleeves and collars for their work to the General Contractor, who installs where directed by this Contractor. Coordinate carefully.

1.18 FIRESTOPPING

- A. Each Contractor shall be responsible for firestopping around all openings for pipes, conduits, etc., installed by them at all fire walls and smoke walls. Firestopping shall be performed by an installer who has been trained by manufacturer, or manufacturer's representative, in the installation procedures based on published UL tested fire stop systems.
- B. This contractor shall provide firestopping details for all type of penetrations to be utilized on the project and provide details to the Construction Manager.
- C. Quality assurance
 - 1. Conform to applicable governing codes:
 - a. Ohio Building Code (OBC).
 - b. NFPA 101 - Life Safety Code.
 - c. NFPA 70 - National Electrical Code.
 - 2. Meet requirements of ASTM E-814 or UL 1479 Fire Tests by recognized testing agency.
 - 3. Obtain firestop materials for each different system from a single manufacturer.
- D. Sequencing
 - 1. Coordinate work so firestopping materials are installed before the areas involved are concealed by drywall and other finish work.

1.19 INSTALLATION OF PIPING

- A. Refer to Part 3 – Execution, for general piping installation requirements that apply to all interior piping systems installed under this Contract, except where otherwise noted on the Drawings or elsewhere in the Specifications.

1.20 PAINTING

- A. All unpainted steel in exposed areas (not including Mechanical Equipment Rooms) including piping, hangers, ironwork, etc., installed by the Plumbing Contractor shall be cleaned of oil and other debris by the Plumbing Contractor in preparation for painting by the General Contractor. If preparation is determined to be unsatisfactory, additional cleaning required by the General Contractor shall be paid for by the Plumbing Contractor.

- B. All steel supports shall have minimum one (1) coat of metal primer after fabrication.
- C. Factory finished equipment which has rusted or been damaged shall be cleaned at the completion of the project and rust spots and marred areas shall be refinished and restored to the original factory finish.

1.21 LUBRICATION

- A. All equipment shall be lubricated with correct grade, type, and quantity of lubrication before being placed in service.
- B. Damages caused by neglecting to provide proper lubrication will be repaired at this Contractor's expense.
- C. Maintain all lubrication and packing seals during construction, and assure that at the time of final acceptance, all equipment is operating properly.

1.22 CUTTING AND PATCHING

- A. Refer to Division 01 - General Requirements for cutting and patching.
- B. Avoid cutting of concrete, masonry and other new work by the use of inserts and sleeves.
- C. Cutting for openings, when necessary, shall be done by this Contractor with such tools and methods as to prevent unnecessary damage to surrounding areas or equipment.
- D. The corners of all openings in poured concrete shall be core drilled to minimize overcutting.
- E. This Contractor shall give the General Contractor locations and sizes of all openings required for the installation of equipment (other than piping openings), before walls, etc., are started. If it becomes necessary to cut into new work because of the failure of this Contractor to notify the General Contractor, then the General Contractor shall do any necessary cutting and patching at this Contractor's expense.
- F. Fill space in all areas where core drilled with packing where required to maintain fire rating. Openings shall be temporarily fire-stopped until permanent fire stopping is done. This includes holes left due to removal of piping.
- G. All holes cut for the installation of piping and equipment shall be neatly patched and refinished with the same materials as, and to match, adjacent surfaces, and damages thereto shall be repaired in kind and to match existing conditions by this Contractor. This includes patching existing ceilings and floors where required and patching holes left by removal of existing piping and equipment, etc.
- H. No structural member will be cut into without the expressed permission of the Construction Manager.

1.23 ELECTRICAL WORK

A. WORK INCLUDED - THIS CONTRACTOR

1. Furnish to the Electrical Contractor information, drawings, schedules, locations of rough-ins, electric loads, sizes and characteristics for motors and equipment furnished by this Contractor requiring electric services. "Stock" wiring diagrams are not acceptable.
2. Starters which are specified to be provided as a part of the plumbing equipment shall be furnished by this Contractor. Equipment shall be provided with protection devices against voltage and current unbalance and single phasing. Wiring by the Electrical Contractor.
3. All alarm, control or interlocking wiring for motors and equipment furnished by this Contractor unless otherwise specified.
4. 120 volt wiring required for equipment furnished by this Contractor when not shown or specified elsewhere.
5. Final connections to water heaters from wired junction boxes.

B. WORK INCLUDED - ELECTRICAL CONTRACTOR

1. Electrical Contractor shall provide all power services for motors and equipment furnished by other contractors, including safety disconnect switches (unless specified with plumbing equipment), if required by code, and final connection to motors and equipment.
2. All starters installed in motor control centers and loose starters shall be provided by the Electrical Contractor and shall be as specified in Division 26 except where specifically specified to be furnished with certain plumbing equipment.

1.24 TESTS AND ADJUSTMENTS

- A. After work has been completed but before pipe covering has been applied, the Contractor shall test and adjust the systems they have installed.
- B. The Construction Manager shall be notified of all scheduled tests at least 48 hours before they are scheduled so that they may witness same. If the Contractor performs any test without the Construction Manager present or without properly notifying the Construction Manager, the Contractor will be required to perform the test a second time in the presence of the Construction Manager.
- C. If the Construction Manager determines that any work requires special inspection, testing, or approval, they will, upon written authorization from the Owner, instruct the Contractor to order such special inspection, testing or approval. The Contractor shall give timely notice so the Construction Manager may observe the inspections, tests or approvals. If such special inspection or testing reveals a failure of the work to comply

with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Engineer's additional services made necessary by such failure; otherwise the Owner shall bear such costs, and an appropriate Change Order shall be issued.

- D. Concealed lines shall be tested before being concealed. If this is not done and a leak appears during the final test, this Contractor shall repair leak and all damage resulting there from.
- E. This Contractor shall adjust all equipment in the plumbing system to obtain proper operation and shall demonstrate to the Owner and Construction Manager that the entire system will function properly.

1.25 MANUFACTURER'S DRAWINGS

- A. The Contractor shall submit to the Construction Manager for review, within six weeks after date of contract, electronic copies in PDF format per Division 01 of manufacturer's drawings, wiring diagrams, pump curves or data. The Engineer will review Contractor's shop drawings and related submittals (as indicated below) with respect to the ability of the detailed work, when complete, to be a properly functioning integral element of the overall system designed by the Engineer. Before submitting a shop drawing or any related material to the Engineer, Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of Contractor; approve each such submission before submitting it; and so stamp each such submission before submitting it. The Engineer shall assume that no shop drawing or related submittal comprises a variation unless Contractor advises Engineer otherwise via a written instrument which is acknowledged by Engineer in writing. The shop drawings and related material (if any) called for are indicated in the appropriate specification section.
- B. The Engineer shall return shop drawings and related materials with comments provided that each submission has been called for and is stamped by Contractor as indicated above. The Engineer shall return without comment material not called for or which has not been approved by the Contractor.
- C. This Contractor shall furnish equipment shop drawings which will indicate power hook up and control connections as required for mechanical equipment. "Stock" wiring diagrams are NOT ACCEPTABLE.
- D. The manufacturer shall provide a statement on submittals that equipment furnished complies with the Ohio Energy Code. This previously relates to premium efficiency motors, EER's, COP's, etc. If this is not done, submittals will be rejected.
- E. This Contractor is responsible for overlaying their work onto sheetmetal shop drawings and proposed work of other contractors. Provide drawings in electronic format for use I coordinating work. Drawings shall be created in AutoCAD, Revit or other format as determined by the Construction Manager. Coordinate scale dimensions of drawings with HVAC Contractor and provide information as to size, elevation and location proposed for all components. This Contractor shall coordinate their work with that of

other Contractors. Final resolution of all items to be determined at project meetings held by Construction Manager.

- F. Engineer's review of manufacturer's drawings or schedules shall not relieve the Contractor from compliance with the requirements of the plans and specifications.
- G. Items may be referred to in singular or plural on Plans and Specifications. Contractor is responsible for determining quantity of each item.

1.26 PROTECTION AND CLEANING

- A. Protect all plumbing equipment against damage from any cause whatsoever and pay the cost of replacing and repairing equipment made necessary by failure to provide suitable protection.
- B. After all plumbing fixtures have been set, thoroughly clean all fixtures, removing all stickers, rust stains and other foreign matter and leave every part in acceptable condition, clean and ready for use.
- C. After all piping and equipment has been approved and after all plastering has been completed, bare piping and insulation provided under this Contract shall be thoroughly cleaned of dirt, grease, rust and oil, and primed (where necessary), ready for painting.
- D. Repair all dents and scratches in factory prime or finish coats on all plumbing equipment, including plumbing fixtures, to the satisfaction of the Construction Manager. If damage is excessive, replacement may be required.
- E. Cover all motors, pumps, plumbing fixtures, open pipes, etc., to keep out dirt, water and weather during construction.
- F. This Contractor shall clean up and remove all debris from the site and shall at all times keep the premises in a neat and orderly condition.

1.27 FLUSHING AND STERILIZATION

- A. Flush out all domestic water piping systems to remove all dirt and grease from pipes and equipment before systems are placed into operation. Clean strainers after each flushing until the strainer remains clean.
- B. After domestic water lines are all installed, sterilize lines, including outside services as prescribed by AWWA-C-651-05. Sterilization shall be done under the immediate on the job supervision of a water testing laboratory regularly engaged in the service and shall be done per their instructions. All fees for testing and test equipment shall be paid by this Contractor.
- C. Furnish a Certificate of Sterilization and Approval For Human Consumption signed by a Professional Engineer registered in the State of Ohio regularly in the employ of the Testing Laboratory. Certification shall be furnished to the Construction Manager before payment will be made.

1.28 SUBSTITUTIONS

- A. The Base Bid shall be based on equipment as specified. Where items are mentioned thusly, "may be furnished at the Contractor's option", the Contractor may use any one of the items named for their Base Bid. Proposals for substitutions are welcomed, but must be noted separately from the Base Bid and applied for in writing at Bid submittal.
- B. Where the Contractor furnishes equipment or material specified as equal or which is accepted as a substitution, they are responsible for all modifications required for his work, and work of all other trades to install the equipment and insure performance as originally specified.
- C. Equipment and materials furnished as equal or as a substitution must be equal in quality, design, features, performances, arrangement, and appearance to that specified as standard.

PART 2 PRODUCTS

2.01 SLEEVES

- A. Sleeve material: black steel pipe, machine cut, large enough to allow proper clearance (1/4" minimum, 3/4" for fire stopping) all around pipe (around pipe covering on cold water), except use machine cut copper sleeves for uninsulated copper pipe.
- B. The Contractor has the option on sleeves passing through fire rated walls or floors to use Pipe Shields, Inc. Wall Fire Barrier Model WFB- CS-CW. The sleeve body to be adjustable and made of 26 gauge galvanized sheet metal. Annular space packed on both ends with neoprene coated rope. If pipe is insulated, provide water proofed calcium silicate insert to match thickness of specified insulation, extending 1" beyond sleeve.

2.02 FIRESTOPPING

- A. Acceptable manufacturer's products
 - 1. Penetration sealants:
 - a. Dow Corning "Firestop Foam" and "Firestop Sealant".
 - b. 3M Brand "Fire Barrier" Caulk.
 - c. 3M Brand Moldable Putty "Pads" and Moldable Putty "Stix".
 - d. Hilti FS One.
 - e. Metacaulk Series 835, 880, 910 and 950.
 - 2. Intumescent sealants for use at openings and sleeves involving plastic pipe, insulated pipe or flexible cable:
 - a. Dow Corning "Firestop Intumescent Wrap Strip".
 - b. Fox Coupling, Inc. "Cast-In-Place Firestop Coupling".
 - c. 3M Brand "Fire Barrier" Caulk or Putty with FS-195 Wrap Strip and or CS-195 Composite Sheet.

- d. Hilti FS One.
- e. Hilti CP-642 and CP-643 Firestop Collar.
- f. Metacaulk Series 880 and 950.

B. MATERIAL REQUIREMENTS

- 1. Flame (F) rating minimum one hour but not less than fire resistance rating of assembly in which installed, per ASTM E- 814.
- 2. Maintain effective barrier against flame, smoke, water and hot gases per ASTM E-814 and UL 1479.
- 3. Suitable for firestopping of penetrations by steel, glass, plastic, and insulated pipe, flexible cable, buss duct and cable tray.
- 4. Non-asbestos.

2.03 PAINTING

- A. Paint shall meet requirements of Division 09 – Finishes

2.04 LUBRICATION

- A. Follow Manufacturer's recommendations for specific lubricants.

2.05 ELECTRICAL WORK

- A. Refer to Division 26 - ELECTRICAL.
- B. All motors 1/2 HP and larger shall be three phase; all motors, 1/3 HP and smaller shall be single phase unless specified otherwise.
- C. All single-phase motors provided by this Contractor to have built-in thermal overload protection.
- D. Motor starters, contactors, and disconnects are provided and installed by the Electrical Contractor, unless part of packaged equipment furnished by this Contractor, or otherwise specified.
- E. All motors 1 HP or more shall be “premium efficient” motors meeting all requirements of ASHRAE Standard 90.1 – 2010 and latest version of EPA Act by the federal government.

2.06 STERILIZATION

- A. Sterilization: Chlorinating material either liquid chlorine meeting AWWA Standard B301, sodium or calcium hypochlorite meeting AWWA Standard B300

PART 3 EXECUTION

3.01 SLEEVES AND COLLARS

- A. Sleeves shall be provided through all new masonry construction. Sleeves are not required if holes are core drilled through existing walls unless required to maintain fire rating.
- B. Sleeves in partitions to have length equal to the thickness of finished partitions. Sleeves in floors of finished areas to project 1/8" above finished floor. Sleeves in floors of non-finished areas to project 3" above finished floor. Fill space between pipe and sleeves into exposed areas with sealing compound. Ream all sleeves before installing.
- C. Sleeves in floors of all Mechanical/Electrical Rooms receiving a membrane floor to project 6" above floor to receive the membrane base.
- D. Where pipes pass through fire rated walls or floors, the space between the pipe and sleeve shall be fire stopped to maintain fire integrity.
- E. Sleeves to be set in forms before concrete is poured and in partitions at the time same are being built.
- F. In exposed location, other than in Mechanical Equipment Rooms, bare pipe or insulated pipe shall be provided with chromium plated collars at floor, ceiling, and at partitions.
- G. Cutting required of any masonry wall after it is in place shall be done by core drilling.
- H. Piping not allowed to bear on sleeves.
- I. Sleeves shall be installed plumb and true to line, grade, and position.
- J. Unused sleeves shall be plugged and finished to match adjacent surface.

3.02 SEALING AROUND PIPE OPENINGS

- A. The openings around all pipes that penetrate full height walls (defined as walls that extend from the floor to the structure above) unless otherwise required to be firestopped shall be sealed to maintain the acoustic integrity of the wall. This applies to all full height walls regardless of whether the wall has a fire rating.
- B. Gaps less than 1/2" between the pipe and the wall opening or sleeve shall be packed with batt insulation and the exposure caulked on both sides of the wall.
- C. Gaps 1/2" and larger between the pipe and the wall opening or sleeve shall be packed with batt insulation and a sheetmetal collar installed around the entire pipe on both sides of the wall. The sheetmetal collar shall extend from the surface of the pipe to a minimum 2" on the wall and be secured to the wall.

3.03 FIRESTOPPING

A. Examination

1. Examine surfaces to receive penetration sealant or foam and report unacceptable conditions before starting firestopping work.
2. Verify that penetration holes are approximately 1-1/2" larger diameter than the penetrating element to allow space for wrap strip. Firestopping systems installed external to the opening with a collar to hold in place are acceptable.
3. Start of work indicates acceptance of sizing of holes and application conditions.

B. Penetration

1. Clean penetration holes of dirt, loose materials, and foreign matter which may affect bond or installation.
2. Remove coatings such as paint, curing compounds, water repellent, sealers, as required.
3. Install backing materials to prevent liquid material leakage.

C. Application

1. Prepare and apply penetration sealing systems in accordance with manufacturer's printed instructions.
2. Employ installation techniques which will ensure that firestopping is deposited to fill and seal holes and openings.
 - a. Provide Flame (F) rating minimum one hour but not less than fire resistance rating of assembly in which installed.
 - b. Ensure effective smoke seal and water seal.
3. Tool exposed surfaces of applied sealant to smooth finish.
4. Protect materials from damage on surfaces subjected to traffic.

D. Field quality control

1. Examine sealed penetrations to ensure proper installation before concealing or enclosing areas.
2. Keep areas of work accessible until inspection by applicable code authorities.

- E. Clean-up
 - 1. Clean surfaces adjacent to sealed joints free of excess sealant and soiling from this work as work progresses, using solvent or cleaning agent recommended in writing by the sealant manufacturer.
 - 2. Leave finished work in neat, clean condition.

3.04 INSTALLATION OF PIPING

- A. All piping systems shall be installed with adequate provisions made for expansion and contraction to prevent stresses on piping, valves and equipment. Anchor and guide piping at all points as required. Type and method of anchoring, guiding and attachments to sustaining members to suit job requirements and conditions and shall be approved by the Construction Manager.
- B. Provide pipe loops where required for accurate control of movement.
- C. Provide unions or flanges at each final connection, and at each piece of equipment. Branches from mains to equipment stubs, risers, etc., to have swing joints with at least one change of direction in the horizontal plane, and one change of direction in the vertical plane, before connecting to equipment or fixtures. Piping shall be arranged and unions and flanges located to permit easy removal of parts and equipment for inspection and cleaning without disconnecting any part except unions or flanges. No welded connections shall be made to valves or equipment. Use bronze unions in copper lines. Unions to be downstream of valves.
- D. Make proper connections to all items of equipment in the Contract as recommended by the Manufacturer or as detailed on the Drawings.
- E. All piping shall be arranged in accordance with the best standards of the trade with vertical pipes plumb and horizontal runs parallel or perpendicular to the building wall.
- F. Provide valves and specialties where indicated on the Drawings.
- G. Provide 3/4" drain valves in piping at low points to provide complete drainage of all systems and as shown on the Drawings.
- H. Ream ends of pipe and clean before installing.
- I. Copper joints: Copper piping in plumbing systems less than 2 inches shall be soldered using 95/5 tin/antimony solder. Copper piping in plumbing systems 2 inches and larger shall be brazed using a 6 percent silver alloy with a 1000°F solidus minimum. Solders and fluxes containing lead are prohibited. For solder to threaded adapter nipples, the contractor shall use either a 95/5 tin/copper solder similar to "Taramet Sterling" or a 96/4 tin/silver solder similar to "Tarasil 964" in lieu of brazing.
- J. All underground steel piping shall be welded. All joints in underground copper piping shall be made with "Silfos".

- K. Use pipe dope on male threads of screwed pipe only. Teflon pipe joint tape may be used, at the Contractor's option.
- L. Make all changes of direction with fittings, rather than bending.
- M. Flanged joints shall be faced true and square. Flanges shall be same face style as mating surface to which it is connected.
- N. Install thermometers and gauges so they may be read from floor level.
- O. Install Pete's Plugs as close as possible to control valves, coils, etc., as shown on the Drawings, and arranged so that a probe may be inserted into the plug.
- P. All valves and unions to be installed so as to be accessible through ceiling, access panels, etc.
- Q. Provide dielectric unions or insulating flanges between dissimilar metals, i.e., copper to steel.
- R. Where pipe drops occur in block walls, pipes to enter and leave walls at block joints. Coordinate with General Contractor.
- S. Install galvanized sheet metal troughs with drains under pipes crossing electrical equipment. Seal to make water tight.
- T. Properly support all relief valve discharge piping and provide no more than one 90° ell.
- U. Bull head connections in any piping service are expressly prohibited.
- V. At the end of each day's work and otherwise as required or directed, provide caps and/or plugs at all openings in piping for protection. Particular attention must be given to avoid the possibility of any foreign materials entering the pipes, whether it be inadvertent or with malicious intent.
- W. All piping indicated on the Drawings, and piping within 50 feet of mechanical equipment on vibration isolators, shall be isolated from the structure by means of vibration and noise isolators. Suspended piping shall be isolated by the incorporation of combination spring and fiberglass hangers in the supporting rods.
- X. When water piping is called for to be buried under floor slabs, it shall be encased in a tile or plastic pipe sleeve and shall be a continuous length of Type L soft copper with no joints inside the sleeve.

3.05 LUBRICATION

- A. Each shaft or valve stem containing a packing gland shall be checked for condition, and examined for proper packing.

- B. When filling systems initially for hydrostatic pressure tests, adjust valve packing glands to finger tight, allow packing to absorb water for five (5) minutes prior to tightening packing nuts.

3.06 ELECTRICAL WORK

- A. All wiring, conduits, etc., shall be in strict accordance with the requirements of the latest edition of the National Electrical Code and Division 26, Electrical specification.
- B. All wiring, including low voltage wiring, shall be run in conduit.
- C. Low voltage wiring may be size and type recommended by the Manufacturer.

3.07 TEST AND ADJUSTMENTS

- A. After work has been completed but before pipe covering has been applied, the Contractor shall test the systems as follows. At these pressures, the circulation shall be free and the piping free of leaks.

System	Test Medium	Pressure Not Less Than	Time Not Less Than	Notes
Water lines	water	125 lbs	6 hrs	no drop
Drainage systems	In accordance with applicable plumbing code			

- B. Purge gas system to outdoors. Purge and test to be witnessed by Gas Company and Construction Manager. Test gas piping as specified in Section 22 16 16 "Building Natural Gas Piping".
- C. Before turning job over to Owner, inspect all valves and repack valves as necessary.
- D. This Contractor shall adjust all equipment in the Plumbing system to obtain proper operation and shall demonstrate to the Construction Manager that the entire system will function properly.

3.08 FLUSHING AND STERILIZATION

- A. With all outlets closed, fill system to working pressure and close valve at supply main.
- B. A cleaning solution containing not less than 150 parts per million of chlorine shall be introduced into the system.
- C. Each outlet, hot and/or cold, shall be tested during fill to prove the presence of chlorine at that outlet and valves and faucets shall be opened and closed several times during the disinfecting time period.

- D. Water piping systems shall remain filled for a period of 24 hours and each outlet shall be again tested and shall produce not less than 100 parts per million of chlorine at the end of the retention period.
- E. All outlets shall be opened wide and the main supply valves opened, flushing system with water until chlorine content is not greater than 0.2 parts per million or until approved by the Health Department. Flush drain valves.
- F. After final flushing all aerators on plumbing brass shall be removed, cleaned and reinstalled.
- G. Sterilization test may be performed at the same time the pressure test is placed on the system.
- H. Provide additional valves where needed on remodeling projects to add or circulate sterilization solution or cleaning solution. Coordinate location with the Sterilization Subcontractor.

END OF SECTION 22 05 00

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SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following plumbing systems:
 - 1. Gate and check valves
 - 2. Ball Valves
 - 3. Butterfly valves
 - 4. Gas Cocks
 - 5. Combination Balance and Stop Valves

1.03 SCOPE

- A. Furnish and install all necessary valves for piping systems and equipment in the building required to provide proper shut off and balancing of systems included under this Contract.

1.04 SUBMITTALS

- A. Not Required

1.05 QUALITY ASSURANCE

- A. NSF Compliance: NSF 61 for valve materials for potable-water service
- B. Valves and Valves Parts may contain no greater than 15% ZINC content to prevent dezincification of specified products.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect internal parts against rust and corrosion.
- B. Maintain valve end protection.
- C. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- D. Do not use handwheels or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GATE VALVES

- A. Gate valves by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the Contractor's option and shall all be by the same manufacturer.
 - 1. Stockham
 - 2. Jenkins
 - 3. Crane
 - 4. Milwaukee
 - 5. Powell
 - 6. Velan
 - 7. Nibco
- B. 3" and larger - iron body, bronze mounted, O.S.&Y., flanged, taper solid wedge disc, rising stem, 200 PSI non shock cold working pressure.

2.02 BALL VALVES

- A. Ball Valves by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the Contractor's option and shall all be by the same manufacturer.
 - 1. Stockham
 - 2. Jenkins
 - 3. Crane
 - 4. Milwaukee
 - 5. Apollo
 - 6. Velan
 - 7. Nibco
- B. Ball valves 2" and smaller shall be two-piece all bronze body ball valves, screwed, quick opening lever handle, teflon seats, full port, blowout proof stem, adjustable packing gland, chrome plated bronze ball, (stainless steel ball and stem optional) suitable for 150 S.W.P. and 600 PSI non shock cold working pressure.
- C. Ball valves 2-1/2" and 3" shall be same construction as above but have conventional port.
- D. Valves used on outlets of devices for balance purposes or shown on drawings shall have an adjustable memory stop (position lock).
- E. Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material that allows operation of the valve without breaking the vapor seal or disturbing the insulation.

2.03 BUTTERFLY VALVES

- A. Butterfly valves shall be based on Keystone. Valves by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the Contractor's option and shall be all by the same manufacturer.
 - 1. Bray Figure 31H
 - 2. Flowseal
 - 3. Jamesbury
- B. Butterfly valves 2-1/2" to 12" shall be similar to Keystone Fig. 222 with cast or ductile iron body, lug pattern, aluminum bronze disc, stainless steel stem, EPDM seat, extended neck for full 2" insulation, and rated for bidirectional and deadend drop tight services to 250 psig and 250°F.
- C. Butterfly valves 5" and smaller shall have minimum 10 position lever actuators, with positive latching and position indicator.
- D. Butterfly valves may be used for gate valves 2 1/2" and larger.

2.04 DRAIN VALVES

- A. Drain valves shall be ball valves as specified above.

2.05 CHECK VALVES

- A. Check valves by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the Contractor's option and shall all be by the same manufacturer.
 - 1. Apollo
 - 2. Dunham Bush
 - 3. Webster
 - 4. Homestead
 - 5. Velan
 - 6. Milwaukee
 - 7. Nibco
 - 8. Clow
 - 9. Mueller
- B. 3" and larger - iron body, bronze mounted, horizontal swing check with bronze disc, bolted cap, flanged, 200 PSI non shock cold working pressure.
- C. 2-1/2" and smaller - all bronze, horizontal swing check with bronze or TFE disc, renewable, screwed, 200 PSI non shock cold working pressure.

- D. Non-slam check valves at pumps only - 2-1/2" and larger shall be flanged, cast iron or semi-steel body, bronze trim, center guided lift check with bronze disc and stainless steel spring, 200 PSI non shock cold working pressure. 2" and smaller shall be screwed, bronze, cast iron or semi-steel body, bronze trim, center guided lift check with bronze or TFE disc and stainless steel or alloy spring, 200 PSI non shock cold working pressure.

2.06 GAS COCKS

- A. Gas cocks by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the Contractor's option and shall all be by the same manufacturer.
 - 1. ITT
 - 2. Grinnell
 - 3. Homestead
 - 4. DeZurick
- B. Gas Cocks - 1-1/2" and smaller - all bronze, screwed, flat head, brass plug and washer, 200 lb. W.O.G.
- C. Gas Cocks - 2" and larger and all gas main shut-offs - permanently lubricated plug valves, cast iron body with bolted cover. Flanged 175 lb. W.O.G. Furnish with wrench.
- D. Valves shall be labeled as required to be compliant with all requirements of the International Fuel Gas Code (IFGC).

2.07 COMBINATION BALANCE AND STOP VALVES

- A. Combination Balance and Stop Valves shall be based on Bell & Gossett. Combination Balance and Stop Valves by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option and shall all be by the same manufacturer.
 - 1. Taco
 - 2. Griswold
 - 3. Tour & Andersson / Victaulic
 - 4. Flow Design
- B. Combination Balance and Stop Valves shall be Bell & Gossett Circuit Setter Plus Lead Free, Model CB, bronze body, 304 stainless steel ball positive shut-off, memory stop, differential pressure readout ports, drain port. Valves on piping systems operating below 100°F shall be furnished with pre-formed insulation cover.

PART 3 EXECUTION

- 3.01 This Contractor shall install all valves in strict accordance to the manufacturer's recommendations.
- 3.02 Where drain lines are not piped to floor drains, furnish hose end adapters. Provide caps for all hose end adapters.

END OF SECTION 22 05 23

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SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following items:

- 1. Pipe hangers
- 2. Trapeze hangers
- 3. Equipment supports

1.03 SCOPE**A. SUPPORTING PIPING**

- 1. Furnish and install all necessary inserts, beam clamps and auxiliary steel for pipe hangers in the building.
- 2. Furnish and install necessary pipe hangers and supports to properly support all piping and to maintain uniform elevation.
- 3. Ceiling grid systems shall not be supported from piping, and vice versa. Each utility system and the ceiling grid system shall be a separate installation and each shall be independently supported from the building structure. Where interferences occur, provide trapeze type hangers or other suitable supports where they will not interfere with access to valves and other appurtenances requiring servicing.

B. EQUIPMENT SUPPORTS

- 1. Pads to be provided for plumbing equipment by this Contractor. Refer to Drawing for locations. Exact sizes as determined by this Contractor. This contractor to coordinate with General Contractor who is providing a floor membrane. Any other equipment that may interfere with the installation of the membrane floor shall be coordinated with the General Contractor to determine if the membrane is to go on top of the pad or stop at the base.
- 2. This Contractor shall furnish welded steel frames and supports for all equipment requiring same. Furnish auxiliary steel as required for supporting pipes.

3. Pitch pockets and pipe supports for the roof mounted pipe to be furnished and installed by the General Contractor. The Roofing Subcontractor to weatherproof same. Auxiliary steel for supporting roof mounted pipe by this Contractor unless otherwise noted on the Drawings.

1.04 SUBMITTALS

- A. Not Required

PART 2 PRODUCTS

2.01 PIPE HANGERS

- A. Pipe Hangers based on Anvil. Hangers by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 1. B-Line
 2. Erico
 3. Hilti
 4. PHD Manufacturing
 5. Modern Pipe Hangers
- B. Hangers for copper lines, 2" and smaller, shall be similar to Anvil Fig. CT-69, adjustable carbon steel pipe ring, with 3/8" hanger rods. All copper plated.
- C. Hangers for copper lines 2-1/2" to 4" shall be similar to Anvil Fig. CT-65, adjustable carbon steel clevis, with proper size rods, all copper plated.
- D. When copper lines are insulated and hangers are sized for outside of insulation, provide steel hangers as described below.
- E. Hangers for steel lines 2" and smaller shall be similar to Anvil Fig. 97, adjustable pipe ring, galvanized steel band with 3/8" hanger rods.
- F. Hangers for steel lines 2-1/2" and larger shall be similar to Anvil Fig. 260, adjustable carbon steel clevis, heavy duty, with proper size rods.
- G. Hangers for domestic cold water lines 1-1/4" and larger shall be sized for outer diameter of insulation. Furnish 1/2 round galvanized sheet metal insulation protectors minimum 12" long similar to Anvil Fig. 167 on bottom half of insulation for domestic cold water lines 1-1/4" and larger at each pipe hanger.
- H. Horizontal soil pipe to be supported at hub of each joint, base of each riser, at each floor and elsewhere as required, using Anvil Fig. 260, adjustable carbon steel clevis with proper size rods.

2.02 TRAPEZE HANGERS

- A. Trapeze Hangers based on B-Line, trapeze hangers by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Anvil
 - 2. Erico
 - 3. Hilti
 - 4. PHD Manufacturing
 - 5. Modern Pipe Hangers
 - 6. Unistrut
- B. At the Contractor's option, trapeze hangers may be used for the support of multiple pipes or where pipes are being routed below ductwork, etc. prohibiting a direct hanger to the deck above. Struts shall be similar to B-Line Figure B22SH.
- C. Trapeze hanger struts and hanger rods shall be sized per the manufacturer's recommendations to adequately support the piping and pipe content load.
- D. Trapeze hangers shall be spaced per the worst case of the pipes being supported per the table below in Part 3 - Execution.
- E. Secure pipes to strut with straps similar to B-Line Figure B2000. Insulation protectors (1/2 round galvanized sheet metal) shall be provided on all domestic cold water pipes 1-1/4" and larger.

2.03 EQUIPMENT SUPPORTS

- A. Reference Division 03 – CONCRETE
- B. All steel for frames and supports shall be standard weight black steel pipe or standard structural steel shapes. All steel supports exposed to the weather shall be galvanized steel.
- C. Concrete for pads shall be a minimum of 6 bag mix per cubic yard with maximum slump of 4" and shall be air entrained 5 to 7% by volume.

PART 3 EXECUTION

- 3.01 Wall bracket pipe supports shall be installed where required.
- 3.02 All copper piping is to be shielded from steel pipes or electrical conduit with electrical tape wherever pipes would touch each other.
- 3.03 Galvanized hangers and strap hangers will not be permitted for supporting copper lines except for hangers sized for outside of insulation.

- 3.04 Provide pipe anchors and guides where required to properly control pipe. Method to suit job conditions.
- 3.05 Piping except as noted below shall be supported according to the following schedule. Support at intervals not to exceed spacing listed or elsewhere as required in accordance with good workmanship. No pipe shall be supported from another pipe. All hangers shall be plumbed before insulation is applied.

<u>Steel Pipe</u>			<u>Copper Pipe</u>		
<u>Rod</u>	<u>Pipe Size</u>	<u>Spacing</u>	<u>Rod</u>	<u>Pipe Size</u>	<u>Spacing</u>
3/8"	Thru 1"	7'-0"	3/8"	Thru 3/4"	5'-0"
3/8"	1-1/4"	7'-0"	3/8"	1"	6'-0"
3/8"	1-1/2"	9'-0"	3/8"	1-1/4"7'-0"	
3/8"	2"	10'-0"	3/8"	1-1/2" & 2"	8'-0"
1/2"	2-1/2"	11'-0"	1/2"	2-1/2"9'-0"	
1/2"	3"	12'-0"	1/2"	3"	10'-0"

- 3.06 Steel gas piping shall be supported at intervals not to exceed spacing as follows: 1/2" - 6 ft. intervals, 3/4" and 1" - 8 ft. intervals, 1-1/4" and larger (horizontal) - 10 ft. intervals.
- 3.07 Support plastic pipe at intervals not to exceed 4 feet, 6 feet on 4 inch and larger.
- 3.08 Support piping at pumps and equipment from floor or walls, so that piping weight is not supported directly from pumps or equipment.
- 3.09 Grind all sharp corners and projections on supporting steel after fabrication. All steel shall have one (1) coat of metal primer after fabrication. All steel supports exposed to the weather shall be galvanized steel.

END OF SECTION 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide brass tags on all valves. Tags shall state type of line in which the valve is installed (Domestic Hot Water Supply, Domestic Hot Water Return, etc.) and number of valve. Furnish a schedule or schedules of all valves tagged with number, location and purpose of each valve and mount schedules under glass on Equipment Room wall, or elsewhere as required. Schedules shall be located near and convenient to the valves on the schedule.
- B. After piping and insulation is painted, this Contractor shall apply adhesive labels for all piping systems, lettered with the name of contents of piping. Flow direction arrows of the same colors are to be located on each end of the label and wrapped around the entire pipe.
- C. This Contractor shall label all disconnects, motor starters, switches and equipment furnished under this Contract.

PART 2 PRODUCTS

2.01 Valve tags shall be brass minimum 16 gauge.

2.02 Pipe labels and flow arrow tape shall be similar to Brady B-946 indoor/outdoor marking film with high gloss, durable, flexible, pressure-sensitive adhesive product. Flow arrow tape background color shall match label background color. Furnish a minimum of 12 additional labels for each service and a minimum additional roll of arrow tape for each service. Size of labels and letters shall be per ASME A13.1 as follows:

Size of Legend Letters (Per ASME A13.1)		
Pipe Cover O.D.(in.)	Length of Color Field	Size of Letter
¾ to 1¼	8"	½"
1 ½ to 2	8"	¾"
2 ½ to 6	12"	1¼"
8 to 10	24"	2½"

2.03 Equipment labels shall be 1/16" thick laminated plastic nameplates or 0.020" thick aluminum nameplates. Background shall be black with 3/16" letters engraved on the face. Letters shall be white or natural aluminum.

PART 3 EXECUTION

3.01 Secure equipment labels with screws. Do not attach to covers where covers can be easily mixed up.

3.02 Tape shall be wrapped completely around pipe on end of the label in a fashion to help hold the label onto the pipe.

3.03 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.

3.04 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed and above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as 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 through walls, 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. Once in each room.

- B. Pipe Label Color Schedule:

<u>SERVICE</u>	<u>PIPE LABEL</u>	<u>BACKGROUND COLOR</u>	<u>LETTER COLOR</u>
Domestic Cold Water	COLD WATER	White	Blue
Domestic Hot Water	HOT WATER	White	Dark Red

END OF SECTION 22 05 53

SECTION 22 05 80 - EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

- A. This Contractor shall excavate and backfill all trenches and other excavations required for laying drains, sewers, services, manholes, catch basins, surface inlets, appurtenances and other excavations required for their work.
- B. All construction shall conform to the safety requirements as listed in the Federal Register Sections on Safety and Health Regulations for Construction.

1.03 SUBMITTALS

- A. Not Required

PART 2 PRODUCTS

2.01 BACKFILL MATERIAL

- A. Earth Fill: Soil as approved by Construction Manager, free of organic soil, sod, roots, wood, metal, rubbish, debris, lumps or excessive amounts of clay and rocks greater than 2" in diameter; capable of being compacted into dense and stable condition as specified.
- B. Granular Fill:
 - 1. Structural:
 - a. Coarse: Bank-run sand and gravel having uniform mixture of sand and gravel, capable of being compacted into dense and stable condition as specified, and free of organic soil, shale, lumps or excessive amounts of clay, and other foreign substances. NOTE: 100% of material must pass 2" sieve and have less than 25% passing #200 sieve as approved by Soils Engineer.
 - b. Fine: "6X" by American Aggregates; a finely graded crushed stone and stone by-product from approximately 3/8" to 10-20% passing the #200 sieve. Material to be of low solubility as approved by Soils Engineer.

2. Slab Sub-Base: Provide under all interior concrete slabs on grade.
 - a. ODOT 703, Size #304 crushed or uncrushed stone.
 - b. Surface choke with sand or fines to prevent damage to vapor barrier.
 3. Drainage: ODOT 703, Size #467. Washed, uniformly graded mixture of uncrushed gravel, with 100% passing a 2-inch sieve, and not more than 5% passing a #4 sieve.
- C. Under Footings and Foundations: Concrete.
- D. Plastic Pipe. Soil free of large rocks, building materials, etc., that might cause damage to the plastic pipe.

PART 3 EXECUTION

3.01 TESTS AND INSPECTIONS

- A. All required tests and inspections are to be approved by the Construction Manager before any backfilling is done.

3.02 EXCAVATION

- A. Trench width shall be sufficient to permit proper installation of the pipe and bottom of trenches evenly graded to insure uniform bearing for pipe.
- B. Trenches shall be sheathed or braced and pumping or bailing performed as necessary to protect workers and adjacent structures and to permit proper execution of the work.
- C. Bell and Spigot joint holes to be carefully excavated so that none of the load is supported by the bells or joints.
- D. Mechanical excavation shall be held to 4" above final pipe elevation. The remainder shall be shaped by manual excavation, so that pipe is fully supported on undisturbed soil.
- E. Excavations below required depths shall be refilled with sand or gravel firmly compacted. Rock encountered shall be excavated three inches (3") below the lowermost part of the pipe and the space so formed, refilled with sand and gravel well compacted. Refill shall be concrete under footings and foundations.
- F. All lines below slab-on-grade floors to be bedded in coarse sand or pea gravel, minimum 2" under pipe, 4" above.

- G. Whenever in the opinion of the Construction Manager, the soil at or below grade is unsuitable for supporting piping, or other construction included under this Contract, such provisions for proper foundations shall be made, in addition to those shown or specified, as the Architect/Engineer may direct, equitable adjustment for same to be made in the Contract price.

3.03 BACKFILLING

- A. Backfill to rough grade within area of grading work required under General Contract, and to finish grade elsewhere.
- B. Backfill shall be free of rubbish and boulders.
- C. Tamp in 6" layers to a point 24" above pipe, and 12" layers above this point. Thoroughly compact.
- D. No frozen backfill shall be used.
- E. Under footings and foundations, concrete backfill to extend one foot each side of footing or foundation.
- F. Locations:
 - 1. Under Building: Where additional excavation required or against footing sides where formed sides used; Granular, Fine Structural, to underside of slab sub-base.
 - 2. Under All Interior Slabs: Provide 4" layer of slab sub-base; smooth and compact to specified density and leave ready for installation of vapor barrier.
 - 3. Against Walls: Drainage fill.
 - 4. Under Pavements:
 - a. Drives and Roads: Granular, Course Structural.
 - b. Walks: Granular, Course or Fine Structural.
 - 5. Trenches: Granular, Fine Structural.
 - 6. Site: Earthfill.

- 3.04** All pavements, curbs, walks and lawns damaged by this work shall be repaired by the General Contractor at this Contractor's expense to their original condition in kind.

- 3.05 Protect all utilities shown on Drawings or encountered in the construction work. Any damage to utilities shall be repaired by this Contractor to Owner's satisfaction, without cost to the Owner.
- 3.06 Surplus earth shall be deposited on site where directed by Construction Manager.

END OF SECTION 22 05 80

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Extent of work - insulate pipes and other surfaces as follows:
 - Cold water pipe
 - Hot water pipe
 - Hot water and drain piping below handicapped lavatories and sinks

1.03 SUBMITTALS

- A. Not Required

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. Store insulation on site in dry location. Cover insulation to protect from moisture.

1.06 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.01 INSULATION

- A. All insulation cover except elastomeric based on Johns Manville. Insulation cover by the following manufacturer's of the same type, thickness and conductivity meeting all other requirements may be furnished at the Contractor's option.
 - 1. Owens Corning
 - 2. Knauf
 - 3. CertainTeed
 - 4. Manson
- B. Pipe insulation shall be Johns Manville "Micro-Lok" AP-T glass fiber insulation rated for 850°F with factory applied AP-T all purpose self-sealing vapor barrier jacket. Butt strips shall be minimum 3" wide of same material as jacket.

- 2.02** All cements, adhesives, finishes, etc. based on Foster. Cements, adhesives, finishes, etc. by the following manufacturer's of the same type, thickness and conductivity meeting all other requirements may be furnished at the Contractor's option.

- 1. Childers
- 2. Vimasco

- 2.03** All insulating materials, including jackets, cements, adhesives, vapor barriers, etc. shall be U.L. listed with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50. All exterior finishes shall have a minimum service temperature limit (FSTM 70) of minus 50°F to 220°F.

- 2.04 Molded plastic fitting covers shall be U.L. approved with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50.
- 2.05 At handicap access lavatories and/or sinks with exposed piping below, provide pre-fabricated insulation jacket with molded PVC resin vinyl cover assemblies for all supply (hot and cold) and drain piping, equal to McGuire Pro-Wrap Series. Offset drains to be provided with cover assemblies specifically designed for same. Completed installation to be listed by manufacturer as A.D.A. compliant for handicap access.

PART 3 EXECUTION

3.01 Cover cold water piping, as follows:

- A. Cover with 1/2" thickness glass fiber pipe insulation except piping 3 inch and larger shall be 1" thick.
- B. Butt all edges of insulation and seal all longitudinal laps and butt strips with white vapor barrier cement, similar to Foster No. 85-20, or factory self-sealing laps.
- C. Fittings shall be wrapped with compressed fiber glass to same thickness and density as adjacent pipe covering and covered with a molded plastic fitting.
- D. All valves, flanges, unions etc. in cold water lines shall be wrapped with full thickness insulation and covered with molded plastic fitting or an open mesh glass cloth applied over wet Foster 30-33 vapor barrier mastic and covered with a second coat of fire resistant vapor barrier mastic.
- E. Use 12" long sections of calcium silicate insulation with jacket same as adjacent pipe covering at each hanger. At the Contractor's option, install a wood block or high density (20 lb./ft.³) fiberglass block at each hanger. Vapor barrier to be maintained throughout.
- F. All pipe covering inside attic space shall be 2" thick same as above.

3.02 Cover hot water pipe, as follows:

- A. For systems operating at 140°F and less cover 1-1/4" pipe and less with 1" thick and 1-1/2" pipe and larger with 1-1/2" thick glass fiber pipe insulation. For systems operating above 140°F cover 1-1/4" pipe and less with 1-1/2" thick and 1-1/2" pipe and larger with 2" thick glass fiber pipe insulation.
- B. Fittings shall be wrapped with compressed fiber glass to same thickness and density as adjacent pipe insulation and covered with a molded plastic fitting.
- C. All pipe covering inside attic space shall be 2" thick same as above.

- 3.03 Application shall be made on clean, dry surfaces with all joints butted firmly together.
- 3.04 Cover all valves, flanges, unions, flexible connections and appurtenances in cold water lines with full thickness insulation.
- 3.05 On domestic cold water lines 1-1/4" and larger, provide sheet metal saddles and rigid insulation at hangers. On smaller lines provide rigid insulation but no saddles.
- 3.06 Insulation must run continuous through hangers and wall on all cold water.
- 3.07 No insulation is required on pipes which are underground or buried under floor slab.
- 3.08 Insulation shall not be applied until the general construction has progressed sufficiently to insure against physical or moisture damage to the insulation. All damaged insulation shall be replaced at this Contractor's expense.
- 3.09 Install 20 gauge galvanized steel insulation protectors on all insulated exposed pipes passing through floor. Sleeves to be 12" above the floor.
- 3.10 Hanger rods must be perpendicular before insulation is installed.
- 3.11 Longitudinal lap joints and butt strips for glass fiber pipe insulation shall be secured with staples on three (3) inch centers and sealed with an approved vapor barrier adhesive where applicable. Staples are not required when insulation utilizes a "double" adhesive self sealing system.

END OF SECTION 22 07 00

SECTION 22 11 16 - BUILDING DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes pipe and fitting materials, joining methods, special duty valves, and specialties for the following:
 - 1. Domestic cold water piping
 - 2. Domestic hot water piping
 - 3. Domestic tempered water piping
- B. Related Sections include the following:
 - 1. Section 22 05 00 "Common Work Results for Plumbing" for description on the following: Tests, Adjustments, Flushing and Sterilization.

1.03 SCOPE

- A. The Plumbing Contractor shall connect to a flange provided by the Site Utility Contractor at 5 ft. beyond exterior face of building perimeter wall at location indicated on plans. Pipe material outside building shall match what was provided by the Site Utility Contractor.
- B. All piping shall conform with NSF 61 and the current plumbing code.
- C. From connection to site cold water main extend a system of cold water piping to all plumbing fixtures requiring same and to other points as indicated.
- D. From water heaters construct a system of hot water piping to all plumbing fixtures requiring same and to other points as indicated.
- E. From ends of hot water system extend hot water return system back to water heaters.
- F. From mixing valves construct a system of tempered water to all plumbing fixtures requiring same, and to other points as indicated.
- G. Provide valves, thermometers, gauges, etc., where shown on Drawings.

1.04 SUBMITTALS

A. Provide the following information:

1. Test results

1.05 DELIVERY, STORAGE AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dewpoint temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Water distribution pipe and fittings shall conform to NSF 61 and conform to one of the standards listed in the current Plumbing Code.

B. Type L hard drawn copper with cast bronze or wrought copper, solder type fittings.

- C. Underground trap primer lines - type K soft copper tubing or Pex tubing. Trap primer lines above grade to be Type K soft copper tubing. No joints allowed in underground lines.
 - 1. Underfloor tubing to be similar to Wirsbo Aquapex Plus, cross-linked polyethylene tubing with an oxygen diffusion barrier. Tubing shall be rated at 80 psi at 200°F, 100 psi at 180°F, and 160 psi at 73°F.
 - 2. Fittings used for underfloor tubing shall be similar to Wirsbo QS20 compression fittings and installed as recommended by the manufacturer.
- D. At the Contractor's option, mechanically formed tee connections utilizing the T-Drill tube branching system may be used for domestic water piping systems.
 - 1. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. The collaring device shall be fully adjustable as to insure proper tolerance and complete uniformity of the joint.
 - 2. The joining branch tube shall be notched and dimpled in a single process so as to set the proper penetration of the branch tube into the fitting to assure a free flow joint.
 - 3. All joints shall be brazed in accordance with the Copper Development Association Copper Tube Handbook using B-cup series filler metal.
Note: Soldered joints will not be permitted.
 - 4. All mechanically formed branch collars shall be approved by the National Standard Plumbing Code, B.O.C.A., I.A.M.P.O., S.B.C.C.
- E. Solder and fluxes containing lead are prohibited.

PART 3 EXECUTION

- 3.01 All cold water lines that have a flush valve shall have a shock absorber at the end of each line.
- 3.02 Branches to fixtures the following sizes unless otherwise indicated:

- Water Closets, F.V. - 1 inch
- Lavatories - 1/2 inch
- Sinks - 1/2 inch
- Receptor trim - 1/2 inch
- Service sink - 1/2 inch
- Hose Bibbs (exterior) - 3/4 inch
- Individual showers - 1/2 inch

- 3.03 Unless otherwise shown on drawings, this Contractor shall be responsible for sizing domestic water piping in chases, etc. to individual fixtures. When piping serves flush valves, cold water pipe shall be run full size to end of pipe chase run and a shock absorber installed. When cold water pipe is 2" or above and serves flush valves, the pipe main in the chase can only be reduced to 1-1/2" size. 1/2" hot water pipe shall serve up to four (4) lavatories. Other pipe sizing criteria shall be as outlined in latest edition of "ASHRAE Fundamentals Handbook".
- 3.04 Pitch all water piping to drainage points and conceal wherever possible.
- 3.05 Install vacuum breakers in all lines to hose bibbs and other valves or trim with hose or serrated ends except no separate vacuum breaker is required where trim is furnished with integral vacuum breaker.
- 3.06 Balance recirculating branch line flows as required for proper operation of systems.
- 3.07 FIELD QUALITY CONTROL
- A. Inspect domestic water piping as follows:
1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 2. 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:
 - a) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b) Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Certification
1. All brazing of pipe joints shall be done by a certified brazer.
- 3.08 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 water-circulation return piping to provide adequate flow.
5. Adjust calibrated balancing valves to flows indicated.
6. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
7. Remove and clean strainer screens. Close drain valves and replace drain plugs.
8. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
9. Check plumbing specialties and verify proper settings, adjustments, and operation.

END OF SECTION 22 11 16

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SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following domestic water piping specialties:

1. Thermometers
2. Gauges
3. Temperature/Pressure Test Plugs
4. Shock Absorbers
5. Hose Bibbs
6. Vacuum Breakers
7. Trap Primers
8. Thermostatic Mixing Valves
9. Backflow Preventers
10. Equipment Backflow Preventers
11. Thermal Expansion Tanks

1.03 SCOPE

- A. Furnish and install all necessary domestic water piping specialties to include thermometers, gauges, pipe strainers, etc., included under this Contract.
- B. The Plumbing Contractor shall be responsible for having backflow preventers certified prior to initial building occupancy and 11 months after substantial occupancy. Any problems with the backflow preventers discovered during re-certification shall be corrected under warranty.

1.04 SUBMITTALS

- A. Provide the following:
 1. Thermostatic mixing valve
 2. Provide operation and maintenance data for the following:
 - a) Hose Bibbs
 - b) Vacuum Breakers
 - c) Trap Primers
 - d) Thermostatic Mixing Valves
 - e) Equipment Backflow Preventers
 - f) Roof Hydrant

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect internal parts against rust and corrosion.
- B. Store equipment indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.

PART 2 PRODUCTS

2.01 THERMOMETERS AND GAUGES

- A. Thermometers and gauges shall be based on Trerice and Weiss. Thermometers and gauges by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option and shall all be by the same manufacturer.
 - 1. Ashcroft
 - 2. Marsh
 - 3. Palmer
- B. Thermometers - Trerice "Industrial Type" blue colored organic filled thermometer with 9" cast aluminum case, front double- strength clear glass window, adjustable pattern. Provide brass separable socket. Ranges as shown on the Drawings.
- C. Pressure Gauges - Weiss 4PGA-I, standard single spring, aluminum case, 4-1/2" diameter with ball valve and pigtail. Ranges as indicated.

2.02 SHOCK ABSORBERS

- A. Shock absorbers based on Zurn. Shock absorbers by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Wade
 - 2. Jay R. Smith
 - 3. Josam
 - 4. Sioux Chief
 - 5. Watts Drainage
 - 6. Precision Plumbing Products
- B. Zurn Z-1700 Series - Size, quantity and installation per manufacturer's recommendations.

2.03 HOSE BIBBS

- A. Hose bibbs based on Zurn. Hose bibbs by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Watts

- B. Exterior hose bibbs (HB-1) - 3/4" frostproof Zurn 1310 exposed "Anti-Siphon" wall hydrant complete with Integral Backflow Preventer - Non-Freeze type - with bronze casing, all interior parts and non-turning operating rod with free-floating compression closure valve. Face shall be stainless steel complete with operating locking cover and key. Length to suit wall.

2.04 VACUUM BREAKERS

- A. Vacuum breakers based on Watts. Vacuum breakers by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Wade
 - 2. Jay R. Smith
 - 3. Josam
 - 4. Woodford
 - 5. Zurn
- B. Watts No. NF8 with bronze body and trim non-removable type. Size to be line size as indicated on the Drawings.

2.05 TRAP PRIMERS

- A. Trap primers based on Precision Plumbing Products. Trap primers by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. MIFAB
 - 2. Watts
- B. Precision Plumbing Products Oregon #1 diaphragm operated primer with distribution units as required. Provide trap primers on all floor drains where shown on the Drawings.
- C. Trap primers noted on drawings as electric trap primers shall be Precision Plumbing Products Model PTS electronic type with atmospheric vacuum breaker, pre-set 24 hour clock, manual override switch, 120V solenoid valve, 120V, 3 wire connection, calibrated manifold for equal water distribution, pre-assembled in a surface mounted steel cabinet.

2.06 THERMOSTATIC MIXING VALVES

- A. Thermostatic mixing valves based on Lawler. Thermostatic mixing valves by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Leonard
 - 2. Powers
 - 3. Symmons
 - 4. Bradley

- B. Thermostatic mixing valves for hand sinks in restrooms with labels TV-1 shall conform to ASSE 1070 with union connected inlet strainer check stops. Capacity of mixers as scheduled on Drawings. Mixers must control down to 0.5 gpm. Control temperature must be adjustable and be locking type adjustment. Adjustable high temperature limit shall be set for 110°F (maximum).

2.07 BACKFLOW PREVENTERS

- A. Backflow preventers shall be based on Watts. Backflow preventers by the following manufacturers of the same size, type, capacity and meeting other requirements including using reduced pressure principle may be furnished at the contractor's option and shall all be by the same manufacturer.
 - 1. Febco
 - 2. Aero
 - 3. Lawler
 - 4. Ames
 - 5. Wilkins
- B. Backflow preventers shall be Watts Series 909 for sizes up to 2", Series 957 for sizes 2-1/2" to 10" reduced pressure principle backflow preventer type. Provide sizes as shown on the Drawings. It shall be a complete assembly including tight- closing shut-off valves before and after the device. Valve shall be protected by a strainer. Backflow preventer shall include test cocks and pressure-differential relief valve located between two positive seating check valves. Provide with threaded connections for sizes 2" and smaller, 150 class flange connections for sizes 2-1/2" and larger. Furnish backflow preventer with a fixed air gap secured to relief vent. Backflow preventers shall meet approval of ASSE Standard 1013, CSA and be approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California.

2.08 EQUIPMENT BACKFLOW PREVENTERS

- A. Equipment backflow preventers based on Watts. Equipment backflow preventers by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the Contractor's option:
 - 1. Wilkins
 - 2. Febco
 - 3. Flomatic
- B. Dual check backflow preventers except as noted in next paragraph shall be Watts Series 7, furnished with bronze construction, union connections, two plastic check modules, stainless steel spring, and "O" ring union seal. Units shall comply with ASSE Standard 1024 and be so certified. Size to be line size as indicated on Drawings.

- C. Dual check backflow preventers serving beverage dispensers (carbonated and non-carbonated) and coffee machines shall be Watts Series SD-3, furnished with atmospheric vent, stainless steel body and adapters, stainless steel spring and screen. All rubber components shall comply with FDA food additive regulations. Units shall comply with ASSE Standard 1022 and be so certified. Size to be 3/8". Furnish with wye-type strainer. Piping downstream of backflow preventer serving carbonated beverages shall be stainless steel (copper pipe not allowed).

2.09 THERMAL EXPANSION TANKS

- A. Thermal expansion tanks based on Amtrol. Thermal expansion tanks by the following manufacturers of the same style may be furnished at the contractor's option:
 - 1. State
 - 2. Taco
 - 3. Watts
 - 4. AO Smith
- B. Steel pressure-rated tank constructed with welded joints ASME rated for 150 psig, factory-installed butyl-rubber diaphragm and air charging valve. Unit to include a 55 psig factory precharge. Polypropylene liner complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

PART 3 EXECUTION

- 3.01 All specialties to be installed in accordance with manufacturer's recommendations.
- 3.02 Vent connection to backflow preventer shall be made by means of a fixed air gap. No direct connection will be permitted. Extend line to nearest floor drain.
- 3.03 All cold water lines that have a flush valve shall have a shock absorber at the end of each line.
- 3.04 Install vacuum breakers in all lines to hose bibbs and other valves or trim with hose or serrated ends except no separate vacuum breaker is required where trim is furnished with integral vacuum breaker.

END OF SECTION 22 11 19

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SECTION 22 13 16 - BUILDING SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes pipe and fitting materials and joining methods for Building Soil, Waste and Vent Systems.
- B. Related Sections include the following:
 - 1. Section 22 05 00 "Common Work Results for Plumbing" for description on pipe pressure testing.

1.03 SCOPE

- A. Furnish a complete system of soil, waste and vent piping from all fixtures and outlets to approximately 5' outside the building foundation wall as shown on the drawings.

1.04 SUBMITTALS

- A. Not Required

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Soil and waste lines and fittings shall be cast iron soil pipe. 2" and smaller may be type DWV copper drainage tube with cast brass solder joint drainage fittings.
- B. Vent lines shall be cast iron drainage fittings or cast iron soil pipe and fittings or type DWV copper drainage tube with cast brass drainage fittings, at the Contractor's option.
- C. All underground lines shall be cast iron. "No Hub" joints are not permitted under slabs.
- D. House drain and branches shall be cast iron soil pipe and fittings.
- E. All cast iron soil pipe shall be service weight or "No- Hub".
- F. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

- G. Plastic piping manufactured by Yardley, Charlotte or Cresline may be used in place of piping described in this Section, except in return air plenums, underfloor or elsewhere prohibited by Local Codes. Plastic piping shall be non-flammable and meet requirements of all local codes. All underground lines shall be cast iron.

PART 3 EXECUTION

- 3.01 Provide a cleanout at the base of all stacks, at the end of each horizontal run (distance between cleanouts not to exceed 100') in house drains at building walls and elsewhere as shown on the Drawings or required by the applicable code. Cleanouts accessible for rodding.
- 3.02 Roof flashings furnished and set by this Contractor, but will be made weathertight by the General Contractor. Flashing shall be compatible with roofing membrane. Coordinate flashing work with roofer to obtain watertight installation.
- 3.03 All cast iron soil pipe shall be bitumastic coated inside and out. Joints in soil pipe shall be approved rubber O- ring slip type seals with soil pipe and fittings approved for this type of seal, or use "No-Hub" pipe and fittings with a neoprene sealing sleeve and a stainless steel shield and clamp assembly. "No-Hub" joints are not permitted under slabs. All cast iron pipe shall be installed in accordance with standards as set forth by The Cast Iron Soil Pipe Institute.
- 3.04 At the Contractor's option, hubless cast iron soil pipe may be joined by using "Clamp All" couplings in lieu of "No-Hub" couplings. Couplings are to be made of 24 gauge type 304 stainless steel with hi- torque clamps and neoprene gaskets. Couplings shall be installed and tested in accordance with the manufacturer's recommendations.
- 3.05 **CLEANING**
- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- 3.06 Venting exceptions in the plumbing code will not be allowed unless shown on the drawings.
- 3.07 Plastic piping shall be installed according to manufacturer's specifications and recommendations.
- 3.08 Install PVC soil and waste drainage and vent piping according to ASTM D2665.
- 3.09 Install underground PVC soil and waste drainage piping according to ASTM D2321.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following sanitary drainage piping specialties:

- 1. Drains
- 2. Cleanouts
- 3. Backwater Valves

1.03 SCOPE

- A. Furnish and install drains, cleanouts, and drainage specialties as required, and shown on the Drawings.

1.04 SUBMITTALS

- A. Provide the following:

- 1. Drains
- 2. Cleanouts

1.05 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply NSF 14, "Plastics piping Components and Related Materials," for plastic sanitary piping specialty components.

1.06 DELIVERY, STORAGE, AND HANDLING

- 1. Protect internal parts against rust and corrosion.
- 2. Store equipment indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.

1.07 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- B. Coordinate size and location of roof penetrations.

PART 2 PRODUCTS

2.01 DRAINS, CLEANOUTS AND BACKWATER VALVES

- A. Drains, Cleanouts and Backwater Valves based on Zurn. Drains, Cleanouts and Backwater Valves by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
1. Wade
 2. Jay R. Smith
 3. Josam
 4. Watts Drainage
- B. FD-1: Floor Drains in finished areas (general access; toilet rooms, shower/locker rooms, etc.) - Zurn ZN-415, cast iron body shallow sump drain with double drainage flange and weepholes, flashing clamp, bottom outlet with neoprene gasket inside connector and type B, 6" diameter adjustable grate. Frame and grate to have polished nickel-bronze finish. Furnish with funnel where indicated on plans.
- C. FD-2: Equipment Room Floor Drains - Zurn Z-610 cast iron body square top shallow sump drain with double drainage flange, flashing clamp, weepholes, 12" x 12" heavy duty top and removable sediment bucket. Bottom outlet with neoprene gasket inside connector. Provide cast iron frame and grate, with factory applied protective coating.
- D. Hub Drains - To consist of hub and spigot waste pipe section installed in the vertical position, with the "hub" portion exposed above floor. The hub inlet opening shall be a minimum of 3" above the finish floor surface.
- E. Cleanouts
1. In walls of finished areas, use cleanout tee and provide cleanout and access cover similar to Zurn Z-1468, with round polished stainless steel access cover, vandalproof securing screw and bronze taper threaded plug. Size to suit cleanout.
 2. All other cleanouts shall be similar to Zurn Z-1470 with tapered thread counter-sunk bronze plugs.
 3. Contractor may, at their option, use ABS plastic plugs in lieu of bronze plugs. Not permitted if exposed in finished areas, or above ceilings used for return air plenums.
 4. All cleanouts installed in carpeted areas shall be provided with vandal-proof carpet markers. Carpeted areas to be confirmed from Architectural documentation by the Plumbing Contractor.

- F. Backwater control valve - Zurn Z-1088 cast iron drainage control valve with brass shear gate, O-ring seal, non-rising bronze handle and stem operator, and automatic flapper type check valve. Furnish with factory applied protective coating on frame and cover, and inlet and outlet connections for soil pipe. Provide extensions as required by installed conditions to locate operator access cover flush at finished grade/floor level.

PART 3 EXECUTION

- 3.01 Furnish and install a P-trap for each inlet drain terminal (floor drain, hub drain, etc.), of the same material and installation type as the piping system connected to, unless indicated otherwise.
- 3.02 When trap primer water supply is indicated on plans for drain assemblies, the Contractor has the option to connect to a fitting on either the drain assembly or the P-trap inlet above the water seal, in accordance with inspection/approval authorities. Provide a dielectric union at trap primer supply connection points. When drain body primer connections occur within the slab/floor structure, provide offset immediately at drain location to allow installation of supply piping entirely below the slab/floor structure, including the conduit sleeve required for under slab on grade installations.
- 3.03 Provide a compatible fastening assembly with internal secondary drainage flange and weepholes for all items specified herein being installed in structures having waterproof membrane, flashing or other similar elements provided under separate contract. Installation conditions to be verified from Architectural documentation and coordinated with the appropriate Contractor.
- 3.04 Counterflashing for items specified herein (when required) is to be compatible with waterproof membrane or flashing under separate contract. Counterflashing to be provided and set in place by the Plumbing Contractor, but will be made watertight by the Contractor installing the membrane or flashing. Coordinate installation with other Contractor(s) in advance of work.
- 3.05 This Contractor shall be responsible for having all drains, cleanouts and other items so noted installed flush and level with finish wall, floor or other structure as applies. Coordinate installation with Contractor providing associated structure, including required elevations and dimensioned locations. Items not properly installed shall be removed and replaced to the satisfaction of the Owners' on-site representative.
- 3.06 All items and accessories specified herein are to be installed in accordance with the manufacturer's recommendations, and in accordance with the requirements of the inspection/approval authorities.
- 3.07 Coordinate location of all drains as required for proper operation when associated with sloped floors, or other structures provided under separate contract.
- 3.08 Verify exact locations of drains furnished for items under separate contract with the equipment as actually provided and installed by the appropriate Contractor. Coordinate installation in advance of work involved.

- 3.09 All items specified herein to have connection sizes as indicated by associated piping shown on Drawings, unless directed otherwise.
- 3.10 Coordinate locations of items specified herein, installed in or at structure provided under separate contract, relative to foundations, beams, and other structural elements to avoid conflicts. Make minor adjustments as required for proper installation, clearance and accessibility. Refer to Architectural/Structural documentation in advance of work and coordinate installation with the appropriate Contractor.
- 3.11 When floor drains DIRECTLY connected to the Sanitary Waste system are provided in toilet rooms, provide an individual trap primer accessory as specified herein for the flush valve assembly on an adjacent water closet fixture. Extend a 1/2" trap primer supply line below floor to the floor drain, accordance with the manufacturer's recommendations, and the requirement of the inspection/approval authorities. Floor drains INDIRECTLY connected to the Sanitary Waste system do not require individual trap primers.
- 3.12 All elements/items specified herein installed in above grade structures to be provided with anchor flange. Secondary drainage flange at drain assemblies may also serve as an anchoring flange.

END OF SECTION 22 13 19

SECTION 22 16 16 - BUILDING NATURAL GAS PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes pipe and fitting materials, joining methods, special duty valves, and specialties for the building natural gas piping
- B. Related Sections and items include the following:
 - 1. Section 22 05 00 "Common Work Results for Plumbing" - Tests.
 - 2. Local Gas Company Requirements
 - 3. NFPA - Pamphlet 54
 - 4. International Fuel Gas Code

1.03 SCOPE

- A. Extend gas line from meter to air handling units, unit heaters, water heaters, and elsewhere as indicated on the Drawings. Final connection to HVAC equipment by the HVAC Contractor.
- B. Locate pressure gauges at the service entrance and upstream and downstream of pressure reducing valves.
- C. Provide gas cock, union, and dirt leg in convenient location close to connection to each item of equipment.

1.04 SUBMITTALS

- A. Not Required

1.05 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel".
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping".
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Piping shall be Schedule 40, ASTM A53, black steel pipe. Joints in 1-1/2 inch and smaller pipe shall be screwed fittings, class 150 lb. banded, malleable iron, black. Use of bushings is prohibited. Weld joints in pipe 2 inch and larger. Use backing rings for welding 8 inch and larger pipe.
 - 1. Piping exposed to weather shall be primed and coated with a weather resistant paint. Color approved by Construction Manager.
- B. Piping 4" and smaller exposed to weather designed to operate with less than 1 psig pressure shall be Schedule 40, ASTM A53, galvanized steel pipe. Joints shall be screwed fittings, class 150 lb. banded, malleable iron, galvanized. Use of bushings is prohibited.
- C. Piping within last ten (10) feet of appliance may be screwed if approved by Code Authorities and Gas Company (between shutoff valve and appliance).

2.02 GAS PRESSURE REGULATORS

- A. Gas pressure regulators based on Sensus. Gas regulators shall be listed as complying with ANSI Z21.80. Gas pressure regulators by the following manufacturers of the same size, type and capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Fisher
 - 2. Cashco

PART 3 EXECUTION

- 3.01 Use dielectric fitting for connection of copper pipe and black steel pipe.
- 3.02 All gas piping shall be installed level. Purge and vent all gas lines to outside as required by the Gas Co., local codes, and International Fuel Gas Code.
- 3.03 Install pipe sleeves on gas piping through walls. Where main enters building, provide sleeve and vent to outside per Gas Company requirements.
- 3.04 Piping shall not be installed in or through a circulating air duct or gas vent.
- 3.05 Concealed piping shall not be located in solid partitions and solid walls, unless installed in a chase or casing.

- 3.06 Portions of a piping system installed in concealed locations shall not have unions, tubing fittings, right and left couplings, bushings, compression couplings and swing joints made by combinations of fittings.

Exceptions:

1. Tubing joined by brazing.
2. Fittings listed for use in concealed locations.

A concealed location is a location that requires the removal of permanent construction in order to gain access. The space above a dropped ceiling having readily removable lay-in panels or other locations that have removable access panels are not considered concealed locations. Concealed locations include wall, floor and ceiling cavities bounded by permanent finish materials such as gypsum board, masonry or paneling.

- 3.07 All branch connections shall be made on the top or side of horizontal lines.
- 3.08 Install 6" dirt leg at all connections to equipment.
- 3.09 Before the gas service is turned on, the house lines shall be subjected to a pressure test, as required by the Gas Company and the International Fuel Gas Code. Test pressure shall be no less than 1-1/2 times the proposed maximum working pressure but not less than 3 psig. The test shall be performed by the Contractor and witnessed by the Gas Company. This Contractor to initially pressurize system. Gas Company to rule on acceptability of the piping system after the test.
- 3.10 Shutoff valves shall be prohibited in concealed locations and furnace plenums. See explanation of concealed space described earlier. Shutoff valves in spaces above ceilings and below floors used for conveying environmental air is allowed as long as the space is accessible.
- 3.11 Black steel gas piping exposed to weather shall be primed and coated with a weather resistant paint. Color approved by Construction Manager.

END OF SECTION 22 16 16

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SECTION 22 34 00 - FUEL FIRED DOMESTIC WATER HEATERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following water heaters:
 - 1. Gas fired water heaters
- B. Related sections include the following:
 - 1. Section 22 11 23 Domestic Water Pumps for recirculation pumps.

1.03 SCOPE

- A. Furnish and install automatic gas fired water heaters, piping and appurtenances as shown on Drawings.
- B. Furnish and install circulation pumps as shown on the Drawings.
- C. Water heaters must comply with all requirements of the State of Ohio Code For Energy Conservation.
- D. Vent and flue piping by HVAC Contractor.

1.04 SUBMITTALS

- A. Provide the following:
 - 1. Gas Fired Water Heaters
 - 2. Operation and maintenance data for the above items.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect internal parts against damage, rust and corrosion.
- B. Store equipment indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases.

1.07 EXTENDED WARRANTY

- A. Provide extended warranties for equipment as noted in products sections below.

PART 2 PRODUCTS

2.01 GAS FIRED WATER HEATERS

- A. Gas fired water heaters based on A.O. Smith. Gas fired water heaters by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Lochinvar
 - 2. Ruud
 - 3. RBI
- B. Natural gas water heaters shall be as noted on drawings, minimum 95% thermal efficiency, a storage capacity, input rating, and recovery rate as indicated on drawings. Water heater shmaximum hydrostatic working pressure of 160 psi.
- C. Water heater shall have: 1. Modulating gas burner that automatically adjusts the input based on demand. 2. Powered anodes that are non sacrificial and maintenance free. 3. Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded; 4. Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1; 5. Have foam insulation and a CSA Certified and ASME rated T&P relief valve; 6. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up; 7. Be approved for 0" clearance to combustibles.
- D. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. No charge connectivity shall be provided allowing for remote viewing and fault notification via app. 1. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters; 2. Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.
- E. 120K-250K BTU Input: For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a 3" diameter PVC pipe for a total distance of 50 equivalent feet of vent piping and 50 equivalent feet of intake air piping.

- F. Heater tank shall have a three year limited warranty against corrosion.

PART 3 EXECUTION

- 3.01 Install water heaters as recommended by manufacturer.
- 3.02 Install ASME rated temperature pressure relief valve as indicated on the Drawings. Valve setting 210°F. and 125 psig. Extend discharge pipe full size to 6" above floor, not to floor drain.
- 3.03 Set supply water temperature for normal usage at 130°F.
- 3.04 Install vacuum relief valve on inlets to bottom fed water heater(s). Valve shall meet ANSI Z21.22 requirements and be similar to Watts N36.
- 3.05 Flue piping shall be by the Plumbing Contractor.

END OF SECTION 22 34 00

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SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following plumbing fixtures and related components:
 - 1. Water Closets and Trim
 - 2. Urinals
 - 3. Lavatories
 - 4. Stainless Steel Sinks
 - 5. Showers
 - 6. Service Sinks

1.03 SCOPE

- A. Furnish and install all plumbing fixtures and associated accessories as specified herein at locations indicated on plans. Fixtures to be provided free of defects and set in a neat, finished and uniform manner.
- B. Where fixtures are indicated to be handicap accessible, install as directed herein and in compliance with the codes and guidelines referenced.

1.04 SUBMITTALS

- A. Provide the following:
 - 1. Water Closets and Trim
 - 2. Urinals
 - 3. Lavatories
 - 4. Stainless Steel Sinks
 - 5. Showers
 - 6. Service Sinks

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect parts against rust and corrosion.
- B. Store fixtures indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.

PART 2 PRODUCTS

2.01 WATER CLOSETS, URINALS, LAVATORIES, AND TRIM

- A. Fixtures based on American Standard. Fixtures by the following manufacturers of the same size, type, and meeting other requirements may be furnished at the contractor's option:
 - 1. Kohler
 - 2. Toto

- B. Flush valves and accessories based on "Royal" series as manufactured by Sloan. Flush valves by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Zurn Aquadventure series
 - 2. Toto

- C. Seats for Water Closets based on Bemis. All seats are to be furnished with self-sustaining check hinges. Seats by the following manufacturers of the same size, type, and meeting other requirements may be furnished at the contractor's option:
 - 1. Church
 - 2. Olsonite
 - 3. Beneke
 - 4. Centoco

- D. Fixture carriers based on Zurn. Fixture carriers by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Jay R. Smith
 - 2. Josam
 - 3. Wade
 - 4. Watts Drainage

- E. Faucets and accessories based on Chicago Faucets. All faucets provided to be furnished with ceramic disk cartridges. Faucets by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. American Standard
 - 2. Kohler
 - 3. Eljer
 - 4. Moen Commercial
 - 5. Sloan

6. Speakman
7. T & S Brass
8. Zurn

F. WATER CLOSETS

1. WC-1 (HANDICAP ACCESSIBLE)
 - a) Floor mounted, hard-wired sensor flush valve type, vitreous china fixture. Siphon jet action with water saver (1.28 gallon maximum consumption per flush) operation. Provide with elongated bowl, chrome plated trip lever and fixture finish escutcheons, white seat with extended back and open front, stainless steel hinge post with self-sustaining check operation and neoprene gasket fixture connector. Provide trap primer accessory at locations specified herein.
 - b) Equipment manufacturers and model numbers as follows:
 - 1) Water Closet - American Standard Flowise 3641.00
 - 2) Flush Valve - Sloan Royal 111 ESS
 - 3) Seat - Bemis 1655SS/C

G. LAVATORIES

1. LAV-1 (HANDICAP ACCESSIBLE)
 - a) Public access wall mounted mixing faucet type, vitreous china fixture. Provide with 4" centerset faucet deck, plug in sensor operated high arc faucet, aerator (maximum .5 gpm) and grid drain. Wall supplies for tempered water with loose key angle stops, flexible tube risers, wall escutcheons and connecting hardware. 1-1/4" cast brass P-tray with integral cleanout, 17 gauge 1-1/2" tailpiece, wall escutcheon and connecting hardware. Provide under-counter mounting hardware for installation in casework. Provide vandal-proof installation for all faucet components.
 - b) Overall size - 16-1/2" x 16-1/2" x 5-3/8".
 - c) Equipment manufacturers and model numbers as follows:
 - 1) Lavatory - American Standard Regalyn 4867.008
 - 2) Faucet - Sloan Optima ETF-600
 - 3) Drain - McQuire 155A

2.02 STAINLESS STEEL SINKS

- A. Stainless steel sinks and accessories based on Elkay. Sinks and accessories by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the Contractor's option:
1. Just
 2. Kohler
- B. Stainless steel sinks
1. S-1 (ADA accessible)
 - a) Single compartment countertop undermount sink. Sink with 18 gauge type 304 (18-8) stainless steel construction, self-rimming installation, faucet deck, basket strainer with 1-1/2" tailpiece and mounting hardware. Faucet with high arc swing spout, aerator (1.0 gpm maximum flow), concealed mixing assembly and two handle wrist blade operation. Provide 1-1/2" cast brass P-trap with cleanout, hot and cold water wall supplies with angle stops and flexible tube risers.
 - b) Compartment size - 22" x 19-1/2" x 5-1/2"
 - c) Equipment manufacturers and model numbers as follows:
 - 1) Sink - Elkay LRAD2219655
 - 2) Faucets - Chicago Faucets 895-317GN2AE3ABCP
 - 3) Strainer - Elkay LK99 strainer drain

2.03 SHOWERS

- A. Shower Control Valves and accessories based on American Standard. Shower Control Valves and accessories by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
1. Powers
 2. Lawler
 3. Leonard
 4. Chicago Faucet
- C. Showers
1. SH-1 (HANDICAP ACCESSIBLE)
 - a) Refer to architectural specifications for shower insert information.
 - b) Equipment manufacturers and model numbers as follows:
 - 1) Shower System Trim Kit - American Standard TU662.211

2.04 JANITOR'S RECEPTORS

- A. Janitor's receptors and faucets based on Fiat. Janitor's receptors and faucets by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the Contractor's option.
1. Williams
 2. Creative Industries
 3. Cutler
- B. JR-1
1. Floor mounted terrazzo mop basin with 6" drop front. Basin with stainless steel drain body and strainer, neoprene gasket connector, stainless steel caps and stainless steel wall guard on sides adjacent to walls. Faucet with hot and cold water inlet stops, wall brace, vacuum breaker, hose end connection, bucket hook, exposed mixing assembly and four-arm indexed handle operators. Provide 3" cast iron P-trap for underfloor installation.
 2. Overall size - 24" x 24" x 10" high.
 3. Equipment manufacturers and model numbers as follows:
 - a) Basin - Fiat MSB-2424
 - b) Faucet - Chicago 830-AA

PART 3 EXECUTION

- 3.01 Provide individual accessible stop valves on all fixture and equipment supply piping.
- 3.02 All exposed metal parts, accessories and fittings associated with plumbing fixtures (including piping) shall be chrome finished unless another finish is specifically indicated otherwise. Provide polished chrome plated brass escutcheons at all exposed piping structure penetrations (wall, floor, ceiling, etc.) and fixture connections.
- 3.03 Furnish fixture carriers where specified to suit wall construction as indicated on Architectural Drawings. Carriers to be anchored securely to floor.
- 3.04 Install all fixtures according to manufacturer's recommendations.
- 3.05 Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants".
- 3.06 Individual fixture connections sized as indicated in Section 22 11 16 Building Domestic Water System, unless directed otherwise.

- 3.07 Mounting heights of fixtures and associated equipment as indicated on drawings.
- 3.08 Install vandal resistant .5 gpm flow restrictors on all lavatory faucets in public access areas.
- 3.09 Provide insulation on supply (full range of hot and cold water) and drain piping exposed below handicap access lavatories. See Section 22 07 00 PLUMBING INSULATION for requirements.
- 3.10 At all countertop or other casework conditions, verify exact location and installation of all items with Architectural documentation before any work is performed. Coordinate installation with the General Contractor. Where plumbing fixtures are installed in casework and indicated to be "Handicap Accessible", coordinate installation with General Contractor to provide clearances and mounting heights as required.
- 3.11 Coordinate with the General Contractor where shower enclosures are furnished by the Plumbing Contractor with grab bars, seats, etc., to provide the required structural support for all items per the manufacturer's recommendations.
- 3.12 Where pre-fabricated shower units are provided, verify whether right hand or left hand installations are required from the Architectural Drawings and provide the proper quantities of each.
- 3.13 Set limit stops on all shower mixing valves for maximum 110 degree Fahrenheit supply to shower heads.
- 3.14 When floor drains DIRECTLY connected to the Sanitary Waste system are provided in toilet rooms, provide an individual trap primer accessory as specified herein for the flush valve assembly on an adjacent water closet fixture. Extend a 3/8" trap primer supply line below floor to the floor drain, in accordance with the manufacturer's recommendations, and the requirements of the inspection/approval authorities. Floor drains INDIRECTLY connected to the Sanitary Waste system do not require individual trap primers.

END OF SECTION 22 40 00

SECTION 23 01 00 - OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

- A. This Contractor shall thoroughly instruct and supervise the Owner's Maintenance Personnel in the proper operation and maintenance of the HVAC system equipment. This Contractor shall be responsible for arranging for the instruction and supervision at a time convenient to the Owner or their representative and for notifying the Construction Manager of the time at least 48 hours in advance. The Owner shall be permitted to video tape these training sessions.

Instructions shall include the following:

- 1. Location of equipment and explanation of what it does.
 - 2. Reference to "Operating Instruction Manuals" for record and clarity.
 - 3. Coordination of written and verbal instruction so that each is understood by all personnel.
 - 4. Explanation of Temperature Control System including panels.
 - 5. Specific maintenance to be performed by Owner.
- B. Furnish electronic copies of the printed Operating and Maintenance Instructions for the HVAC System for review. After final approval, provide electronic copies of Operation and Maintenance Instructions in PDF format for submittal to Owner. Instructions shall consist of the following items:
 - 1. Title Page: Title of Project, address, date of submittal, name and address of Contractor, name of Architect, name of Engineer.
 - 2. Second Page: Index of Manual Contents.
 - 3. First Section: A copy of each approved shop drawing and submittal with an index at the beginning of the section.
 - 4. Second Section: A list of all equipment used on the project, together with supplier's name and address.

5. Manufacturer's maintenance manuals for each item of equipment furnished under this contract. Manuals shall include such items as parts list, detailed lubrication instructions, procedures for performing normal maintenance functions, preliminary trouble shooting procedures and wiring diagrams.
 6. Complete wiring diagrams for the HVAC system as actually wired including control and interlock wiring.
 7. Brief but complete instructions for start-up, shut- down and routine maintenance of each system.
 8. Routine and 24-hour emergency information:
 - a. Name, address and telephone number of servicing agency.
 - b. Include names of personnel to be contacted for service arrangements.
- C. Temperature Control schematics and wiring diagrams shall be laminated with plastic and mounted inside or adjacent to each temperature control panel.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION 23 01 00

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer to Division 26 - Electrical, sections that apply to wiring, conduit, etc.

1.02 SUMMARY

- A. This section includes the following items:
 - 1. General requirements
 - 2. Drawings
 - 3. Permits and fees
 - 4. Ohio Energy Code
 - 5. Utilities
 - 6. Record documents
 - 7. Deliverable items
 - 8. Service and maintenance
 - 9. Coordination
 - 10. Supervision
 - 11. Unacceptable work and observation reports
 - 12. Final inspection
 - 13. Guarantee
 - 14. Sleeves and collars
 - 15. Firestopping
 - 16. Installation of piping
 - 17. Painting
 - 18. Lubrication
 - 19. Cutting and Patching
 - 20. Electrical Work
 - 21. Test and adjustments
 - 22. Manufacturer's drawings
 - 23. Protection and cleaning
 - 24. Substitutions

1.03 SCOPE

- A. Furnish all labor, materials, tools, incidentals and details necessary to provide a complete HVAC system, ready to operate, including but not limited to the items listed under the HVAC Specification Index.

1.04 GENERAL REQUIREMENTS

- A. Include any minor details essential to successful operation and any other items specified or shown on the Drawings.
- B. If the Contractor has any questions concerning the Plans and Specifications or notices any discrepancies or omissions in either Plans or Specifications, they shall feel free to contact the Engineer for clarification before Bids, to fully understand the extent and responsibilities of their work.
- C. The Contractor is required to visit the site and fully inform themselves concerning all conditions affecting the scope of their work. Failure to visit the site shall not relieve the Contractor from any responsibility in the performance of their Contract.
- D. Other than minor adjustments shall be submitted to the Construction Manager for approval before proceeding with the work.
- E. Scheduling of all work performed by this Contractor shall be completely coordinated with the Construction Manager.
- F. All material hoisting by trade involved.
- G. The Contractor, insofar as this Contract is concerned, shall at all times keep the premises and the building in a neat and orderly condition. This includes using a vacuum cleaner.
- H. At the completion of the project, this Contractor shall promptly clean up and remove from the site, all debris and excess materials.

1.05 DRAWINGS

- A. Consult all Contract Drawings which may affect the locations of any equipment, apparatus, piping and ductwork and make minor adjustments in location to secure coordination.
- B. Piping and duct layout is schematic and exact locations shall be determined by structural and other conditions and verified in the field. This shall not be construed to mean that the design of the system may be changed, it refers only to the exact location of piping and ductwork to fit into the building as constructed, and to coordination of all work with piping and equipment included under other Divisions of the Specifications.
- C. The layout shown on the Drawings is based on a particular make of equipment. If another make of equipment is used which requires modifications or changes of any description from the Drawings or Specifications, this Contractor shall be responsible for making all such modifications and changes, including those involving other trades, as a part of this Contract and the cost thereof shall be included in their Bid. In such case, the Contractor shall submit Drawings and Specifications showing all such modifications and changes prior to starting work, which shall be subject to the approval of the Construction Manager.

- D. The Construction Manager reserves the right to make minor changes in the location of piping and equipment up to the time of rough-in without additional cost to the Owner.
- E. Where certain grades and/or elevations are given on the Drawings, they have been obtained from the best information available; however, they are not guaranteed. This Contractor **MUST** assume the full responsibility of verifying present elevations in the field and making any adjustments as may be necessary, all of which must be included in their Bid Price.
- F. Due to the scale of the Drawings, it is impossible to show all offsets and transitions which may be required. This Contractor shall carefully investigate the conditions affecting all work and shall furnish all elbows, fittings, transitions, etc., required to accomplish the desired result at no additional cost to the Owner.
- G. Install all work as close as possible to walls, structural, members, etc., consistent with the proper space for covering, access, etc., so as to occupy the minimum of space and allow as much space as possible between ductwork, piping, etc. and the ceiling.
- H. Actual dimensions shown on the Drawings and field dimensions shall take precedence over scaled dimensions.
- I. Working Clearances: At least 6'-6" clear headroom must be maintained in front of all electrical equipment. Provide at least 3'-6" for 480/277 volt and 3'-0" for 208/120 volt clear space in front of all electrical equipment as wide as the equipment with a minimum of 2'-6" wide. The same clearance shall be required at the rear of rear access equipment.

1.06 PERMITS AND FEES

- A. This Contractor shall file all Drawings, pay all necessary charges and fees, and obtain all necessary permits and certificates of inspection relative to their work.
- B. Submit Qualification Certificate for each welder to the Construction Manager before such welder starts work.
- C. Completed installations shall conform with all applicable Federal, State and Local Laws, Codes and Ordinances, including but not limited to the latest editions of the following:
 - 1. Ohio Building Code.
 - 2. A.S.M.E. Pressure Piping Code - Section B31.1
 - 3. A.S.M.E. Boiler and Pressure Vessel Code - Section I - Power Boilers, Section IV - Heating Boilers, Section VIII - Unfired Pressure Vessels.
 - 4. Rules and Regulations for Fuel Burning Equipment and Equipment Pertaining Thereto, The Office of Pollution Control, Ohio Environmental Protection Agency.

5. National Electrical Code, Bulletin No. 70, National Fire Protection Association.
 6. Air Conditioning and Ventilating, Bulletin No. 90 A, National Fire Protection Association.
 7. Life Safety Code, Bulletin No. 101, National Fire Protection Association.
 8. Local Building Code.
- D. Nothing contained in the Plans and Specifications shall be construed to conflict with these laws, codes and ordinances and they are hereby made a part of these Specifications.

1.07 OHIO ENERGY CODE

- A. The HVAC System must comply with all requirements of the State of Ohio "Code for Energy Conservation". This includes, but is not limited to, efficiencies, power factors, insulation thickness, etc.
- B. All motors 1 HP or more shall be "premium efficient" motors meeting all requirements of ASHRAE Standard 90.1 – 2019 and latest version of EPC Act by the federal government.

1.08 UTILITIES

- A. The Contractor shall investigate and locate all utilities prior to construction.
- B. Each Contractor is responsible for rerouting or replacing existing utilities where necessary to permit installation of their work.
- C. The identity and location of the existing underground utility facilities known to be located in the construction area have been shown on the plans as accurately as provided by the Owner of the underground utility. The Architect and/or Engineer assumes no responsibility as to the accuracy or the depths of the underground facilities shown on the plans.
- D. Support, protection and restoration of all existing utilities and appurtenances shall be the responsibility of the Contractor. The cost of this work shall be included in the price bid for the various items.
- E. The Contractor shall cause notice to be given to the Ohio Utilities Protection Service (telephone 800-362-2764 - toll- free) and to the Owners of underground utility facilities shown on the plans who are not members of a registered underground protection service in accordance with Section 153.64 of the Revised Code. The above mentioned notice shall be given at least 48 hours, excluding Saturdays, Sundays and legal holidays, prior to commencing work.

- F. The Contractor shall alert immediately the occupants of nearby premises as to any emergency that they may create or discover on or near such premises of the underground facility, any break or leak on its lines or any dent, gouge, groove or other damage.

1.09 RECORD DOCUMENTS

- A. Maintain at the site, one copy of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders and other modifications, in good order. The Drawings shall be marked to record all changes made during construction especially deviations made necessary to incorporate equipment different from base equipment specified. These shall be available to the Owner's Representative. The Drawings marked to record all changes made during construction shall be delivered to the Owner's Representative for the Owner upon completion of the work. Loose sheets or details will not be accepted. Only full sized drawing sheets shall be submitted. An additional set of Drawings will be furnished by the Construction Manager for this purpose upon request.
- B. At the completion of project and before final approval, make any final corrections to Drawings and certify to the accuracy of each print by signature and deliver same to Construction Manager.
- C. Furnish electronic copies of final sheet metal shop drawings in PDF format to the Construction Manager for review.
- D. All pressure tests shall be documented by the Contractor to confirm that the piping and high pressure duct systems have been tested properly and completely. All tests shall be witnessed and signed by the Construction Manager. Electronic copies of this final test document shall be furnished to the Construction Manager for review.

1.10 DELIVERABLE ITEMS

- A. Refer to the specifications for tools, filters, equipment, spare parts, etc. to be provided by the Contractor. Deliverable items to be provided to the Construction Manager.

1.11 SERVICE AND MAINTENANCE

- A. Refer to specifications for maintenance requirements after completion of work but as part of this contract.

1.12 COORDINATION

- A. The Contractor is required to read the Specifications covering all branches of the work and will be held responsible for coordination of their work with work performed under all other Contracts.

1.13 SUPERVISION

- A. This Contractor shall have in charge of the work, on the job as required, during construction, a competent superintendent experienced in the work installed under this Contract.

1.14 UNACCEPTABLE WORK AND OBSERVATION REPORTS

- A. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.
- B. The Contractor shall promptly correct all work found unacceptable by the Engineer whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such unacceptable work, including compensation for the Engineer's additional services made necessary thereby.
- C. During the course of construction, the Engineer will prepare "Observation Reports" with a list of items found to be in need of correction. All items listed shall be corrected by the Contractor. A space is provided on the form for the Contractor to note the completion of each item. All prior "Observation Report" items must be completed, the lists signed and returned to the Engineer prior to making the final inspection. After the final list is issued, the same procedure will apply.

1.15 FINAL INSPECTION

- A. When the Contractor determines all work is completed and working properly per the Contract Documents, they shall request a "final" inspection by the Construction Manager in writing. If more than one reinspection is required after this final inspection, the Contractor shall bear all additional costs including compensation for the Engineer's additional services made necessary thereby. A final inspection will not be made until Operating and Maintenance Manuals and Air and Water Balance Reports are submitted and approved and all prior "Observation Report" punch lists completed, signed and returned to the Engineer.

1.16 GUARANTEE

- A. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after approval of the Certificate of Contract Completion.

1.17 SLEEVES AND COLLARS

- A. This Contractor shall furnish sleeves and collars for their work to the General Contractor, who installs where directed by this Contractor. Coordinate carefully.

1.18 FIRESTOPPING

- A. Each Contractor shall be responsible for firestopping around all openings for pipes, ducts, conduits, etc., installed by them at all fire walls and smoke walls. Firestopping shall be performed by an installer who has been trained by manufacturer, or manufacturer's representative, in the installation procedures based on published UL tested fire stop systems.

- B. This contractor shall provide firestopping details for all types of penetrations to be utilized on the project and provide details to the Construction Manager.
- C. Quality assurance
 - 1. Conform to applicable governing codes:
 - a. Ohio Building Code (OBC).
 - b. NFPA 101 - Life Safety Code.
 - c. NFPA 70 - National Electrical Code.
 - 2. Meet requirements of ASTM E-814 or UL 1479 Fire Tests by recognized testing agency.
 - 3. Obtain firestop materials for each different system from a single manufacturer.
- D. Sequencing
 - 1. Coordinate work so firestopping materials are installed before the areas involved are concealed by drywall and other finish work.

1.19 INSTALLATION OF PIPING

- A. Refer to Part 3 – Execution, for general piping installation requirements that apply to all interior piping systems installed under this Contract, except where otherwise noted on the Drawings or elsewhere in the Specifications.

1.20 PAINTING

- A. All unpainted steel in exposed areas (not including Mechanical Equipment Rooms) including piping, hangers, ironwork, etc., installed by the HVAC Contractor shall be cleaned of oil and other debris by the HVAC Contractor in preparation for painting by the General Contractor. If preparation is determined to be unsatisfactory, additional cleaning required by the General Contractor shall be paid for by the HVAC Contractor.
- B. All steel supports shall have minimum one (1) coat of metal primer after fabrication.
- C. Factory finished equipment which has rusted or been damaged shall be cleaned at the completion of the project and rust spots and marred areas shall be refinished and restored to the original factory finish.

1.21 LUBRICATION

- A. All equipment shall be lubricated with correct grade, type, and quantity of lubrication before being placed in service.
- B. Damages caused by neglecting to provide proper lubrication will be repaired at this Contractor's expense.

- C. Maintain all lubrication and packing seals during construction, and assure that at the time of final acceptance, all equipment is operating properly.

1.22 CUTTING AND PATCHING

- A. Refer to Division 01 – General Requirements for cutting and patching.
- B. Avoid cutting of concrete, masonry and other new work by the use of inserts and sleeves.
- C. Cutting for openings, when necessary, shall be done by this Contractor with such tools and methods as to prevent unnecessary damage to surrounding areas or equipment.
- D. The corners of all openings in poured concrete shall be core drilled to minimize overcutting.
- E. This Contractor shall give the General Contractor locations and sizes of all openings required for the installation of equipment (other than piping openings), before walls, etc., are started. If it becomes necessary to cut into new work because of the failure of this Contractor to notify the General Contractor, then the General Contractor shall do any necessary cutting and patching at this Contractor's expense.
- F. Fill space in all areas where core drilled with packing where required to maintain fire rating. Openings shall be temporarily fire-stopped until permanent fire stopping is done. This includes holes left due to removal of piping.
- G. Patching shall match existing surfaces in kind and finish, and shall be done by the General Contractor at this Contractor's expense.
- H. No structural member will be cut into without the expressed permission of the Construction Manager.

1.23 ELECTRICAL WORK

- A. **WORK INCLUDED - THIS CONTRACTOR**
 - 1. Furnish to the Electrical Contractor information, drawings, schedules, locations of rough-ins, electric loads, sizes and characteristics for motors and equipment furnished by this Contractor requiring electric services. "Stock" wiring diagrams are not acceptable.
 - 2. Starters which are specified to be provided as a part of the HVAC equipment shall be furnished by this Contractor. Equipment shall be provided with protection devices against voltage and current unbalance and single phasing. Wiring by the Electrical Contractor.
 - 3. All alarm, control or interlocking wiring for motors and equipment furnished by this Contractor unless otherwise specified.

4. 120 volt wiring required for equipment furnished by this Contractor when not shown or specified elsewhere.
5. All interconnecting control wiring between temperature control panels and control devices shall be the responsibility of the Temperature Control Subcontractor.

B. WORK INCLUDED - ELECTRICAL CONTRACTOR

1. Electrical Contractor shall provide all power services for motors and equipment furnished by other contractors, including safety disconnect switches (unless specified with HVAC equipment), if required by code, and final connection to motors and equipment.
2. All starters installed in motor control centers and loose starters shall be provided by the Electrical Contractor and shall be as specified in Division 26 except where specifically specified to be furnished with certain HVAC equipment.
3. For all miscellaneous devices which require 120V power for fans and thermostats (projection unit heaters, cabinet unit heaters, etc.), the Electrical Contractor shall wire through the line voltage thermostat provided and mounted by the Temperature Control Subcontractor to control the unit fan.

C. TEMPERATURE CONTROL WIRING RESPONSIBILITY

1. Electrical Contractor to include the following:
 - a. Wiring of devices used for control or operation of mechanical equipment and wired in series or parallel with the control circuit of motor controller to extent shown on the Electrical Drawings. These devices will normally include but not be limited to E.P. switches, high and low limit thermostats, relays, contacts, fire alarm contacts, emergency power off (EPO) switches, etc.
 - b. Necessary wiring between temperature control panels and motor controllers, to extent shown on the Electrical Drawings. Final termination of the wiring inside the temperature control cabinets by the Temperature Control Subcontractor.
 - c. Electrical Contractor shall provide 120 volt power to a wired junction box near each Temperature Control Cabinet or panel. Final connections to be made by the Temperature Control Subcontractor.
 - d. Electrical Contractor shall provide 120 volt junction box(es) as shown on the Drawings for power to the terminal box controllers. All required transformers and wiring to terminal boxes by the Temperature Control Subcontractor.

- e. Necessary wiring between heating devices and 120V line voltage thermostats. Thermostats furnished by Temperature Control Subcontractor.
- 2. Temperature Control Subcontractor wiring to include the following:
 - a. Wiring of devices provided by the HVAC Contractor or the Temperature Control Subcontractor and wired in series or parallel with the control circuit of the motor controller to the extent shown on the control diagrams on the Electrical Drawings. These devices will normally include but not be limited to flow switches, low limit thermostats, DDC contacts, etc.
 - b. Changes from or additions to wiring shown on the Electrical Drawings which are required by the HVAC Specifications to provide a complete and workable temperature control system.
 - c. On all miscellaneous devices which require 120V line voltage thermostats (projection unit heaters, cabinet unit heaters, etc.), the Temperature Control Subcontractor shall provide and mount the thermostat as shown on the Drawings. Wiring by the Electrical Contractor.
 - d. Temperature Control Subcontractor to furnish a complete set of approved shop drawings to Electrical Contractor prior to system installation. Drawings shall include terminal designations on control items and equipment. Wiring diagrams to be compatible with those shown on the Electrical Drawings (Construction Documents).
 - e. All equipment and wiring furnished by the Temperature Control Subcontractor shall meet the requirements of Division 26.
 - f. All wiring to sensors, etc., which are part of the DDC control system and not shown on any of the Electrical Control Diagrams, shall be by the Temperature Control Subcontractor.
 - g. Power wiring from 120V junction boxes to terminal box controllers and all transformers shall be by the Temperature Control Subcontractor.
 - h. All terminations inside of Temperature Control Panels shall be by the Temperature Control Subcontractor.

1.24 TESTS AND ADJUSTMENTS

- A. After work has been completed but before pipe covering has been applied, the Contractor shall test and adjust the systems they have installed.

- B. The Construction Manager shall be notified of all scheduled tests at least 48 hours before they are scheduled so that they may witness same. If the Contractor performs any test without the Construction Manager present or without properly notifying the Construction Manager the Contractor will be required to perform the test a second time in the presence of the Construction Manager.
- C. If the Construction Manager determines that any work requires special inspection, testing, or approval, they will, upon written authorization from the Owner, instruct the Contractor to order such special inspection, testing or approval. The Contractor shall give timely notice so the Construction Manager may observe the inspections, tests or approvals. If such special inspection or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Construction Manager's additional services made necessary by such failure; otherwise the Owner shall bear such costs, and an appropriate Change Order shall be issued.
- D. Concealed lines shall be tested before being concealed. If this is not done and a leak appears during the final test, this Contractor shall repair leak and all damage resulting there from.
- E. This Contractor shall adjust all equipment in the HVAC system to obtain proper operation and shall demonstrate to the Owner and Construction Manager that the entire system will function properly.

1.25 MANUFACTURER'S DRAWINGS

- A. The Contractor shall submit to the Construction Manager for review, within six weeks after date of contract, electronic copies in PDF format per Division 01 of manufacturer's drawings, wiring diagrams, pump and fan curves or data. The Engineer will review Contractor's shop drawings and related submittals (as indicated below) with respect to the ability of the detailed work, when complete, to be a properly functioning integral element of the overall system designed by the Engineer. Before submitting a shop drawing or any related material to the Engineer, Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of Contractor; approve each such submission before submitting it; and so stamp each such submission before submitting it. The Engineer shall assume that no shop drawing or related submittal comprises a variation unless Contractor advises Engineer otherwise via a written instrument which is acknowledged by Engineer in writing. The shop drawings and related material (if any) called for are indicated in the appropriate specification section.
- B. The Engineer shall return shop drawings and related materials with comments provided that each submission has been called for and is stamped by Contractor as indicated above. The Engineer shall return without comment material not called for or which has not been approved by the Contractor.

- C. This Contractor shall furnish equipment shop drawings which will indicate power hook up and control connections as required for mechanical equipment. “Stock” wiring diagrams are NOT ACCEPTABLE.
- D. The manufacturer shall provide a statement on submittals that equipment furnished complies with the Ohio Energy Code. This previously relates to premium efficiency motors, EER’s, COP’s, etc. If this is not done, submittals will be rejected.
- E. This Contractor is to provide 1/4” scale sheetmetal drawings in electronic format for use in coordinating work of Plumbing, Fire Protection, HVAC piping and Electrical with layout of air distribution systems and related work. Drawings shall be created in AutoCAD, Revit, or other format as determined by the Construction Manager. Lighting, ceiling grid and ceiling access doors shall be shown lightly to verify coordination. HVAC Contractor to provide initial drawings within 60 days of award of contract. Each Prime Contractor is responsible for overlaying their work on these drawings; for providing information as to size, elevation and location proposed for all components; and for coordination of their work with that of other Contractors. Final resolution of all items to be determined at project meetings held by Construction Manager.

Refer to Section 23 31 13 “Metal Ducts” for additional requirements associated with sheet metal shop drawings.
- F. Engineer's review of manufacturer's drawings or schedules shall not relieve the Contractor from compliance with the requirements of the plans and specifications.
- G. Items may be referred to in singular or plural on Plans and Specifications. Contractor is responsible for determining quantity of each item.

1.26 PROTECTION AND CLEANING

- A. Protect all equipment against damage from any cause whatsoever and pay the cost of replacing and repairing equipment made necessary by failure to provide suitable protection.
- B. After all piping, equipment and ductwork has been approved and after all plastering has been completed, bare piping and insulation provided under this Contract shall be thoroughly cleaned of dirt, grease, rust and oil, and primed (where necessary), ready for painting.
- C. Repair all dents and scratches in factory prime or finish coats on all equipment to the satisfaction of the Construction Manager. If damage is excessive, replacement may be required.
- D. Ductwork and air handling equipment shall have all openings sealed closed during transportation, storage and construction to keep construction dust out.
- E. All materials shall be stored so as to be protected from the weather.

- F. Cover all motors, pumps, open pipes, etc., to keep out dirt, water and weather during construction.
- G. This Contractor shall clean up and remove all debris from the site and shall at all times keep the premises in a neat and orderly condition.

1.27 SUBSTITUTIONS

- A. The Base Bid shall be based on equipment as specified. Where items are mentioned thusly, "may be furnished at the Contractor's option", the Contractor may use any one of the items named for their Base Bid. Proposals for substitutions are welcomed, but must be noted separately from the Base Bid and applied for in writing at Bid submittal.
- B. Where the Contractor furnishes equipment or material specified as equal or which is accepted as a substitution, they are responsible for all modifications required for their work, and work of all other trades to install the equipment and insure performance as originally specified.
- C. Equipment and materials furnished as equal or as a substitution must be equal in quality, design, features, performances, arrangement, and appearance to that specified as standard.

PART 2 PRODUCTS

2.01 SLEEVES

- A. Sleeve material: black steel pipe, machine cut, large enough to allow proper clearance (1/4" minimum, 3/4" for fire stopping) all around pipe (around pipe covering on chilled water, makeup water and high pressure steam), except use machine cut copper sleeves for uninsulated copper pipe.
- B. Foundation sleeves: Install cast-iron sleeve with water stop and mechanical sleeve seal (similar to Link Seal) at each pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.
- C. The Contractor has the option on sleeves passing through fire rated walls or floors to use Pipe Shields, Inc. Wall Fire Barrier Model WFB- CS-CW. The sleeve body to be adjustable and made of 26 gauge galvanized sheet metal. Annular space packed on both ends with neoprene coated rope. If pipe is insulated, provide water proofed calcium silicate insert to match thickness of specified insulation, extending 1" beyond sleeve.

2.02 FIRESTOPPING

- A. Acceptable manufacturer's products
 - 1. Penetration sealants:
 - a. Dow Corning "Firestop Foam" and "Firestop Sealant".
 - b. 3M Brand "Fire Barrier" Caulk.
 - c. 3M Brand Moldable Putty "Pads" and Moldable Putty "Stix".

- d. Hilti FS One.
 - e. Metacaulk Series 835, 880, 910 and 950.
- 2. Intumescent sealants for use at openings and sleeves involving plastic pipe, insulated pipe or flexible cable:
 - a. Dow Corning "Firestop Intumescent Wrap Strip".
 - b. Fox Coupling, Inc. "Cast-In-Place Firestop Coupling".
 - c. 3M Brand "Fire Barrier" Caulk or Putty with FS-195 Wrap Strip and or CS-195 Composite Sheet.
 - d. Hilti FS One.
 - e. Hilti CP-642 and CP-643 Firestop Collar.
 - f. Metacaulk Series 880 and 950.

B. MATERIAL REQUIREMENTS

- 1. Flame (F) rating minimum one hour but not less than fire resistance rating of assembly in which installed, per ASTM E- 814.
- 2. Maintain effective barrier against flame, smoke, water and hot gases per ASTM E-814 and UL 1479.
- 3. Suitable for firestopping of penetrations by steel, glass, plastic, and insulated pipe, flexible cable, buss duct and cable tray.
- 4. Non-asbestos.

2.03 PAINTING

- A. Paint shall meet requirements of Division 09 - Finishes

2.04 LUBRICATION

- A. Follow Manufacturer's recommendations for specific lubricants.

2.05 ELECTRICAL WORK

- A. Refer to Division 26 - ELECTRICAL. Refer to Section 23 05 13 "Common Motor Requirements for HVAC Equipment" for more detailed motor requirements.
- B. All motors 1/2 HP and larger shall be three phase; all motors, 1/3 HP and smaller shall be single phase unless specified otherwise.
- C. All single-phase motors provided by this Contractor to have built-in thermal overload protection.
- D. Motor starters, contactors, and disconnects are provided and installed by the Electrical Contractor, unless part of packaged equipment furnished by this Contractor, or otherwise specified.

- E. All motors 1 HP or more shall be “premium efficient” motors meeting all requirements of ASHRAE Standard 90.1 – 2010 and latest version of EPA Act by the federal government.

PART 3 EXECUTION

3.01 SLEEVES AND COLLARS

- A. Sleeves shall be provided through all new masonry construction. Sleeves are not required if holes are core drilled through existing walls unless required to maintain fire rating.
- B. Sleeves in partitions to have length equal to the thickness of finished partitions. Sleeves in floors of finished areas to project 1/8" above finished floor. Sleeves in floors of non-finished areas to project 3" above finished floor. Fill space between pipe and sleeves into exposed areas with sealing compound. Ream all sleeves before installing.
- C. Sleeves in floors of all Mechanical/Electrical Rooms receiving a membrane floor to project 6" above floor to receive the membrane base.
- D. Where pipes pass through fire rated walls or floors, the space between the pipe and sleeve shall be fire stopped to maintain fire integrity.
- E. Sleeves to be set in forms before concrete is poured and in partitions at the time same are being built.
- F. In exposed location, other than in Mechanical Equipment Rooms, bare pipe or insulated pipe shall be provided with chromium plated collars at floor, ceiling, and at partitions.
- G. Cutting required of any masonry wall or floor after it is in place shall be done by core drilling.
- H. Piping not allowed to bear on sleeves.
- I. Sleeves shall be installed plumb and true to line, grade, and position.
- J. Unused sleeves shall be plugged and finished to match adjacent surface.

3.02 SEALING AROUND PIPE OPENINGS

- A. The openings around all pipes that penetrate full height walls (defined as walls that extend from the floor to the structure above) unless otherwise required to be firestopped shall be sealed to maintain the acoustic integrity of the wall. This applies to all full height walls regardless of whether the wall has a fire rating.

- B. Gaps less than 1/2" between the pipe and the wall opening or sleeve shall be packed with batt insulation and the exposure caulked on both sides of the wall.
- C. Gaps 1/2" and larger between the pipe and the wall opening or sleeve shall be packed with batt insulation and a sheetmetal collar installed around the entire pipe on both sides of the wall. The sheetmetal collar shall extend from the surface of the pipe to a minimum 2" on the wall and be secured to the wall.

3.03 FIRESTOPPING

- A. Examination
 - 1. Examine surfaces to receive penetration sealant or foam and report unacceptable conditions before starting firestopping work.
 - 2. Verify that penetration holes are approximately 1-1/2" larger diameter than the penetrating element to allow space for wrap strip. Firestopping systems installed external to the opening with a collar to hold in place are acceptable.
 - 3. Start of work indicates acceptance of sizing of holes and application conditions.
- B. Penetration
 - 1. Clean penetration holes of dirt, loose materials, and foreign matter which may affect bond or installation.
 - 2. Remove coatings such as paint, curing compounds, water repellent, sealers, as required.
 - 3. Install backing materials to prevent liquid material leakage.
- C. Application
 - 1. Prepare and apply penetration sealing systems in accordance with manufacturer's printed instructions.
 - 2. Employ installation techniques which will ensure that firestopping is deposited to fill and seal holes and openings.
 - a. Provide Flame (F) rating minimum one hour but not less than fire resistance rating of assembly in which installed.
 - b. Ensure effective smoke seal and water seal.
 - 3. Tool exposed surfaces of applied sealant to smooth finish.
 - 4. Protect materials from damage on surfaces subjected to traffic.

- D. Field quality control
 - 1. Examine sealed penetrations to ensure proper installation before concealing or enclosing areas.
 - 2. Keep areas of work accessible until inspection by applicable code authorities.
- E. Clean-up
 - 1. Clean surfaces adjacent to sealed joints free of excess sealant and soiling from this work as work progresses, using solvent or cleaning agent recommended in writing by the sealant manufacturer.
 - 2. Leave finished work in neat, clean condition.

3.04 INSTALLATION OF PIPING

- A. Make proper connections to all items of equipment in the Contract as recommended by the Manufacturer or as detailed on the Drawings.
- B. All piping shall be arranged in accordance with the best standards of the trade with vertical pipes plumb and horizontal runs parallel or perpendicular to the building wall.
- C. Provide valves and specialties where indicated on the Drawings.
- D. Provide 3/4" drain valves in piping at low points to provide complete drainage of all systems and as shown on the Drawings.
- E. Ream ends of pipe and clean before installing.
- F. Copper joints: Copper piping in HVAC systems less than 2 inches shall be soldered using 95/5 tin/antimony solder. Copper piping in HVAC systems 2 inches and larger shall be brazed using a 6 percent silver alloy with a 1000°F solidus minimum. For solder to threaded adapter nipples, the contractor shall use either a 95/5 tin/copper solder similar to "Taramet Sterling" or a 96/4 tin/silver solder similar to "Tarasil 964" in lieu of brazing.
- G. Use pipe dope on male threads of screwed pipe only. Teflon pipe joint tape may be used at the Contractor's option.
- H. Make all changes of direction with fittings, rather than bending.
- I. Flanged joints shall be faced true and square. Flanges shall be same face style as mating surface to which it is connected.
- J. All valves and unions to be installed so as to be accessible through ceiling, access panels, etc.

- K. Provide dielectric unions or insulating flanges between dissimilar metals, i.e., copper to steel. In closed loop HVAC systems which have provisions for regular water treatment and little or no make-up water, bronze valves can serve as the dielectric.
- L. Where pipe drops occur in block walls, pipes to enter and leave walls at block joints. Coordinate with General Contractor.
- M. Install galvanized sheet metal troughs with drains under pipes crossing electrical equipment. Seal to make water tight.
- N. At the end of each day's work and otherwise as required or directed, provide caps and/or plugs at all openings in piping for protection. Particular attention must be given to avoid the possibility of any foreign materials entering the pipes, whether it be inadvertent or with malicious intent.

3.05 LUBRICATION

- A. Each shaft or valve stem containing a packing gland shall be checked for condition, and examined for proper packing.
- B. When filling systems initially for hydrostatic pressure tests, adjust valve packing glands to finger tight, allow packing to absorb water for five (5) minutes prior to tightening packing nuts.

3.06 ELECTRICAL WORK

- A. All wiring, conduits, etc., shall be in strict accordance with the requirements of the latest edition of the National Electrical Code and Division 26, Electrical specification.
- B. All wiring, including low voltage wiring, shall be run in conduit.
- C. Low voltage wiring may be size and type recommended by the Manufacturer and/or Temperature Control Subcontractor.

3.06 ELECTRICAL WORK

- A. All low voltage temperature control wiring in mechanical rooms (boiler room and air handling unit room) and outside of the building shall be run in EMT conduit. Conduit and junction boxes shall be labeled as being for the temperature control system.
- B. All low voltage temperature control wiring in concealed locations (above ceilings, in walls, etc.) shall be run in plenum rated cable. Cable shall be properly supported and shall not lay on the ceiling grid. Cable shall be identified at least once every 20 feet and at least once in each room as being for the temperature control system.

- C. All status and control wiring at line voltage power, (Class I circuits) must run in EMT conduit or flexible metal conduit. All Class I wiring shall be copper, THHN, 14 gauge AWG with 600 volt minimum isolation class insulation. Power and Class I 120 volt control circuits may not run together with Class II or III data transmission or signal circuits. Where different wiring classes terminate per NEC requirements, all control system wiring shall be labeled with control system logical point name. These point names shall be exactly as shown on control drawings, digital controller, sensor, actuator device terminal connectors and on "As-Built" drawings exactly as installed.
- D. All wiring, conduits, etc., shall be in strict accordance with the requirements of the latest edition of the National Electrical Code.
- E. Low voltage wiring may be size and type recommended by the Temperature Control Subcontractor.

3.07 TEST AND ADJUSTMENTS

- A. After refrigerant piping system is completed, it shall be thoroughly tested for leaks. Inert gas at 250 psig may be used for initial test. After system is tight, all inert gas shall be evacuated. Full refrigerant charge for proper operation shall be furnished and placed in the system by this Contractor. System shall be leak tested with Halogen Leak Detector after installation of refrigerant. All defective materials shall be replaced.
- B. All dampers, damper operators and motor operated valves shall be checked and adjusted for proper operation and travel.
- C. Before turning job over to Owner, inspect all valves and repack valves as necessary.
- D. This Contractor shall adjust all equipment in the HVAC system to obtain proper operation and shall demonstrate to the Owner and Construction Manager that the entire system will function properly.

END OF SECTION 23 05 00

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SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- B. Related sections include the following:
 - 1. Section 23 05 00 "Common Work Results for HVAC" for pressure testing of piping systems.

1.03 SCOPE

- A. This Contractor shall procure the services of an independent company which specializes in the testing and balancing of air and water systems. All balancing work shall be done under the direct supervision of a qualified Heating and Ventilating Engineer. It shall be the responsibility of this Contractor to make all necessary arrangements with the Balancing Company for balancing the air and water systems after all equipment, ductwork, outlets, piping and accessories have been installed. A detailed report on all balancing work shall be prepared and submitted, in triplicate, to the Construction Manager for review. Each copy of the report shall be dated, signed by the supervising Engineer of the Balancing Company and bound in a suitable cover. The Balancing Company shall be selected by the Contractor from the following qualified firms:
 - 1. Any member of the Associated Air Balance Council (AABC)
- B. The Temperature Control Contractor shall confirm the system is fully functioning. Refer to 23 09 00 "Instrumentation and Control for HVAC" for more detailed requirements.

1.04 SUBMITTALS

- A. Provide the following:
 - 1. Test and Balance Report

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

- 3.01 Balancing procedures and report to be in accordance with procedures set forth by the Associated Air Balance Council. Report shall also include fan and pump curves for all equipment.
- 3.02 Where Pete's Plugs are installed, report shall include pressure drop readings across coils, control valves (Cv), etc., to confirm flow rates. Where flow meters are provided, they shall be used to confirm flow rates. Where automatic balancing valves are installed, pressure drop readings across control valves (Cv), coils, etc. shall be read to confirm flow rates.
- 3.03 Balance reports shall include starter element sizes, voltage and amperage ratings for each motor. If starter elements amperage rating is more than 10 percent greater or less than motor nameplate amperage, this Contractor shall inform the Electrical Contractor to furnish and install proper size elements. Balance report shall include the corrected proper size starter element sizes and amperage ratings. 3 phase motors shall have voltage and amperage of all phases recorded.
- 3.04 Air quantities at individual registers or diffusers shall be adjusted to within 10% of quantities shown on the Drawings and total air quantity handled by each system to within 5% of the quantity shown or specified.
- 3.05 This Contractor shall provide all necessary sheave and belt changes as required by the Balancing Subcontractor to obtain air quantities as shown or specified.
- 3.06 Balance Subcontractor shall report by letter to the Engineer on preliminary results of balancing before the final balance report is prepared. This report shall include any problems encountered during balancing or major deviations from specified conditions.
- 3.07 If required, a meeting shall be arranged between this Contractor, the Balance Subcontractor and the Engineer to resolve any problems or deviations from the Contract Drawings and Specifications before the final balance work is completed and final report is submitted for review by the Engineer.
- 3.08 This Contractor shall adjust all equipment in the HVAC system to obtain proper operation and shall demonstrate to the Owner and Engineer that the entire system will function properly.

END OF SECTION 23 05 93

SECTION 23 07 00 - HVAC INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Extent of Work - Insulate pipes and other surfaces as follows:

Refrigerant Piping
Condensation Drain Piping
Supply, Return, and Exhaust Air Ducts

- B. Related sections include the following:

- 1. Section 23 31 13 "Metal Ducts" for duct liners.

1.03 SUBMITTALS

- A. Not Required

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. Store insulation on site in dry location. Cover insulation to protect from moisture.

1.06 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.01 INSULATION (Except Elastomeric)

- A. All insulation cover, except elastomeric, based on Johns Manville. Insulation cover by the following manufacturer's of the same type, thickness and conductivity meeting all other requirements may be furnished at the Contractor's option.
 - 1. Owens Corning
 - 2. Knauf
 - 3. CertainTeed
 - 4. Manson
- B. Pipe insulation shall be Johns Manville "Micro-Lok" AP-T glass fiber insulation rated for 850°F with factory applied AP-T all purpose, self-sealing vapor barrier jacket. Butt strips shall be minimum 3" wide of same material as jacket.
- C. Duct insulation shall be Johns Manville blanket flexible type or rigid type as noted with FSK glass fiber reinforced foil faced flame resistant kraft paper vapor barrier facing.

2.02 ELASTOMERIC INSULATION

- A. All elastomeric cover based on Armacell. Elastomeric cover by the following manufacturer's of the same type, thickness and conductivity meeting all other requirements may be furnished at the Contractor's option.
 - 1. Aerotube
 - 2. Halstead
 - 3. Imcoa
 - 4. Rubatex
- B. Elastomeric pipe insulation shall be 25/50 rated flexible closed cell, Armaflex AP rated for -40°F to 220°F.

- 2.03 All cements, adhesives, finishes, etc based on Foster. Cements, adhesives, finishes, etc. by the following manufacturer's of the same type, thickness and conductivity meeting all other requirements may be furnished at the Contractor's option.
1. Childers
 2. Vimasco
- 2.04 All insulating materials, including jackets, cements, adhesives, vapor barriers, etc. shall be U.L. listed with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50 per ASTM E84. All exterior finishes shall have a minimum service temperature limit (FSTM 70) of minus 50°F to 220°F.
- 2.05 Molded plastic fitting covers shall be U.L. approved with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50.

PART 3 EXECUTION

- 3.01 Provide pre-insulated refrigerant line sets by split system air conditioner manufacturer.
- 3.02 Cover all supply, return air, and exhaust air ducts (10 ft. from exhaust fan) as follows:
- A. All supply air ducts shall be insulated with 2" thick, 1 lb. density blanket flexible duct insulation.
 - B. Adhere insulation to duct surface with Foster No. 85-20/85-60 adhesive applied in 6" wide strips on 12" centers. Butt all edges of insulation and seal all joints with a foil-skrim-kraft tape or flange adhered over the joint. Secure insulation with flare door staples until the adhesive sets.
 - C. Seal all breaks and joints in vapor barrier with 2-1/2" wide pressure sensitive tape and Foster 30-33 vapor barrier mastic to match vapor barrier facing. Adhere with Foster 85-20/85-60 adhesive where necessary.
 - D. Cover all round low-pressure ductwork (including that on the downstream side of the air terminal boxes).
- 3.03 Cover the top of all supply diffusers above ceilings when not in a return air plenum. Insulation to be 1-1/2" thick, 1 lb. density flexible blanket. Contractor may utilize optional molded insulation blanket (R-6) furnished with diffusers where available.
- 3.04 Application shall be made on clean, dry surfaces with all joints butted firmly together.
- 3.05 All supply air conditioning ducts and refrigerant pipe insulation to be continuous through floors, walls, ceilings, roofs and pipe hangers.
- 3.06 Insulation shall not be applied until the general construction has progressed sufficiently to insure against physical or moisture damage to the insulation. All damaged insulation shall be replaced at this Contractor's expense.

- 3.07 Install 20 gauge galvanized steel insulation protectors on all insulated exposed pipes passing through floor. Sleeves to be 12" above the floor.
- 3.08 Hanger rods must be perpendicular before insulation is installed.
- 3.09 Longitudinal lap joints and butt strips for glass fiber pipe insulation shall be secured with staples on three (3") inch centers and sealed with an approved vapor barrier adhesive where applicable. Staples are not required when insulation utilizes a "double" adhesive self sealing system.
- 3.10 Cover condensation drain piping as follows:
 - A. Cover all piping with 1/2" thickness glass fiber pipe insulation.
 - B. Seal all laps and butt strips with white vapor barrier cement or factory self-sealing laps.
 - C. Fittings shall be wrapped with compressed fiberglass to same thickness and density as adjacent pipe insulation and covered with a molded plastic fitting.
 - D. All pipe covering outside shall be same type as above, 2" thick, and finished as follows:

END OF SECTION 23 07 00

SECTION 23 31 13 - METAL DUCTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Sheet Metal and Air conditioning Contractors National Association, Inc., (SMACNA) latest edition of the "HVAC Duct Construction Standards, Metal and Flexible".

1.02 SUMMARY

- A. This section includes metal ducts for supply, return, outside, and exhaust air distribution systems. Metal ducts include the following:
 - 1. Rectangular ducts and fittings.
 - 2. Single-wall, round spiral-seam ducts and formed fittings.
- B. Related sections include the following:
 - 1. Section 23 07 00 "HVAC Insulation"
 - 2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, flexible ducts, etc.

1.03 DEFINITIONS

- A. The term "Exhaust Duct" system shall be construed to mean the ductwork and related manual dampers from the first inlet to the air handling device serving that duct system, and from the air handling device to the related louver, hood, etc.

1.04 SCOPE

- A. Furnish and install low and high pressure sheet metal work and appurtenances with sizes as shown on Drawings.
- B. All sheetmetal work from the discharge side of Air Handling Units to air terminal boxes shall be high pressure construction.

1.05 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Construction Manager. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.06 SUBMITTALS

- A. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot scale. Show fabrication and installation details for metal and flexible ducts. Note, this is not a generic material submittal, but rather fabrication drawings which are to be used by the installing contractor for proper installation of the system.
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating sizes and pressure classes.
 - 3. Elevations of top and bottom of ducts.
 - 4. Dimensions of main duct runs from building grid lines.
 - 5. Fittings.
 - 6. Reinforcement and spacing.
 - 7. Seam and joint construction.
 - 8. Penetrations through fire-rated and other partitions.
 - 9. Equipment installation based on equipment being used on Project.
 - 10. Duct accessories, including access doors and panels.
 - 11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.
- B. Coordination Drawings: Reflected ceiling plans, CAD-generated and drawn to 1/4 inch equals 1 foot scale on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling grid and supports
 - 2. Other systems including piping installed in same space as ducts.
 - 3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
 - 4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Refer to Section 23 05 00 Common Work Results for HVAC under "Manufacturer's Drawings" for more detailed description of coordination drawings.
- C. Welding certificates.
- D. Duct pressure test reports.

1.07 QUALITY ASSURANCE

- A. All sheet metal work including ductwork, dampers, etc., shall be fabricated in accordance with the recommendations of the Sheet Metal and Air conditioning Contractors National Association, Inc., (SMACNA) latest edition of the "HVAC Duct Construction Standards, Metal and Flexible".

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect all sheet metal against rust and corrosion.

- B. Store sheet metal indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store metal off the ground in watertight enclosure.
- C. All pre-insulated duct shall be shipped and stored on site with open ends shrink wrapped to protect insulation from weather damage. Any insulation damaged by weather, as determined by the Engineer will be removed and replaced.

PART 2 PRODUCTS

2.01 LOW PRESSURE SHEET METAL DUCTWORK

- A. Unless otherwise noted, all sheet metal ducts and plenums shall be fabricated of lock forming quality, hot-dipped galvanized steel sheets and shall comply with 2" w.g. pressure class construction. Metal gauges shall be in accordance with current SMACNA Standards.
- B. All of the following ducts shall be constructed of aluminum with joints sealed watertight.
 - 1. All shower exhaust ducts.
- C. All duct sealing compounds, mastics and duct tape shall meet NFPA 90A standards and shall be UL listed with ratings not to exceed 25 for flame spread and 50 for smoke development.
- D. Sealer for ducts shall be equal to Foster Duct Fas 32-19.

PART 3 EXECUTION

3.01 LOW PRESSURE SHEET METAL DUCTS

- A. Refer to Section 3.05 for duct sealing requirements.
- B. Seal all seams and joints in aluminum ducts. All ducts to be watertight. Pitch ducts to low points and drain all low points in the system.
- C. Sheet metal plenums shall be single wall construction, reinforced with steel angles 2 ft. on center. Provide hinged access doors where shown on the Drawings. Provide close off sheet metal as required. Provide neoprene sponge gaskets between filter frames and housing for mixed air plenums. Gauges same as specified for ducts, unless otherwise noted. At the Contractor's option, sheet metal ducts and plenums may be put together using "K-Lock", "Ductmate" or "TDC Lockformer" couplings.
- D. Sheet metal baffles to be constructed of sheet metal with ½" duct lining, both sides.
- E. All round ductwork and fittings shall be spiral lockseam construction.
- F. The use of multi-piece adjustable angles and elbows is prohibited.
- G. Provide turning vanes in all mitered 90 degree elbows.

3.02 DUCT SEALING

- A. Ductwork and plenums shall be sealed in accordance with Table 1.

Table 1
Minimum Duct Seal Level

	Duct Type			
	Supply		Exhaust	Return
	≤ 2 in. w.c.	> 2 in. w.c		
Outdoors	A	A	C	A
Unconditioned Spaces	B	A	C	B
Conditioned Spaces ⁽¹⁾	C	B	B	C

1. Includes indirectly conditioned spaces such as return air plenums.

Duct Seal Levels	
Seal Level	Sealing Requirements ⁽¹⁾
A	All transverse joints, longitudinal seams, and duct wall penetrations. Pressure-sensitive tape shall not be used as the primary sealant.
B	All transverse joints and longitudinal seams. Pressure-sensitive tape shall not be used as the primary sealant.
C	Transverse joints only.

1. Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod, or wire. Spiral lock seams in round and flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps and other branch connections, access door frames and jambs, duct connections to equipment, etc.

3.03 DUCT SEALING (LOW AND HIGH PRESSURE)

- A. All ductwork and plenums shall be sealed in accordance with Seal Class A. Refer to SMACNA for Seal Class A requirements. This includes, but not limited to all transverse joints, longitudinal seams, any duct wall penetrations (including screw fasteners), duct connections (i.e. spin-ins, taps, branch connections), access doors, access panels, duct connections to equipment, rotating openings sealed with bushings, etc. Sealing that would void product listings is not required to be sealed. Pressure-sensitive tape shall not be used as the primary sealant.

3.04 SEALING AROUND LOW PRESSURE DUCT OPENINGS

- A. The openings around all ducts that penetrate full height walls (defined as walls that extend from the floor to the structure above) shall be sealed to maintain the acoustic integrity of the wall. This applies to all full height walls regardless of whether the wall has a fire rating.
- B. Gaps less than 1/2" between the duct and the wall opening shall be packed with batt insulation and the exposure caulked on both sides of the wall.
- C. Gaps 1/2" and larger between the duct and the wall opening shall be packed with batt insulation and a sheet metal collar installed around the entire duct on both sides of the wall. The sheet metal collar shall extend from the surface of the duct to a minimum 2" on the wall and be secured to the wall.

END OF SECTION 23 31 13

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SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following:
 - 1. Louvers
 - 2. Manual dampers
 - 3. Motorized control dampers
 - 4. Flexible connectors
 - 5. Flexible ducts

1.03 SCOPE

- A. Furnish and install air duct accessories with size and capacities as shown on Drawings.

1.04 SUBMITTALS

- A. Provide the following:
 - 1. Louvers
 - 2. Manual Dampers
 - 3. Motorized Dampers

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect internal parts against rust and corrosion.
- B. Store equipment indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.

PART 2 PRODUCTS

2.01 LOUVERS

- A. Louvers shall be based on Greenheck. Louvers by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option.
 - 1. Ruskin
 - 2. Airolite

B. STATIONARY LOUVERS

1. Provide louver as shown on Drawings.

2.02 DAMPERS

- A. Dampers shall be based on Ruskin Manufacturing Co. Dampers by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option.

1. Arrow
2. Greenheck

- B. Manual balancing based on type MD-35/0B opposed blade with molded synthetic bearings, 6" wide 16 gauge galvanized steel blades, extended shaft and linkage.

1. Balance dampers for round ducts shall be type MDRS- 25 single blade, 20 gauge galvanized steel.
2. All dampers shall be equipped with locking quadrants.

- C. Motor operated dampers based on type CD-50, opposed blade with self- lubricating molded synthetic bearings, 5" X 1" X .125-6063 T5 extruded aluminum hat channel with hat mounting flanges on both sides of frame. 6" wide 6063 T5 heavy gauge extruded aluminum airfoil shape blades. Anti-leakage jamb seals, vinyl gasket blade seals, extended shaft and linkage. Maximum allowable leakage through dampers, 6 CFM per sq. ft. at 4" of static pressure behind damper. All dampers shall be equipped with multiple 120 volt, 60 cycle, single phase motor operators as required. Spring closed.

- 2.03 Flexible connections to fans shall be made with commercial grade neoprene coated glass fabric (heavy duty).

2.04 FLEXIBLE DUCT

- A. Flexible duct shall be based on Thermaflex MKC. Flexible duct by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option.

1. Flexmaster Type 3M

- B. Flexible duct shall comply with NFPA requirements, Pamphlet 90A, and shall be UL listed with flame spread rating of 25 or less and smoke developed rating of 50 or less. Duct shall be a factory fabricated assembly composed of: An Inner duct of woven and coated fiber glass providing an air seal and bonded permanently to corrosion resistant coated steel wire helix and 1" thick fiber glass insulating blanket and low permeability outer vapor barrier of fiber glass reinforced metallized film laminate.

- C. Flexible duct shall be terminal duct for air system and shall not exceed 5 feet in length. Do not make more than one (1) 90 degree bend with flexible duct. Bend radius shall be minimum of two (2) times duct diameter.
 - 1. Duct shall be rated for minimum 10" W.G. internal working pressure, for all duct sizes.
 - 2. Vinyl, clear plastic or mylar type liners are expressly prohibited.

PART 3 EXECUTION

3.01 FLEXIBLE AND ROUND DUCT CONNECTIONS

- A. Connection of flexible and round ducts to rectangular ducts to be made with spin-in type fittings complete with damper and locking operator.

3.02 FITTINGS AND ACCESSORIES

- A. Install flexible connections in all duct connections to fans and air handling units, unless otherwise noted.
- B. Install manual balancing dampers with locking quadrants where shown on the Drawings and as required for proper balancing of the systems. Locking quadrants shall be easily accessible. On insulated ducts, locking quadrants shall be installed on outside of insulation.
- C. Install double turning vanes in all right angle elbows. Install 45° tap collar for branch ducts and register openings.

3.03 Stationary louvers to be installed by this Contractor. Caulk all around louvers with gun grade "Sonolastic" sealant. Caulking shall be applied with a hand gun and work shall be left neat and clean. Furnish size and locations to the General Contractor.

- A. Finish to be baked enamel, color approved by Architect.

3.04 Install dampers as recommended by manufacturer.

END OF SECTION 23 33 00

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SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following HVAC Power Ventilator systems:

- 1. Powered Roof Exhausters

1.03 SCOPE

- A. Furnish and install fans and appurtenances as shown on the Drawings. Size, capacities, and voltages as scheduled on Drawings.

1.04 SUBMITTALS

- A. Provide the following:
 - 1. Powered Roof Exhausters
 - 2. Operation and maintenance data for all above items.
 - 3. Fan Curves
 - 4. Vibration Isolator Details

1.05 QUALITY ASSURANCE

- A. Fan rating is based on standard air. Rating shall be AMCA certified and fan shall bear AMCA seal.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.07 COORDINATION

- A. Coordinate size and location of structural steel support members.

- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories".

PART 2 PRODUCTS

- 2.01 HVAC Power Ventilator systems based on Greenheck. HVAC Power Ventilator systems by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:

- A. Cook

- 2.02 **CEILING MOUNTED EXHAUST FANS**

- A. Exhaust fans shall have direct drive centrifugal wheel, gravity backdraft damper, removable ceiling grille and internal sound deadening material. Fans shall have factory mounted disconnect.
 - B. Fan Model SP

PART 3 EXECUTION

- 3.01 Starters and wiring by the Electrical Contractor.
- 3.02 Disconnects shall be by the Electrical Contractor unless noted above furnished with fan.
- 3.03 Roof openings and flashing for weatherproofing by the General Contractor. Setting of curbs by General Contractor as directed by the HVAC Contractor. Setting of roof exhausters by the HVAC Contractor.
- 3.04 Fans mounted with ductwork shall be supported from structure above with rods.
- 3.05 Exhaust duct to discharge into ceiling space or outdoors, as shown on the Drawings.
- 3.06 **FIELD QUALITY CONTROL**
 - A. Perform the following field tests and inspections and prepare test reports:
 - 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.
 - 5. Adjust damper linkages for proper damper operation.

6. Verify lubrication for bearings and other moving parts.
7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
9. Shut unit down and reconnect automatic temperature control operators.
10. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.07 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Refer to Section 23 05 93 "Testing, Adjusting and Balancing for HVAC" for testing, adjusting and balancing procedures.
- C. Replace fan motor as required to achieve design airflow.
- D. Lubricate bearings.

END OF SECTION 23 34 23

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SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following:
 - 1. Diffusers, Registers, and Grilles

1.03 SCOPE

- A. Furnish and install diffusers, registers, grilles and appurtenances with size and capacities as shown on drawings.

1.04 SUBMITTALS

- A. Provide the following:
 - 1. Diffusers, registers, and grilles
 - 2. Operation and maintenance data
 - 3. Color samples for approval by Architect
 - 4. Diffuser, Register, and Grille Schedule

1.05 COORDINATION

- A. Coordinate layout and installation of diffuser, register, and grille and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Furnish frames and trim compatible with ceilings shown on Architectural drawings. For lay-in ceilings, verify if any special requirements such as a suitable frame for Narrow-T type lay-in in ceiling is required.
- C. Coordinate diffuser colors in ceilings with the Architect for special requirements. Standard white finish may not be acceptable.

PART 2 PRODUCTS

2.01 DIFFUSERS, REGISTERS, AND GRILLES

- A. Diffusers, registers, and grilles based on Titus. Diffusers, registers, and grilles by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Price
 - 2. MetalAire
- B. RETURN AND EXHAUST AIR REGISTERS - Registers with perforated screen with 3/16 inch diameter holes on 1/4 inch staggered centers and opposed blade dampers, slot operated.
 - 1. Titus 350RL, with AG-15 damper, steel.
- C. SQUARE CEILING SUPPLY AIR DIFFUSERS - Adjustable air pattern steel square ceiling diffusers with round neck. Air pattern to be adjustable from full horizontal to full vertical.
 - 1. Titus Omni with Type 1 frame for surface mount in gypsum board ceilings.

PART 3 EXECUTION

- 3.01 All steel diffusers, registers and grilles shall be furnished with factory prime coat of paint. Outlets in ceilings shall be furnished with factory white finish unless otherwise noted. (Reference Paragraph 1.05).
- 3.02 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 determination of final location.
- 3.03 Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- 3.04 After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing. Initially set for horizontal air pattern distribution unless otherwise noted.

- 3.05 Manufacturer's drawings shall include the "K" factor for use with an Alnor velometer for each size and type of register, grille and diffuser furnished.
- 3.06 Round duct take-offs shall be installed with spin-in fittings and balance damper.
- 3.07 Provide additional support hangers for grilles and registers mounted in lay-in ceiling tiles.

END OF SECTION 23 37 13

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SECTION 23 81 25 – DUCTLESS SPLIT-SYSTEM AIR CONDITIONING UNITS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following:
 - 1. Split System Air Conditioning Units
- B. Related sections include the following:
 - 1. Section 23 23 00 “Refrigerant Piping”

1.03 SCOPE

- A. Provide split system air conditioning units (including indoor and outdoor units) for the Technology Control and Elevator Equipment Rooms where shown on drawings.
- B. Units must comply with Energy Conservation Requirements in regards to COP, EER, etc.

1.04 SUBMITTALS

- A. Provide the following:
 - 1. Split System Air Conditioning Units
 - 2. Operation and Maintenance Data for Above Item

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect internal parts against rust and corrosion.
- B. Store equipment indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.

PART 2 PRODUCTS

- 2.01 Split system air conditioning units based on Carrier, split system air conditioning units by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor’s option:

- A. Sanyo
- B. Trane-Mitsubishi

- 2.02 Indoor downflow fan unit shall be complete with direct expansion coil, direct drive multi-speed fan, filters, return air grille, 12 volt controls for heating and cooling, refrigerant metering devices, and remote controller mounted on wall. Do not provide wireless remote. Evaporator unit shall be 120 volt, 1 phase operation.
- 2.03 Outdoor unit shall be furnished with welded hermetic compressor utilizing R-454b and be provided with crankcase heater, automatically reversible oil pumps, internal and external motor protection, direct-driven horizontal discharge propeller fan. Condensing unit shall be 208 volt, single phase operation as noted on drawings. Provide safety grilles.

Controls and protective devices shall include a crankcase heater, liquid line low pressurestat, suction line accumulator, low ambient control, and pressure relief device. Motor-compressor shall have both thermal and current sensitive overload devices and internal high-pressure protection. Control transformer shall be factory installed and wired on outdoor unit for external control circuit.

- 2.04 A wall mounted controller furnished with the unit shall control the condensing unit to maintain room temperature.
- 2.05 Provide unit with integral condensate pump.

PART 3 EXECUTION

- 3.01 Temperature controls are to be furnished with the equipment and installed by the HVAC Contractor, according to the equipment manufacturer's recommendations. Wiring for temperature controls is the responsibility of the HVAC Contractor and shall conform to the National Electrical Code and to the Electrical Section of the specification.
- 3.02 Insulated tubing sets furnished with unit properly sized and installed according to manufacturer's recommendations may be used. Contractor has the option to provide field piped system. Coordinate piping requirements with the manufacturer.
- 3.03 Power wiring to unit and disconnect by the Electrical Contractor. Control wiring by this Contractor.
- 3.04 Mount condensing unit on a concrete housekeeping pad in the mechanical room as shown on the Drawings.
- 3.05 During construction, this Contractor shall take precaution to minimize contamination of system by dirt, scale, moisture or other foreign matter. All foreign material and moisture in the system shall be removed.
- 3.06 Support indoor unit from wall as recommended by manufacturer.
- 3.07 Extend condensate line to the janitor's receptor as shown on drawings.
- 3.08 Setpoint Temperature for AC-3 shall be 5°F above AC-2.

END OF SECTION 23 81 25

SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Request for Proposal, apply to this Section.

1.02 SUMMARY

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: Three set(s) for each furnace/coil unit.

1.07 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/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.08 COORDINATION

- A. Coordinate sizes and locations of attic access, existing conditions, equipment supports, and roof penetrations with actual equipment provided.

1.09 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: Seven year(s) from date of Substantial Completion.
 - b. For Parts: One year from date of Substantial Completion.
 - c. For Labor: One year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carrier
- B. Trane
- C. Johnson Controls
- D. McQuay

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 thermalexpansion valve. Comply with ARI 206/110.
4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
5. 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.
 - d. Wheel: Galvanized blower wheel shall be centrifugal type, statically and dynamically balanced/ Permanently lubricated with sealed ball bearings.
 - e. Motor: ECM
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Filters: 1" MERV 13, non-pleated

B. Indoor Air Coil (66,000 BTU or Less)

1. Coil shall be compatible and by the same manufacturer as the outdoor condenser.
2. Coil: Cased in 22-gauge, galvanized steel cabinet.
3. Evaporator Material: Aluminum Coil
4. TXV refrigeration valve for R-454ba required.
5. Fully insulated cabinet
6. Warranty: 1 year labor, 10 year parts.

C. Gas Furnaces (120,000 BTU or Less)

1. Fuel Type: Natural Gas (Contractor shall verify pressure and requirements)
2. Type: Condensing
3. Efficiency: 97% minimum
4. Filter: Furnish and install external media cabinet for 1" Merv 13 filters. Door shall be hinged with locking mechanism that can be opened without the use of tools.
5. Unit shall be designed, test and constructed to the current ANSI Z 21.47/CSA 2.3 design standard for gas-fired central furnaces.
6. Warranty: 1 year labor, 5 year parts, and 20 year heat exchanger.
7. Heat Exchangers: Shall be of stainless steel.
8. Gas Valve: 2-stage
9. Controls: Shall include a micro-processor-based integrated electronic control board and a self-test feature that checks all major functions of the furnace. Multiple operational settings shall be available, including blower speeds for high heat, low cooling, high cooling and continuous fan. Continuous fan speed may be adjusted from thermostat.

10. Electrical: 115 Volt, 60 Hz, Single Phase
11. Unit shall be compatible with thermostat requirements and the cooling side split system.
12. Vent Kit: Furnish and install concentric vent kit. Provide adapters to existing roof penetrations or employ a licensed roofing contractor to install or modify any roof penetrations. Vent material and sizing shall comply with manufacturer's recommendations.

2.03 OUTDOOR UNITS (5 TONS OR LESS)

- A. 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: R-454B
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
 3. Fan: Aluminum-propeller type, directly connected to motor.
 4. Motor: Permanently lubricated, with integral thermal-overload protection.
 5. Low Ambient Kit: Permits operation down to 0 deg F.
 6. Mounting Base: Polyethylene.

2.04 ACCESSORIES

- A. Control equipment and sequence of operation are:
 1. Thermostat shall be a 7-day programmable thermostat that is first programmed by the contractor with occupied and unoccupied setpoints provided by the Owner.
- B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- C. Automatic-reset timer to prevent rapid cycling of compressor.

- D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends. Lines shall not exceed manufacturer recommended lengths. New piping is to follow existing piping and exit the building in the same location. Seal penetration water and vapor tight.
- E. 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 compressor-condenser components on equipment pads as recommended by manufacturer.
- D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.02 CONNECTIONS

- A. Where piping is installed adjacent to unit, allow space for service and maintenance of unit. Pipe shall be routed to allow access for maintenance staff to equipment and must penetrate the exterior wall at the same location as the existing refrigerant piping. All refrigerant and condensate piping for the five split systems being replaced is required to be replaced with new.
- B. Duct Connections: Contractor responsible for any duct modifications required to install new equipment back to the existing duct system. Contractor shall follow all applicable SMACNA standards.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. 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.
- C. Tests and Inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - D. Remove and replace malfunctioning units and retest as specified above.
 - E. Prepare test and inspection reports.
- 3.04 STARTUP SERVICE
- A. Perform startup service.
 1. Complete installation and startup checks according to manufacturer's written instructions.
 2. Provide written documentation showing startup procedures followed. This includes testing of the new thermostats on all six systems in the building.
- 3.05 DEMONSTRATION
- A. Train Owner's maintenance personnel to adjust, operate, and maintain units. Training shall include written instructions, be scheduled 14 days in advance, and be for a minimum of 4 hours for up to four staff members select by the City of South Lebanon.

END OF SECTION 23 81 26

SECTION 23 82 39 - UNIT HEATERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following unit heater types:
 - 1. Electric Cabinet Unit Heaters

1.03 SCOPE

- A. Furnish and install unit heaters and appurtenances with sizes and capacities as shown on drawings.

1.04 SUBMITTALS

- A. Provide the following:
 - 1. Electric Cabinet Unit Heaters
 - 2. Operation and maintenance data (for all above items)

1.05 COORDINATION

- A. Coordinate wiring requirements with the electrical contractor.
- B. Coordinate wall and/or ceiling openings for cabinet unit heaters with the general contractor.

PART 2 PRODUCTS

2.01 ELECTRIC CABINET AND PROJECTION UNIT HEATERS

- A. Electric wall unit heaters based on Q Mark. Electric wall unit heaters by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Chromalox
 - 2. Electromode
 - 3. Markel
 - 4. Brasch

- B. Electric wall unit heaters shall be fully recessed with face grille, metal sheath heating element, automatic reset thermal overload protection and built-in thermostat. Units shall meet all UL and NEC requirements and bear UL label.
- C. Unit shall have capacity as indicated on drawings.
- D. Unit shall operate at voltage and phase as specified on drawings and shall be furnished with contactor.
- E. Unit to be controlled from manufacturer provided integral thermostat.

PART 3 EXECUTION

3.01 Wiring by the Electrical Contractor.

3.02 CABINET AND PROJECTION UNIT HEATERS

- A. Install full recessed units with bottom approximately 8" above floor. Adjust top to block course.
- B. Install suspended projection unit heaters as high as possible.
- C. Wall recesses and lintels will be provided by the General Contractor. Notify the General Contractor of size and location of all openings and recesses required.

END OF SECTION 23 82 39

SECTION 26 01 00 - GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 GENERAL

1.01 REFERENCE

- A. All Specifications under this Division Title are directed to and are the responsibility of the Electrical Contractor. Unless other trades or persons are specifically mentioned, "Electrical Contractor" is inferred and intended. The Electrical Contractor is intended wherever the lone term "Contractor" is written and all General and Supplementary Conditions and Division 1 Sections apply to his work. . The Owners Representative (abbreviated O.R.) is the design professional registered by the State and contracted by the Owner to act on his behalf in matters of professional judgement related to the design intent conveyed by the Contract Documents.
- B. The Electrical Contractor is responsible for work shown on the drawings including but not limited to demolition, excavation, loading, unloading, shipping, storage, coordination, rigging, hoisting, and electrical work inclusive of all specification sections in Divisions 26, 27 and 28 and on the Contract Drawings, unless otherwise stipulated in the Contract Bidding Documents.
- C. Contact the Construction Manager regarding questions of plans and/or specifications.

1.02 DEFINITIONS

- A. The following definitions apply wherever used in Divisions 26, 27 or 28.
 - 1. Contractor - Electrical Contractor licensed to work within the State, and local Building Department Jurisdiction.
 - 2. Labeled - Adhesive information sticker applied by the manufacturer indicating the equipment has been prototype tested by an independent third party testing laboratory and listed to have met their standards. All electrical equipment shall be listed and labeled by an NRTL.
 - 3. NRTL - Nationally recognized testing laboratory which is acceptable to list and label products by the local authority having jurisdiction.
 - 4. NEMA - National Electrical Manufacturers Association.
 - 5. Wet Location - See NEMA for definition. In addition to locations and equipment specifically required to be suitable for wet locations, the Contractor should assume all outdoor equipment installations not installed under roof and areas inside the building where liquids under pressure are located closer than 6 feet are wet locations and provide equipment listed for wet locations.

6. Damp Location - See NEMA for definition. In addition to locations and equipment specifically required to be suitable for damp locations, the Contractor shall assume all outdoor equipment installations under roof, areas indoors below grade on exterior walls and areas inside the building where liquids under pressure are 6 feet or more but less than 10 feet from the electrical equipment are damp locations and provide equipment listed for damp locations.
7. Hazardous Location - See NEC Article 500 for definition. Areas identified by the Engineer to fall within these definitions are indicated by note on the drawings. Further guidance and references to special work required to meet the requirements of NEC Articles 500, 501, 502, 503 and 504 are described in this Specification Section.
8. Finished Space - Contractor is directed to the Architectural Schedules on the plans. Any space whose floor treatment is other than paint or finished concrete is a Finished Space.
9. National Electrical Code (NEC) - The National Fire Protection Association (NFPA) Standard No. 70. The applicable edition is that adopted and codified by the local Authority Having Jurisdiction (AHJ).
10. Provide - Furnish, install, test and place in working order in accordance with all relevant plan and specification requirements.
11. OSHA – Occupational Safety and Health Administration. A component of the U.S. Department of Labor. Directed by law to administer and enforce worker protection legislation.

1.03 CONTRACT DRAWINGS

- A. The Drawings accompanying these Specifications and the Specifications themselves are complementary each to the other and what is called for by one shall be as if called for by both.
- B. Consult all Contract Drawings which may affect the location of equipment, conduit and wiring and make minor adjustments in location to secure coordination. If in doubt as to interpretation of minor submit a written request to the Engineer asking for an interpretation.
- C. Wiring layout is schematic (unless dimensioned) and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be changed; it refers only to the exact locations of conduit and equipment to fit as constructed and with the coordination of conduit and other equipment.

- D. Coordinate layout of work with other trades. Make minor adjustments in location required for coordination. Locations of structural systems shall take precedence over locations of conduit lines where conflict occurs. Locations of piping that depend upon gravity flow shall also take precedence over electrical items. However, the Contractor shall obtain written permission to rearrange equipment in electrical spaces and equipment areas. All NEC required "Working Space", "Dedicated Equipment Space" and ventilation space requirements shall be observed.
- E. Other than minor adjustments shall be submitted to the O.R. for approval before proceeding with the work.
- F. The location of equipment shown on the Drawings is approximate (unless dimensioned), and the Engineer shall have the right to relocate any equipment before it is installed without additional cost. The Contractor has the obligation to make an inquiry to the O.R. before installing equipment contrary to NEC requirements.
- G. Inconsistencies in the documents that cause the Contractor to make assumptions to complete his bid shall be submitted to the O.R. prior to bid date and in time to permit clarification.

1.04 MANUFACTURER'S DRAWINGS AND SUBMITTALS

- A. The Contractor shall submit to the O.R. for review copies of manufacturer's drawings and wiring diagrams. The O.R. will review Contractor's shop drawings and related submittals (as indicated below) with respect to the ability of the detailed work, when complete, to be a properly functioning integral element of the overall system designed by the Engineer. Before submitting a shop drawing or any related material to the O.R., Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of Contractor; approve each such submission before submitting it; and so stamp each such submission before submitting it. The O.R. shall assume that no shop drawing or related submittal comprises a variation unless Contractor advises O.R. otherwise via a written instrument which is acknowledged by O.R. in writing. Submittals for testing later in construction are also listed for reference. See individual specification sections listed for more details regarding required submittal content. The items, types of submittals and related material (if any) called for are indicated below:

<u>SECTION</u>	<u>ITEMS</u>	<u>TYPE SUBMITTALS REQUIRED</u>
26 05 00	Conduit Sleeve Seals	Product Data
26 05 13	Medium Voltage Cable,	Product Data Terminations and Accessories

<u>SECTION</u>	<u>ITEMS</u>	<u>TYPE SUBMITTALS REQUIRED</u>
26 05 19	Low Voltage Conductors an Accessories	Product Data
26 05 26	Grounding and Bonding Systems and Hardware	Product Data Ground System Drawing Test Reports
26 05 29	Hangers and Supports	Product Data
26 05 33	Raceways and Boxes	Product Data
26 05 36	Cable Trays	Product Data
26 05 53	Labels and Nameplates	Product Data
26 05 73	Overcurrent Protective Device Coordination and Arc Flash Study Qualifications	Product Data Time Current Curves Reports
26 09 23	Lighting Control Devices	Product Data
26 22 00	Low Voltage Transformers	Product Data
26 23 00	Low Voltage Switchgear	Product Data Shop Drawings Control Panel Layouts Control Panel Wiring Diagrams Panel Components Coordination Drawings
26 24 16	Panelboards	Product Data Shop Drawings
26 25 50	Generator Camlock Docking Station	Product Data Shop Drawings
26 27 26	Wiring Devices	Product Data Shop Drawings Samples Test Reports

<u>SECTION</u>	<u>ITEMS</u>	<u>TYPE SUBMITTALS REQUIRED</u>
26 28 16	Enclosed Switches and	Product Data Circuit Breakers Shop Drawings Test Reports Time Current Curves
26 32 13	Engine Generators	Product Data Shop Drawings Welding Certifications Prototype Test Factory Test Field Test Warranty
26 36 00	Transfer Switches	Product Data Shop Drawings Factory Test Reports Field Test Reports Warranty Time Delay Relay Settings
26 43 13	Surge Protective Devices (SPD)	Product Data Test Lab Reports Warranty
26 51 00	Interior Lighting	Product Data Warranty
26 56 00	Exterior Lighting	Product Data IES Curves Photometric Data Mounting/Installation Details Warranty

- B. The O.R. shall return shop drawings and related materials with comments provided for each required submission that has been properly submitted and is stamped by Contractor as required above. The O.R. shall return without comment material not called for or which has not been stamped and approved by the Contractor.
- C. Submittals shall be reviewed in the order received. The O.R. shall review submittals in 10 working days after receipt or less. Every attempt shall be made to review submittals within five (5) working days. One (1) set of the submittal will be returned with either the approval or comments. Large and/or complex submittals should be scheduled for a specific delivery date to insure timely availability of persons knowledgeable and familiar with the submittal contents. Failure to schedule such submittals can result in the inability of the O.R. to meet the above review times. Do not accumulate submittals for simultaneous submittal unless they are composite parts of a system as this will negatively affect the review time required.

- D. O.R.'s review of Manufacturer's Drawings or Schedules shall not relieve the Contractor from responsibility for errors or omissions in Manufacturer's Drawings or Schedules or deviation from Engineer's Drawings or Specifications.
- E. At the completion of the Job and before final payment is made, the Contractor shall submit the number of copies stipulated in Division 1 Submittal Requirements of Manufacturer's "As-Constructed" Drawings. Included with the Drawings shall be The Operating and Maintenance Manuals as called for in Division 1 Submittal Requirements. As-Constructed Drawings shall reflect changes to any and all information presented on the Engineer's Contract Drawings.

1.05 SUBMITTALS

- A. The Contractor shall at a minimum provide the number of copies stipulated in Division 1 Submittal Requirements of the following:
 - 1. Bill of Material including quantities.
 - 2. Drawings and illustrations to describe the equipment and accessories.
 - 3. Drawings showing arrangement and location of all equipment with dimensions.
 - 4. Type, ratings and characteristics of all equipment furnished.
 - 5. Weight and dimensions of equipment.
 - 6. Equipment performance data.
 - 7. Complete instructions for installation.
 - 8. Connection diagram drawings showing:
 - (a) Power wiring and connections of all control devices, terminal blocks, etc.
 - (b) Circuit diagrams, etc., representing each item of equipment shall be furnished.
 - (c) Point-to-Point wiring diagrams.
 - (d) The manufacturer, prior to delivery, shall furnish complete sets of certified prints of oneline drawings, circuit diagrams, connection diagrams and instruction books for use during installation.
 - 9. Ladder diagrams (control diagrams) showing control logic. Include external or field wiring and devices as indicated on contract control diagrams or as described by function.
 - 10. Block diagram showing functional connectivity of components and systems.

B. Installation, Operating, and Maintenance Instructions

1. The Contractor shall provide copies of an instruction, operating and maintenance manual covering all equipment furnished. See Division 1 requirements for "Operation and Maintenance" requirements.

C. The Contractor shall provide a complete manufacturer's replacement parts list to the Owner. See individual specification sections for parts to be furnished for Owner's stock.

1.06 JOB-SITE COPY OF DOCUMENTS

- A. Maintain at the site, one copy of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders and other modifications, in good order. The Drawings shall be marked to record all changes made during construction especially deviations made necessary to incorporate equipment different from base equipment specified. These shall be available to the O.R.. The Drawings marked to record all changes made during construction shall be delivered to the O.R. for the Owner upon completion of the work. An additional set of Drawings will be furnished by the O.R. for this purpose upon request.**

1.07 VENDOR COPIES OF DOCUMENTS

- A. The Contractor shall reproduce and dispense to his vendors copies of bid documents and all succeeding Addenda and Bulletin documents.**

PART 2 PRODUCTS

2.01 MATERIALS

- A. All materials shall be new (unless otherwise noted), undamaged and undeteriorated and of a quality not less than the minimum specified.**
- B. Materials and equipment for which there are Underwriters' Laboratories (or NRTL) standard requirements, listing and labels, the Contractor shall provide such listing and labeling of Underwriters' Laboratories (or NRTL) and be so labeled.**

2.02 GUARANTEES

- A. The Electrical Contractor shall be responsible for all defects, repairs and replacements in materials and workmanship for all work covered by his Contract for a period of one (1) year after final written acceptance by the Owner.**
- B. Product guarantees greater than one (1) year shall be passed along to the Owner for full benefit of the manufacturer's warranty. Each shall be executed directly between the vendor/supplier and the Owner.**

2.03 QUANTITIES

- A. Items may be referred to as singular or plural on the Drawings and in the Specifications. The Contractor is responsible for determining quantity of each item required.**

PART 3 EXECUTION

3.01 INSTALLATION

- A. Furnish and install all necessary hangers, supports, straps, boxes, fittings and other similar appurtenances not indicated on the Drawings but which are required for a complete and properly installed system consistent with the Architectural treatment of the building and necessary to meet NEC requirements.
- B. Contractor shall inform himself fully regarding peculiarities and limitations of space available for installation of materials and apparatus under this contract, and see that all equipment necessary to be reached from time to time for operation and maintenance are made easily accessible. Clearances, when possible, shall be greater than those required by code.
- C. All electrical work shall meet the requirements of the NEC, the State of [Ohio] Building Code and local building code. These codes establish minimum requirements. Where these Contract Documents exceed those code requirements the Contractor shall ensure that his work meets or exceeds that greater level of work.
- D. Network Cable Clearances: Maintain separations of electrical transformers, panelboards and conduits from network, security and video wiring. The Electrical Contractor shall maintain the following minimum clearances from these low voltage cables/equipment: transformers and 480/277 volt conduits and panelboards - 48 inches, 208/120 volt conduits and panelboards - 24 inches, perpendicular conduit crossings may be half these distances or 24 inches and 12 inches respectively.

3.02 WORKMANSHIP

- A. Electrical work shall meet or exceed the standards of installation and workmanship set forth in the latest edition of the National Electrical Contractors Association publication entitled NECA Standard of Installation and the National Electrical Safety Code, except as otherwise modified in these specifications or shown on the Drawings.
- B. The Owner or Owner's representative reserves the right to direct the removal and replacement of any item which, in his opinion, does not present an orderly, neat or workmanlike appearance, provided that such item can be properly installed in an orderly way by methods usual in such work, or which does not comply with the contract drawings or these specifications. Perform such removals or replacements when directed in writing by the Owner and at the Contractor's expense.
- C. The Electrical Contractor, insofar as the work is concerned, shall at all times keep the premises in a neat and orderly condition, and at the completion of the work shall properly clean up and cart away debris and excess materials.
- D. All work shall be in conformance with the National Electrical Code.

3.03 SAFETY

- A. The Contractor shall obtain all Owner safety requirements, file all required paperwork, inform his employees of all safety requirements and keep his employees up to date with bulletins from the Owner's safety forces. The Contractor shall meet all OSHA requirements, file all appropriate safety paperwork, adhere to all OSHA and Owner safety requirements for his own worker's safety as well as others.

END OF SECTION 26 01 00

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SECTION 26 01 01 - OPERATION AND MAINTENANCE OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

- A. This Contractor shall thoroughly instruct and supervise the Owner's Maintenance Personnel in the proper operation and maintenance of the electrical equipment and systems. This Contractor shall be responsible for arranging for the instruction and supervision by factory trained and knowledgeable persons at a time convenient to the Owner or their representative(s) and for notifying the Construction Manager of the time at least 4 working days in advance. The Owner shall be permitted to video tape these training sessions.

Instructions shall include the following:

1. Location of equipment and explanation of what it does.
 2. Reference to "Operating Instruction Manuals" for record and clarity is essential.
 3. Coordination of written and verbal instructions so that each is understood by all personnel.
 4. Specific maintenance to be performed by Owner and specific maintenance recommended to be by vendor personnel.
- B. Furnish the number of copies required in Division 1 Submittal Requirements of the printed Operating and Maintenance Manuals for the Electrical Equipment and Systems to be covered in the training for review prior to the training. Copy shall be neat, legible and bound in a hardback 3-ring notebook. After final approval, provide the number of copies required in Division 1 Submittal Requirements of Operation and Maintenance Instructions for submittal to Owner. Instructions shall consist of the following items:
 1. Title Page: Title of Project, address, date of submittal, name and address of Contractor, name of Architect, name of Engineer.
 2. Second Page: Index of Manual Contents.
 3. First Section: A copy of each approved shop drawing and submittal with an index at the beginning of the section. Work that requires modifications to existing equipment shall be reflected on updated shop drawings of the existing equipment showing new work bold and highlighted.

4. Second Section: A list of all equipment used on the project, together with supplier's name and address.
 5. Section Three: Manufacturer's maintenance manuals for each item of equipment furnished under this contract. Manuals shall include such items as parts list, detailed lubrication instructions, procedures for performing normal maintenance functions, preliminary trouble shooting procedures and wiring diagrams.
 6. Section Four: Complete wiring diagrams, block diagrams and point to point wiring diagrams for the electrical systems as actually wired including ladder type control and interlock wiring diagrams. See Electrical Section "General Provisions for Electrical Work" requirements for "Manufacturers Drawings and Submittals" requirements.
 7. Brief but complete instructions for start-up, shut- down and routine maintenance of each system.
 8. Routine and 24-hour emergency information:
 - a. Name, address and telephone number of servicing agency.
 - b. Include names of personnel to be contacted for service arrangements.
 9. Field Test Reports.
 10. Warranties. Both Standard and Special.
- C. Operation and Maintenance Manual - Electronic
1. Provide two (2) copies of each manufacturer's O & M Manual in PDF format on CD(s). Clearly identify each CD by specification section number and name as well as vendor's name and product name and model. Include vendors' address, website and support phone number.
 2. Provide two (2) copies of "As-Constructed" plans in PDF format on CD(s). Identify sheet numbers included on each CD.
- D. Electrical control diagrams, riser diagrams and wiring diagrams shall be laminated with plastic and mounted inside or adjacent to each fire alarm control panel and motor starter. Include copies bound into manual.
- E. Electrical one line diagrams shall be laminated with plastic and mounted on or adjacent to each switchboard and switchgear showing the supply to that switchboard/switchgear and the loads served from that switchboard/switchgear. Electrical subsystems shall be shown in separate colors. Life Safety shall be red, Legal Standby shall be yellow, Optional Standby shall be blue and Normal power shall be black. Hang on brass hooks with 3 foot stainless steel chain loop allowing lift from hooks for easier reading. Include identical ring bound laminated copies for use in the maintenance office.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION 26 01 01

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SECTION 26 01 04 - TESTS, OBSERVATIONS, AND INSPECTIONS

PART 1 GENERAL

1.01 INSPECTIONS/OBSERVATIONS

- A. Obtain all required permits and provide all inspections required by all laws, ordinances, rules, regulations or public authority having jurisdiction and obtain certificates of such inspections and submit same to the Owner's Representative. (O.R.). Pay all fees, charges and other expenses in connection therein.
- B. Before any electrical work is covered, the O.R. will observe the electrical work completed at that time. The Contractor shall inform the O.R. at least 5 working days in advance of the time such visit is appropriate.
- C. Final Observation - When the Contractor determines all work is completed and working properly per the Contract Documents, he shall request a "Final" observation by the O.R. and Owner in writing. If more than one visit is required after this final observation, the Contractor shall bear all additional costs, including compensation for the O.R.'s additional services made necessary thereby. A final observation will not be made until Operating and Maintenance Manuals and Test Reports are submitted and approved and all prior "Observation report" punch lists are completed, signed and returned to the O.R.
- D. All work shall be inspected by the Authority Having Jurisdiction (AHJ) and upon completion of the work, the Electrical Contractor shall furnish a certificate of inspection and approval from the AHJ before final payment on the Contract will be allowed. Fee for inspections shall be a part of this Contract.

1.02 OBSERVATION REPORTS

- A. During the course of construction, the O.R. will prepare "Observation Reports" with a list of items found to be in need of correction. All items listed shall be corrected by the Contractor. A space is provided on the form for the Contractor to note the completion of each item. All prior "Observation Report" items must be completed, the lists signed and returned to the O.R. prior to making the final observation. After the final list is issued, the same procedure will apply.

1.03 TESTING

- A. The Contractor shall perform all required field testing and demonstrations, shall provide experienced and competent personnel for said demonstrations/testing, shall provide safe, reliable and accurate testing equipment with current calibration certification and individuals skilled in its operation. Provide evidence of compliance to the O.R.
- B. All field tests, demonstrations and equipment operation and performance required for acceptance of equipment or systems shall be so indicated shall be provided by the Contractor as described in the equipment specifications. All demonstrations, performance and system tests shall be preceded by an organizational meeting with the O.R. at least 1 week prior to the Contractor's desired date to perform. The Contractor shall provide a Test Supervisor (T.S.) whose resume demonstrates experience with the

equipment to be demonstrated/tested, the test equipment and the procedures and safety requirements that satisfy the O.R. prior to the meeting. The test supervisor shall, at the meeting, present paperwork showing how the demonstration/test will proceed in a step by step fashion. All test equipment connections and safety precautions shall be indicated for each step. Forms shall list the expected results for each step and the allowed limits for each result.

The demonstration/test supervisor shall point out the data to be recorded to the O.R. prior to recording it. Data unacceptable to the O.R. shall be circled and a footnote mark added by the T.S. to connect the data to a description footnote explaining the non-compliance. A copy of the raw data form shall be given to the O.R. at test completion. Completed forms with explanations shall be submitted within 1 week or a notice of a retest date shall be scheduled.

- C. See demonstration/testing requirements in each Division 26, 27 or 28 section and as listed for reference in Section "General Provisions For Work of (appropriate section)".
- D. If the O.R. determines that any work requires special observation, testing, or approval which the specification does not include, he will, upon written authorization from the Owner, instruct the Contractor to order such special observation, testing or approval. The Contractor shall give timely notice so the O.R. may make such observation, observe tests or make approvals. If such special observation or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the O.R.'s additional services made necessary by such failure; otherwise the Owner shall bear such costs, and an appropriate Change Order shall be issued.
- E. See Part 1 of each Division 26, 27 and 28 section for testing requirements. See Part 3 of each Division 26, 27 and 28 section for testing details.
- F. The Contractor is advised that he shall be required to provide personnel, tools and assistance for commissioning. Specifications for Contractors' work to assist in commissioning are separate from these specifications. The Contractor is advised that successful commissioning will be required before the Owner will accept work of these specifications.

1.04 UNACCEPTABLE WORK

- A. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.
- B. The Contractor shall promptly correct all work found unacceptable by the O.R. whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such unacceptable work, including compensation for the O.R.'s additional services made necessary thereby.

1.05 GUARANTEE

- A. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after final acceptance of the work by the Owner. See “Special Warranty” requirements in individual Sections for further warranty requirements.

1.06 DEFINITIONS

- A. NETA-International Electrical Testing Association (previously National Electrical Testing Association).
- B. ATS-Acceptance Testing Specifications (for Electrical Power Distribution Equipment and systems). Describes electrical tests and visual and mechanical inspections recommended for application to included electrical equipment prior to acceptance.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

3.01 PERFORMANCE

- A. Contractor, subcontractor, vendors, or manufacturer shall provide personnel, equipment and written records of tests. Refer to the individual specification sections for a detailed description of the demonstrations/tests.
- B. Perform each electrical visual and mechanical inspection stated in NETA ATS for all electrical components work with operating parts (mechanical, electrical or electronic) without exception and provide written statements affirming same for each applicable specification section.

3.02 PHASE ROTATION

- A. Prove that the switchgear, panelboards, switchboards, motor control centers, motor controllers, etc., are connected maintaining and /or providing proper phase rotation. Pay special attention to rotation of all motors.

3.03 LOAD BALANCE

- A. Prove that loads are balanced within 5 percent across all phases of panelboards.
- B. Upon completion of electrical work, test the full load lighting and appliance circuits for phase balance as well as the service and distribution feeders. Tests to be witnessed by the O.R., and results recorded and reported in writing.

- C. Obtain optimum phase balance under full load condition by reconnection of panelboard feeders at the main switchboard. Any panelboards requiring circuit changes for balance shall reflect these changes in the panel directory and wire color identification. Color change can be made with colored tape at panel.
- D. Pay special attention to prevent reverse rotation of motors during load balance and adjustments.

3.04 SYSTEM VOLTAGES

- A. Adjust transformer taps to set typically loaded system voltages to the following: 470 volts for “480” volt systems, 208 volts for “208” volt systems, 230 volts for “240” volt systems, 120 volts for “120” volt systems and 270 volts for “277” volt systems. Systems when lightly loaded will have higher voltages.

3.05 NEUTRAL-GROUND SEPARATION

- A. Prove that the neutral and ground are separated, except as required by the National Electrical Code, at service entrance, transformer secondaries and separately derived sources.

3.06 RESISTANCE AND CONTINUITY

- A. Provide insulation resistance, grounding resistance, and ground continuity tests of feeders, branch circuits or equipment on demand.
- B. Provide earth ground resistance and ground bus to ground bus resistance measurements per “Grounding and Bonding for Electrical Systems” section.

3.07 CONNECTIONS

- A. All bus joints shall be bolted with a torque wrench set to the manufacturers recommended torque in the installation instructions. Coordinate with the Engineer to permit his observation of compliant torque on all bus joints. Provide Engineer with minimum one week notice.
- B. Prove that mechanical connections are torqued to manufacturer's recommended UL and NEMA standards. Install adhesive sticker, indicating torque applied to connections, proximate to each connection including date and initials.

3.08 CONTROL AND INTERLOCKING

- A. Demonstrate that equipment operates as indicated in control and wiring diagrams and described in Division 23 Section “Sequence of Operation”. Provide all control wiring and components except those marked “Temperature Control Contractor”.

3.09 EQUIPMENT

- A. Provide necessary electrical personnel and testing instruments as required to assist in demonstration/testing of installation.

END OF SECTION 26 01 04

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SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes work and tasks required as a part of the Electrical scope of work :
 - 1. Electrical equipment coordination and installation.
 - 2. Fire Rated Sleeves for raceways and cables.
 - 3. Fire Rated Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.
 - 6. Spare and loose deliverables.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.
- C. AHJ: Authority Having Jurisdiction.
- D. OCPD: Overcurrent Protective Device i.e. circuit breaker or fused switch.

1.04 SUBMITTALS

- A. See Specification Section "General Provisions For Electrical Work" for additional requirements.
- B. Product Data: For fire-stop assemblies sleeve seals include rated applications and smoke and flame spread ratings. Each type of seal to be used shall be submitted along with identification of the locations to be used, the wall or floor construction involved along with any rating it may require and signage to be provided indicating certifications. U.L System Number, F-rating, T-rating, L-rating, installation details, listing of limitations and installation requirements and limits shall be included for all firestop seals.
- C. Record drawings shall be submitted by the Contractor at the completion of his work showing modifications occurring during construction as well as new work that includes fire rated penetrations.

1.05 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate fire rated sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- E. Coordinate UL listed systems for firestop sleeves with raceways, cable type and quantities to be included in the finished system. UL listed firestop sleeve system shall identify all allowable cable types, maximum allowable cable fill rate, all firestop materials and associated application rates. UL listed firestop sleeves shall provide for no less than 40% cable fill by cross sectional area unless otherwise noted.
- F. Coordinate work with other Contractors to avoid conflicts with structural components and mechanical systems.

1.06 PERMITS AND FEES

- A. Obtain and pay for all permits, inspections and fees required by all laws and regulations by public authorities. Convey copies to the Owner.

PART 2 PRODUCTS

2.01 FIRE RATED SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 FIRE RATED SLEEVE SEALS

- A. Description:** Flame (F), Thermal (T) and Smoke (L) U.L. rated sealing assemblies designed for field assembly, to fill annular space between rated barrier and sleeve shall match the F,T and L ratings of the rated barrier. The assembly shall possess F,T and L ratings that match the rated barrier as well between sleeve and raceway or cable. The assembly shall expressly meet the fill limitations (Max & min) for the application. Each assembly shall be expressly U.L. rated for the raceways and/ or cable types and materials placed within the sleeve and the rating of the wall or floor penetrated.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti Firestop Systems, Tulsa, Oklahoma
 - b. JACO Manufacturing, Atkins Virginia
 - c. FireStop Systems, Houston, Texas
 - d. 3M Firestop Solutions
 - e. Nelson Firestop (Emerson Industrial Automation)
 - f. Specified Technologies incorporated

2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout:** ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.04 CONTROL WIRING

- A.** The Contractor shall provide all control wiring required to obtain automated and interconnected control functions indicated by interconnections shown on floor plans, control diagrams or schedules. Only wiring clearly indicated to be work of the Temperature Control Contractor on the control diagrams is excluded from this requirement. All control functionality shall be demonstrated by this Contractor as described in Division 26 Section "Tests, Observations and Inspections". Equipment controls that require work by the Temperature Control Contractor shall be jointly demonstrated by both Contractors. All equipment wiring utilizing line voltage control/power (120 volts and higher) supplied from an electrical panelboard provided by the E.C. shall be wired by the Electrical Contractor (e.g. line voltage thermostats, line voltage solenoids).

2.05 SPARES/LOOSE DELIVERABLES

- A. All uninstalled materials, loose deliverables and uninstalled spares required in this Division shall be conveyed to the Owner along with a transmittal detailing all such materials and the specification section under which they are required. The Owner's designated receiver of these items shall sign and print their name and date of the transfer. A copy of this signed transmittal shall be conveyed to the Architect and the Engineer.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.02 FIRESTOPPING

- A. Apply firestopping to penetrations of all fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of floor or wall assembly. Comply with all specifications, materials and applications rates included in each UL listed system. Firestopping materials and installation requirements in addition to those listed herein are specified in Division 07 Section "Penetration Firestopping." Provide U.L. identification at every penetration of a fire rated wall or floor citing type and ratings of that penetration.
- B. SLEEVE INSTALLATION FOR ELECTRICAL FIRE RATING OF PENETRATIONS
 - 1. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Assume all floors are fire rated. Fire rated walls include all enclosed stairwells, corridors and walls containing corridor doors with hold-opens and other walls designated on the plans. See Architectural Plans for location of all smoke/ fire rated walls and floors. . See Section "Raceways and Boxes for Electrical Systems" for further requirements related to penetrations related to appearance, watertight integrity and environmental sealing of wall and floor penetrations.

2. Fire-Rated Assemblies: Install UL listed system sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
 3. Fire Ratings: Fire-Rated-Assembly Penetrations of Fire-Rated Walls, Ceilings, Roofs and Floors: Maintain fire and smoke rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping." Label all rated penetrations with U.L. system number as well as F, T and L ratings. Use only listed putty or similarly removable product to prevent cable damage when used in contact with communications and low voltage cables. Penetration seal materials shall be removable without damage to conductors.
 4. Concrete Slabs and Walls: Install sleeves for penetrations unless smooth core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
 5. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 6. Cut sleeves to length for mounting flush with both surfaces of walls.
 7. Extend sleeves installed in floors 2 inches above finished floor level.
 8. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
 9. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
 - a. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
 10. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals. Maintain wall fire rating.
 11. Underground, Exterior-Wall Penetrations: See Section Raceways and Boxes For Electrical Systems.
- C. See Sections "Raceways and Boxes for Electrical Systems" and Cable Tray Sections for further requirements including penetrations of non-fire rated walls and ceilings.

END OF SECTION 26 05 00

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SECTION 26 05 01 - COMMON WORK RESULTS FOR ELECTRICAL ON
COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. General and Supplementary provisions of the Electrical Contractor's work as well as Division 1 specification sections apply to this section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This section requires the Electrical Contractor to provide all materials and installation specified in specific Division 27 Specification Sections and outside of ER and TR spaces. The Electrical Contractor shall provide all materials and installation to provide device boxes, conduits to accessible ceiling space, wall sleeves for communications cabling to pass through fire rated walls and conduit risers between TR's And ER's, Cable Trays for Communications and Signal Circuits (see Division 26 Section). The Electrical Contractor shall provide these materials and their installation in compliance with the specifications and the "Technology" plans (T sheets) that show all communications requirements for the pathways.
- B. Related Sections include the following:
 - 1. Division 26 Section "Raceways and Boxes For Electrical Systems".
 - 2. Division 26 Section "Hangers and Supports For Electrical systems"
 - 3. Division 26 Section "Cable Trays For Communications Outside TR Spaces and ER Spaces".
 - 4. Division 26 Section "Grounding and Bonding For Electrical Systems".

1.03 SUBMITTALS

- A. All submittals specified in the specification sections listed in the "SUMMARY" Paragraph above shall be provided identifying them distinctly as being supplied for Division 27 Communications requirements. See Section "General Provisions For Electrical Work" for more detailed requirements.

1.04 QUALITY ASSURANCE

- A. All quality assurance requirements for the Sections listed in the "SUMMARY" Paragraph above shall be provided by the Electrical Contractor.

PART 2 PRODUCTS

2.01 Provide all products as specified in sections listed in the “SUMMARY” Paragraph above.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide all installation requirements as specified in sections listed in the “SUMMARY” Paragraph above.

END OF SECTION 26 05 01

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.
- B. Related Sections include the following:
 - 1. Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
 - 2. Division 26 Section "Control-Voltage Electrical Power Cables".
 - 3. Division 26 Section "Raceways and Boxes for Electrical Systems".
 - 4. Division 26 Section "Cable Trays".
 - 5. Division 26 Section "Identification For Electrical Systems".

1.03 DEFINITIONS

- A. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. See Section "General Provisions For Electrical Work" for additional requirements.
- B. Qualification Data: For testing agency.

1.05 QUALITY ASSURANCE

- A. A licensed electrician with testing experience is required to sign and submit all tests and inspections.

- 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.
- C. Comply with NFPA 70.
- D. Provide conductor continuity tests, ground fault tests and conductor termination torques.

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
- B. Manufacturers:
 - 1. General Cable Corporation.
 - 2. Southwire Company.
 - 3. Cerro Wire Inc.
 - 4. nVent (Pyrotenax)
 - 5. Belden Inc.
 - 6. Encore Wire Corporation
- C. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type and cable construction permitted for various applications.
- D. Conductor Material: Copper complying with NEMA WC -70-1999; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
- E. Conductor Insulation Types: Type THHN-THWN and XHHW complying with NEMA WC -70-1999.
- F. Mineral Insulated, Metal Sheathed Cable, Type MI: A factory assembly of one or more conductors insulated with a highly compressed refractory mineral insulation and enclosed in a Liquidtight and gastight continuous copper or ally steel sheath. ANSI/UL 2196 Fire resistive cable with 2 hour fire rating.
- G. Minimum Wire Sizes
 - 1. Minimum power or lighting circuit wiring size shall be AWG #12.
 - 2. Minimum control circuit wiring size shall be AWG #14.
 - 3. Minimum fire protective signaling circuit wire size shall be stranded AWG #18 or solid AWG #18 two conductor cable.

4. Minimum fire alarm remote annunciator circuit shall be stranded AWG #18. Limited energy cable shall have insulation labeled for fire alarm circuits.
5. Minimum wire size for 48V DC circuits shall be AWG #10.

2.02 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.
6. Pentair Thermal Management

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated. Splices shall only be permitted if explicitly denoted on plans or when approved in writing by the Engineer.

C. Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder and branch-circuit phase conductors:

1. 208/120-V Conductors:

- a. Phase A: Black.
- b. Phase B: Red.
- c. Phase C: Blue.

2. 480/277-V Conductors:

- a. Phase A: Brown.
- b. Phase B: Orange.
- c. Phase C: Yellow.

3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:

- a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
- b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

PART 3 EXECUTION

3.01 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, in Slabs-on-Grade, Underground, and in Crawlspace: Type XHHW-2, single conductors in raceway.
- E. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, Underground, and in Slabs-on-Grade: Type XHHW-2, single conductors in raceway.
- H. Conductors installed on Roofs shall be XHHW-2.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- J. Fire Alarm Circuits: Type THHN-THWN, in raceway.
- K. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- L. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.02 INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated. No conduit is permitted "beneath" slabs on grade. Install conduit in the center 1/3 of the slab or install an encasement notch below the slab with minimum 2" concrete cover. Raceways may be surface mounted within mechanical rooms and electric rooms.
- B. All power conductors shall be installed in raceway unless shown on the drawings to be installed in cable tray except for Types MC, AC or MI. If type MC, AC or MI are permitted they are not installed in conduit but have specific support requirements in the NEC. They may be installed anywhere permitted by the NEC (and these contract documents) with appropriate support and bending radius. Provide manufacturer recommended termination hardware.
- C. All power conductors installed in plenums shall be in raceway (other than PVC) or be labeled for installation in a plenum and be a permitted use in the NEC.

- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation and shall be non-combustible and non smoke producing. Do not exceed manufacturer's recommended maximum pulling tensions and conduit sidewall pressure values.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- G. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems".
- H. Seal around cables penetrating fire-rated structure elements according to Division 26 Section "Common Work Results For Electrical."
- I. Identify and color-code conductors and cables according to Division 26 Section "Identification For Electrical Systems."
- J. All conductors shall be continuous from box-to-box. No joints shall be permitted in the circuit other than in junction boxes or fixtures. Mechanical "T" connections or splices shall only be permitted where specifically called for.
- K. All make-up connections to fluorescent lighting fixtures and all branch circuit conductors run in wiring channels of fluorescent lighting fixtures shall be THHN, THHW, or XHHW rated 90°C.
- L. Equipment ground conductors shall be same insulation type as the associated circuit conductors.
- M. All conductors of a circuit shall follow the same path through any openings in metal partitions within enclosure.
- N. The ampacity of all conductors shall be at least as great as the rating of the fuse or circuit breaker on the line side of the conductors. Note the ampacity reduction required by Code when more than three current carrying conductors are placed in a raceway.
 - 1. All conductors for distribution and control equipment terminations shall be based on full 75°C ampacity.
 - 2. All conductors for appliance and utilization equipment terminations rated 100 amperes or less shall be based on 60°C ampacity.
 - 3. All deration calculations shall be based upon the highest ampacity temperature table for the labeled wire temperature (60°C, 75°C, or 90°C). Use NEC Tables 310.

- O. Provide cable supports for vertical raceways per NEC Table 300.19 (A). Provide cable support submittal identifying product, details of installation and locations on plan sheets where cable supports will be used.
- P. Wiring installed in separate conduits.
 - 1. All emergency and exit lighting.
 - 2. Control wiring.
 - 3. Auxiliary systems wiring.
 - 4. All fire alarm signaling circuits.
- Q. Network Cable Clearances: Maintain separations of electric power conductors from network cable conductors. See Division 26 Section "General Provisions For Electrical Work" Part 3 "Installation" Paragraph "Network Cable Clearances".
- R. Fire Alarm signaling circuits shall not be spliced. No parallel branching of wires is permitted. All wiring shall be run parallel and perpendicular to building lines.
- S. Single phase branch circuits that include a neutral conductor shall have separate neutral conductors for each circuit. No shared neutrals are permitted unless specifically requested by note on the drawings.

3.03 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Unless noted otherwise, all connections are to be made using compression type connectors.
- E. Where connections are to be made to devices or equipment under screw heads only, install insulated, locking spade terminals on the wire ends before the connections are made. Back wired receptacle connections shall not be permitted unless the side screw provides compression.
- F. Devices shall not be used as through connection points. Where through circuits are involved they shall be spliced in the box and a pigtail connected to the device.
- G. Connectors shall contain only one wire unless they are listed for multiple conductors.

- H. Joints in #10 and smaller wire shall be made using the following types of connectors: Minnesota Mining and Manufacturing "Scotch Lok", Ideal Industries, Inc. "Wing Nut", or Thomas and Betts Co. Type "PT". Connectors shall be used only within their range. Other threaded-on types of insulated connectors shall not be used.
- I. Joints in #8 and larger wire or joints in any wires above the range of threaded-on connectors shall be made using pressure type mechanical connectors applied after wires are cleaned and then insulated using two (2) layers of "Scotchfil" brand electrical insulation putty and covered by two (2) half-lapped layers of "Scotch 88", or Plymouth Slipnot Gray vinyl plastic electrical tape. Connectors shall be installed and sealed against moisture by installing Raychem "TCS (indoor) or WCSM (exterior)" sealant coated heat shrink tubing.

3.04 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements. Testing shall as a minimum include continuity of each circuit and verification of no ground fault before energizing. Submit conductor termination torques for all conductors.
 - 2. Perform each electrical visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- D. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Tests, settings and adjustments results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

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SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 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 systems described in other Sections. Grounding shall include establishing system voltages to ground (service entrance and separately derived systems), grounding of electrically operated equipment, grounding of steel building framing and electrically conductive piping and duct systems and signal reference grounds. Also work of this section is grounding at Underground Utility Structures, inter-connection of ground systems and inter-connection to related sections below.
- B. Related Sections include the following:
 - 1. Division 27 Section "Grounding and Bonding For Communications Systems".
 - 2. Division 26 Section "Raceways and Boxes for Electrical Systems" for additional grounding and bonding requirements and ground conductor protection requirements.

1.03 DEFINITIONS

- A. BCT - Bonding Conductor for Telecommunications: A conductor that interconnects the telecommunications bonding infrastructure to the building's service equipment (power) ground.
- B. EF - Entrance Facility: An entrance to a building for both public and private network service cables including the entrance point at the building wall and continuing to the Entrance Room (ER) or main Telecommunications Room (TR).
- C. TBB - Telecommunications Bonding Backbone conductor: A conductor that interconnects the telecommunications main grounding busbar (TMGB) to the telecommunications grounding busbar (TGB).
- D. TGB - Telecommunications Grounding Busbar: A common point of connection for telecommunications system and equipment bonding to ground, and located in the telecommunications room or equipment room.

- E. TMGB - Telecommunications Main Grounding Busbar: A busbar placed in a convenient and accessible location and bonded by means of the bonding conductor for telecommunications, to the building service equipment (power) ground.
- F. TR - Telecommunications Room: An enclosed architectural space for housing telecommunications equipment, cable terminations and cross connects.
- G. MGB - Main Ground Bus: Main Ground Bus for the electric power distribution system. The location where grounding electrode conductors terminate and other grounding and bonding conductors are connected. Generally near the electric service disconnect device.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. See Section “General Provisions For Electrical Work” for additional requirements.
- B. Product Data: For the following:
 - 1. Ground rods
 - 2. Ground bus
 - 3. Grounding Connections
- 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.

1.05 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
- C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- D. Comply with TIA-607-B for communications ground systems.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Grounding Conductors, Busbars, Cables, Connectors, and Rods:
 - a. Apache Grounding/Erco Inc.
 - b. Chance/Hubbell.
 - c. Copperweld Corp.
 - d. Erco Inc.; Electrical Products Group.
 - e. Framatome Connectors/Burndy Electrical.
 - f. Harger Lightning Protection, Inc.
 - g. Heary Brothers Lightning Protection Co.
 - h. Ideal Industries, Inc.
 - i. ILSCO.
 - j. Kearney/Cooper Power Systems.
 - k. Lightning Master Corp.
 - l. O-Z/Gedney Co.; a business of the EGS Electrical Group.
 - m. Panduit Corporation
 - n. Raco, Inc.; Division of Hubbell.
 - o. Robbins Lightning, Inc.
 - p. Superior Grounding Systems, Inc.
 - q. Thomas & Betts, Electrical.

2.02 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
1. Solid Conductors: ASTM B 3.
 2. Assembly of Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter, minimum.

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 inches (42 mm) wide and 1/16 inch (1.5 mm) thick, minimum.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick, minimum.
5. Communications grounding conductors shall be sized per TIA-607-B TBB sizing chart. All communications grounding conductors including the conductor from the MGB to the TMGB shall be equal in size to the TBB. This Contractor shall provide all Communication rooms busbars and grounding conductors back to the MGB. If a Grounding Equalizing Conductor (GE) is shown on the Division 27 plans it shall be provided by this Contractor.

2.03 BUSBARS

- A. Communication Ground Bus: Install in TR, EF and ER communication spaces and communication equipment locations.
 1. Telecomm Main Grounding Busbar (TMGB): Shall be a predrilled tin plated copper busbar assembly with insulated stand-off brackets that meet those for Main Ground Bus and be UL listed for the intended purpose. Drill pattern shall be for 2-hole connectors and match TIA-607-B. Minimum dimensions shall be 1/4 inch thick, 4 inches wide and variable length as required to accommodate all required grounding connections. Minimum length shall be no less than 20" where not otherwise shown.
 2. Telecomm Grounding Busbar (TGB): Shall be a predrilled tin plated copper busbar assembly with insulated stand-off brackets that meet those for Main Ground Bus and be UL listed for the intended purpose. Drill pattern shall be for 2-hole connectors and match TIA-607-B. Minimum dimensions shall be 1/4 inch thick, 2 inches wide and variable length as required to accommodate all required grounding connections. Minimum length shall be no less than 20" where not otherwise shown.
 3. See Division 27 Section "Grounding and Bonding For Communications Systems" for further details regarding communications ground bus specifications.

2.04 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 manufacturer's written instructions.

2.05 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
- B. Ground Rods: Sectional type; copper-clad steel.
 - 1. Size: 3/4 inches by 120 inches.
- C. Enhanced Electrodes: Ground rod with enhanced carbon black/cement mixture with an 8 inch radius. Material shall have a resistivity of less than 20 ohm centimeters and require zero maintenance, be permanent and non-polluting.

PART 3 EXECUTION

3.01 APPLICATION

- A. Use only copper bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors. See exception for solitary ground conductors in Section "Raceways and Boxes for Electrical Systems".
- 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. Ground Bus (Busbar): Install in electrical equipment rooms, in rooms housing service equipment (Main Ground bus), and elsewhere as indicated.
 - 1. Use insulated spacer; space 2 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
 - 2. Ground electrode conductor from effectively grounded metal building frame or building water line shall be extended directly to main electric service switch enclosure ground without splice or other connection. Extend full size bonding jumper back from main switch ground to main grounding bus. Connect all other electrode conductors to this bus.
 - 3. Provide ground electrode connection from Main Ground Bus to all grounding electrodes including a concrete encased electrode meeting requirements of NEC 250.52(A)(3) unless concrete foundation is existing work to remain.
 - 4. Provide permanent label on each electrode conductor where attached to main ground bus with listed lugs or other listed means per NEC 250.70.

- F. Communication Ground Bus: The Main Telecommunications Ground Bus (TMGB) shall be installed in the main TR. It and all Telecommunications Ground buses (TMG) shall be installed on plywood with 2 inch insulated standoff insulators.
- G. Underground Grounding Conductors: Use tinned-copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank. Details on the drawings supercede those in this paragraph.

3.02 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes (see Table 250.122), 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 branch circuits.
- C. Bond all ungrounded metal components and surfaces within 6 feet of any panelboard, switchboard, switchgear and control panel to the electrical enclosure with 6 AWG conductor.
- D. 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. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
- E. 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.
- F. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power (or receptacle) panels or power-distribution units.
- G. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic power conductor raceways unless they are designated for telephone or data cables.
- H. Air-Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- I. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

- J. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 3/0 AWG minimum bare grounding conductor in raceway from Main Ground Bus(es) to each TMGB, EF or main TR and from EF or main TR to each TR and equipment rack location. See detail on plans for requirements that are project specific. Provide Communication Ground Bus bars in all TR's and EF's.
1. Bonding conductor from the Main Ground Bus to the TMGB and from the TMGB to all TGB's shall run continuous without splices. All TBB risers shall be continuous from the TMGB to the last TGB on the riser. All intermediate bus connections shall be by a conductor bonded to the continuous TBB and terminated on the bus. Connections to the continuous conductor shall comply with NEC 250.30 (A) (6) (c). The connections of the bonding conductor to the bus shall utilize exothermic welding or listed compression two-hole lug irreversible connections and inspection ports.
 2. See Division 27 Section "Grounding and Bonding for Communications Systems".
 3. See Section 26 "Raceways And Boxes for Electrical Systems" requirements for solitary ground conductors.
- K. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate insulated equipment grounding conductor with supply branch-circuit conductors.
- L. Metallic Fences. Where metallic fence grounding is required on the drawings comply with the current edition of IEEE C2 "The National Electrical Safety Code".

3.03 METAL BUILDING FRAME

- A. Provide an effectively grounded metal building frame per NEC 250.52 (A) (2).
- B. At each exterior building steel corner column provide an exothermically welded 3/0 bare copper connection between the building metal column and the concrete foundation reinforcing steel. Connect to #4 bar or larger. Protect exposed conductor from damage by virtue of location or conduit. Extend exothermically welded connection from column nearest main electric service switch to switch and interconnect with other grounding electrodes. Ground nearest column to resteel as described above.

3.04 INSTALLATION

- A. Ground Rods: As a minimum, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes unless plans call for a ground ring instead or show a ground rod array detail.
1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors to main ground bus. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. 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. Protect ground conductors with conduit per NEC 250.64(B). Non-metallic PVC conduit shall not be used in air handling ceilings, floors, plenums or ducts. Metallic conduit when used (only by special written permission) shall be terminated at both ends with a grounding bushing. See Division 26 Section "Raceways and Boxes for Electrical Systems" for specified raceways and their uses.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building (within 5 feet of entering building). Connect grounding conductors to main metal water service pipes by listed grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors such that removal of meter for maintenance will not affect ground integrity of building water system.
- F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps. Fans and air handling units with flexible duct connections shall be provided with such bonding straps across the flexible connections. Connect at both supply and return duct locations.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- H. Isolated Structural Steel: Exposed structural steel that is interconnected to form a steel building frame and is not effectively grounded by connection to the effectively grounded metal building frame described above shall be bonded to the main ground bus. Provide a #4/0 bonding jumper exothermically welded to each vertical member at an accessible location.
- I. Concrete-Encased Grounding Electrode: Fabricate in all new construction according to NFPA 70, Paragraph 250.52 (3), using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Resteel and imbedded

conductor shall have minimum 2 inches of concrete cover. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.05 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. Grounding Electrode Conductor Connections. All grounding electrode conductor connections shall be exothermically welded unless specifically called for as "bolted". Such "bolted" connections shall utilize compression lugs and "non-reversing" nuts. In general bolted connections are limited to connections to the ground bus bars. All grounding electrodes shall be bonded together to form one grounding electrode system per NEC Article 250.50 through 250.53. Conductors from separate electrodes shall be permanently identified separately. See Identification For Electrical Systems for nametag requirements.
- C. 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.
- D. 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 grounding screw and pressure-type connectors.
- E. Non-continuous 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. Metal raceways not terminated with a grounding bushing to grounded housing shall utilize a bonding jumper.

- F. 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.
- G. 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.
- H. 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.
- I. Nameplates: Provide engraved plastic nameplate at ground buses. Provide engraved tag for each grounding electrode conductor identifying electrode.

3.06 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Duct Banks: Install a grounding conductor with at least 50 percent ampacity of the largest phase conductor or total area for parallel conductors in the duct bank.
- B. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches (450 mm) below grade and 6 inches (150 mm) outside the foundation.

3.07 FIELD QUALITY CONTROL

- A. Testing: 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. Submit all ground bus to ground bus resistances by measurement back to main ground bus.
 - 2. Test completed grounding system at each location where a maximum resistance to ground level is specified, and at service disconnect enclosure grounding terminal. 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. Submit results.
 - 3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

- a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - e. Manhole Grounds: 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, add one additional driven rod to the arrangement shown on the drawings and notify Owner's Representative promptly of the results. If ground resistance still exceeds above limits include recommendations to reduce ground resistance.

3.08 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 32 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 26 05 26

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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment, raceways, cable trays, light fixtures and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.
 - 2. Division 26 Sections : "Raceways and Boxes for Electrical Systems", "Cable Trays", "Low Voltage Transformers", "Wiring Devices", "Lightning Protection for Structures" and "Interior Lighting".

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.
- D. MFMA-4: Metal Framing Manufacturer's Association, 2004 Revision.
- E. AWS: American Welding Society.
- F. Building Structural Element: A component of the designed support system for the building walls, floors, roof and structural ceilings whose design has been approved by the building manufacturer or a registered structural engineer.

- G. Accidental Load: 200 lb (90 kg)
- H. Strut: Common name for slotted steel channel.

1.04 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents as well as accidental load.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components as well as accidental load.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.05 SUBMITTALS

- A. In addition to the following specific data required for inclusion in submittals see Section "General Provisions For Electrical Work" for additional submittal requirements.
- B. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- C. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.
 - 5. Welding certificates.

1.06 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M: 2010, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.07 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Channel Dimensions: Selected for applicable load criteria. Minimum shall meet P-1000 dimensions
 4. Strength: Allowable moment of 5070 in-lb (570 Nm) minimum.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building structural elements include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Cooper B-Line, Inc.; a division of Cooper Industries.
- 2) Empire Tool and Manufacturing Co., Inc.
- 3) Hilti Inc.
- 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
- 5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment. Design shall conform to supported equipment manufacturer's instructions or be sealed by a registered structural engineer.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. All electrical equipment and systems supports shall be capable of supporting the dead weight (apportioned if multiple supports) of the electrical equipment or system plus 200 lb (90kg) at each support. All support systems shall be derived from the building structural elements. No electrical support system shall derive support from support systems, components or equipment provided under any specification division other than Division 26. Where direct supports from equipment or components to building structural elements are not directly accessible the Contractor shall fabricate trapeze supports, vertical or horizontal slotted steel supports or custom fabricated supports (see submittal requirements below).

- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through building structural elements, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus Accidental Load.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Metal Corrugated Roof Deck: Comply with NEC 300.4(E).
 - 6. Items Mounted on Hollow Walls and Nonstructural Building Elements: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate. Extend each slotted-channel from one building structural element to another and secure. Slotted-channel installed on precast concrete wall panels may not require connection to building structural elements if approved by the architect or structural engineer.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment. All fabricated metal supports shall be submitted with a manufacturer's verification or a structural engineers sealed design verifying the required design dead load plus Accidental Load for the application.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 2 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions and equipment manufacturer's requirements.

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 minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes requirements for:
 - 1. Metal Conduits, tubing and fittings.
 - 2. Nonmetal conduits, tubing and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures and cabinets.
 - 7. Penetration of structure surfaces requirements for raceways other than fire related requirements.
- B. Related Sections include the following:
 - 1. Division 33 Section "Utilities" and Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
 - 2. Division 07 Section " Penetration Firestopping" and Section "Joint Sealants" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
 - 3. Division 26 Section "Common Work Results for Electrical" for fire rating requirements for penetrating fire rated structure surfaces.
 - 4. Division 26 Section "Hangers and Supports for Electrical Systems" for supports, anchors, and identification products.
 - 5. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.
 - 6. Division 27 Common Work Results For Communications
 - 7. Division 27 Grounding and Bonding For Communications Systems
 - 8. Division 27 Section "Pathways For Communications Systems".

9. Division 27 Sleeves and “Sleeve Seals For Communications Pathways and Cabling”.
10. Vibration and Seismic Controls For Critical Communications Systems
11. Division 28 Section “Pathways For Electronic Safety and Security”.
12. Division 28 Sleeves and Sleeve Seals For Electronic Safety and Security Pathways and Cabling.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. LFNC: Liquidtight flexible nonmetallic conduit.
- F. RNC: Rigid nonmetallic conduit.
- G. RMC: Rigid metallic conduit.
- H. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

1.04 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets. See Section “General Provisions For Electrical Work” for further requirements.

1.05 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

1.06 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, 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.
- B. Provide raceways for Division 27 and Division 28 as specified herein and as shown on the Drawings. Note special requirements for those raceways in both sizing, firestopping, bending radii etc. as specified for those systems. See Division 26, 27 and 28 drawings for scope and details.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND TUBING

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
- B. Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflec Inc.
 - 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 4. Electri-Flex Co.
 - 5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
 - 6. LTV Steel Tubular Products Company.
 - 7. Manhattan/CDT/Cole-Flex.
 - 8. O-Z Gedney; Unit of General Signal.
 - 9. Wheatland Tube Co.
 - 10. Rob Roy
 - 11. Thomas & Betts
 - 12. Cal Pipe Industries Inc.
- C. Rigid Metal Conduit: ANSI C80.1.
 - 1. Fittings shall be threaded type (all connections).
 - a. Hot dipped galvanized.
- D. IMC: ANSI C80.6.
 - 1. Fittings shall be threaded type.

- E. EMT and Fittings: ANSI C80.3.
 - 1. Fittings: Set-screw type.
- F. FMC: Zinc-coated steel.
 - 1. Fittings shall match raceway system connected to FMC.
 - 2. Provide ground conductor between grounding fittings at both ends.
- G. LFMC: Flexible steel conduit with PVC jacket.
 - 1. Fittings shall match raceway system connected to LFMC.
 - 2. Provide ground conductor between grounding fittings at both ends.
- H. Fittings: NEMA FB 1; compatible with conduit and tubing materials. Termination fittings shall be insulated throat type.
- I. Fire Rated Penetrations: Provide fire rated fittings solutions for all raceway penetrations of fire rated floors and walls. Provide calculations demonstrating minimum 40% cable fill by cross sectional area for each application. See Section "Common Work Results For Electrical" for requirements for fire rated penetrations of fire rated wall and floor assemblies.

2.02 NONMETALLIC CONDUIT

A. Manufacturer:

RNC-PVC

- 1. Arnco Corp.
- 2. Cantex Inc.
- 3. Prime Conduit, Inc.
- 4. Cal Pipe Industries Inc.

RNC-Fiberglass (RTRC)

- 1. Champion Fiberglass.
- 2. United Fiberglass of American.
- 3. Osburn Fiberglass.
- 4. FRE Composites.

B. RNC:

- 1. PVC: NEMA TC 2 and UL 651, Schedule 40 and Schedule 80
- 2. Fiberglass (RTRC): NEMA TC 14 and UL 1684A.

C. LFNC-A:

1. PVC layer, nylon braid layer, PVC layer. Comply with UL 1660

D. RNC Fittings:

1. PVC: NEMA TC 3; match to conduit type and material.
2. Fiberglass: NEMA TC 2002 and UL 514B and 1684, dimensions and material to match conduit.

E. Solvent Cement

1. Solvent cement and adhesive primers shall have VOC content of 510 and 550 g/L or less respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cements and adhesive primers 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."

F. Fire Rated Penetrations

1. Fire Rated Penetrations: Provide fire rated fittings solutions for all raceway penetrations of fire rated floors and walls. Provide calculations demonstrating 40% fill limitations for each application. See Section "Common Work Results For Electrical" for requirements for Fire Rated Penetrations of Rated Floor and Wall Assemblies.

2.03 METAL WIREWAYS

A. Available Manufacturers:

1. Hoffman.
2. Square D.
3. Hammond Manufacturing.
4. Cooper B-Line, Inc.

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

- E. Wireway Covers: As indicated.
- F. Finish: Galvanized steel with Manufacturer's standard enamel finish.

2.04 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
 - 1. Available Manufacturers:
 - a. Wiremold/ Legrand
 - b. Universal Electric Corp., Starline
 - c. Niedax-Kleinhuis USA, Inc.
 - d. Panduit Pan-Way
- B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.
- C. Details
 - 1. Dimensions
 - a. 4-3/4" high, 1-3/4" deep, nominal length per plan.
 - 2. Devices
 - a. Provide one (1) duplex power receptacle at 24" spacing, routed in the bottom channel unless otherwise noted on plans. Provide blank plates if plans stipulate fewer devices.
 - b. Provide one (1) Communications cabled work area location at 24" spacing routed in the top channel unless otherwise noted on plans. Provide manufacturer's box extension assembly at all surface raceway communications locations as required to maintain minimum allowable cable bend radius at installed work area devices inside raceway channel. Manufacturer's assembly shall include a full size single gang device plate, surface mount device box (minimum 1-3/8" deep) and flush mount hardware as required to secure the surface mount device box to the single gang device plate. Hardware shall not protrude into the channel or present sharp edges that might damage installed cables. Provide full size (minimum 2-3/4" deep) device boxes and device plate adapters for telecommunications locations that are fed by surface raceway but not integral to the raceway. Provide blank plates if plans stipulate fewer active telecommunications devices. Division 27 Contractor shall provide applicable devices and plates under their scope of work for active telecommunications devices. Coordinate plate openings with Division 27 Contractor.
 - c. Device colors shall match raceway.

3. Fittings

- a. Provide ANSI/TIA-569-C compliant radius fittings and inserts for all changes in raceway direction, re: inside, outside and flat 90 ells, tees, crosses, reducers, etc. Raceway design shall provide for no less than minimum allowable telecommunications cabling bend radius at all points.
- b. Provide full size riser feed to above accessible ceiling space as noted on plans and specifications. Where back feed is noted, provide back feed with appropriate sized conduit and back box. De-burr rough metal edges and provide effective grommet edging to protect low voltage wiring at all cable entry and exit locations.
- c. Provide continuous solid dividers in all raceways and fittings as required by NEC.
- d. Provide end caps at all raceway end fittings except for riser access.
- e. Provide electrical entrance end fittings as required for electrical power connectors.
- f. Fitting material, finish and colors shall match raceway.

4. Wiring

- a. Provide electrical devices wired to the indicated panelboard. The Division 27 Contractor shall provide telecommunications devices wired to telecommunications closet as indicated for the coverage zone. Coordinate Division 27 Contractor work with Division 26 Contractor work.
- b. Electrical power conductors shall meet Division 26 Section "Low Voltage Electrical Power Conductors and Cables". Telecommunications conductors shall be by Division 27 Contractor and comply with Division 27 Sections "Conductors and Cables for Communications" and "Communications Horizontal Cabling". Electronic Safety and Security conductors shall be by Division 28 Contractor and comply with Division 28 Section "Conductors and Cables for Electronic Safety and Security".
- c. Provide calculations for maximum allowable low voltage cable fill. Cable fill shall not exceed 40% by mathematical cross sectional cable area and applicable raceway channel dimensions. Obtain fill calculations from applicable Division 27 and/ or Division 28 Contractor(s). Where fill would exceed 40% provide additional capacity.
- d. Provide fire rated fittings and calculations demonstrating 40% fill compliance at all fire/ smoke rated floor and wall penetrations. See Section "Common Work Results For Electrical Work for requirements for penetrating fire rated floor and wall assemblies.

2.05 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Adalet.
2. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
3. Emerson/General Signal; Appleton Electric Company.
4. Erickson Electrical Equipment Co.
5. Hammond Manufacturing
6. Hoffman.
7. Hubbell, Inc.; Killark Electric Manufacturing Co.
8. Kraloy.
9. O-Z/Gedney; Unit of General Signal.
10. RACO; Division of Hubbell, Inc.
11. Robroy Industries, Inc.; Enclosure Division.
12. Scott Fetzer Co.; Adalet-PLM Division.
13. Spring City Electrical Manufacturing Co.
14. Thomas & Betts Corporation.
15. Wiremold Company (The)/Legrand.
16. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1 (2008 with 2010 Amendment) and UL 514A. Recessed in stud walls.

1. Galvanized steel interior outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Minimum switchbox depth shall be 2 inches, height shall be 4 inches and width shall be 2-1/8 inches. Outlet boxes for electrical power shall be 2-1/8 inches deep, height shall be 4 inches and width shall be 2-1/8 inches. Outlet boxes for communication (voice and data) shall be minimum 3-1/2 inches deep, height and width as above.
 - a. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes.
2. Accessories shall be compatible with outlet boxes being used and shall meet requirements of individual situations.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Surface or recessed in masonry and surface or recessed outdoors. Surface or recessed in wet or damp locations. Corrosion-resistant cast-metal galvanized weatherproof exterior outlet wiring boxes of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap and corrosion-proof fasteners

- D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb. (23 kg) shall be listed and marked for the maximum allowable weight with a 20% buffer.
- E. Pull and Junction Boxes
 - 1. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1. Indoors, dry locations.
 - a. Boxes shall be galvanized sheet metal with screw-on cover and welded seams, stainless steel nuts, bolts, screws and washers.
 - b. Boxes larger than 12 inches in any dimension shall be panelboard code gauge galvanized steel with hinged cover.
- F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Outdoors and unheated indoor locations. Indoors in wet or damp locations.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Galvanized steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel for indoor dry locations. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.06 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors (entirely outside building footprint):
 - 1. Exposed: RMC.
 - 2. Concealed: RMC.
 - 3. Underground, Single Run: RNC.
 - 4. Underground, Grouped: RNC.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC (with insulated throat).
 6. Boxes and Enclosures: NEMA 250, Type 3R or 4. See Section "General Provisions for Electrical Work" for definitions of wet and damp locations.
- B. Indoors (raceways entirely within exterior limits of walls, floors, roof):
1. Exposed below 8 feet: RMC.
 2. Exposed above 8 feet: EMT.
 3. Concealed within Exterior Walls: RMC.
 4. Concealed within Interior Walls: EMT.
 5. Within Slabs or Floors: RNC.
 - a) Exits floor exposed or in exterior wall: Convert to RMC before exiting floor.
 - b) Exits floor in interior wall: Convert to EMT before exiting floor.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC except FMC in air handling plenums and luminaires in finished spaces. All flexible connections shall include a ground wire and shall not be in excess of 6 feet in length
 7. Damp or Wet Locations: RMC.
 8. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a) Damp locations shall be NEMA 3R.
 - b) Wet locations shall be NEMA 4.
 9. Mechanical Rooms Walls Below 8 Feet: RMC
 10. No raceways shall be installed below slabs on grade. They shall be in the slab or a part of the slab. See "Raceways Embedded in Slabs" under "Installation" below.
 11. No RNC permitted in walls.
 12. Solitary Ground Conductors RNC-PVC except air handling plenums, RNC- in air handling plenums. Solitary ground conductors used for Signal and Communication systems shall be protected from contact with any other metallic surface along their entire length. Extra care to comply with this limitation at bend and deflection points is essential. Use field or factory bends and deflections.
- C. Raceways that extend both indoors and outdoors.
1. Raceways for services into the building or feeders/branch circuits leaving the building shall be RMC in concrete until 5 feet outside the building footprint. Beyond 5 foot line see Outdoor - Underground requirement above.
- D. Minimum Raceway Size: 1/2-inch trade size (DN 16). Minimum size LFMC or FMC is 3/4 inch except where only 1/2 inch knockouts are provided on luminaires. See uses permitted above.

- E. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. All EMT termination fittings shall be insulated throat type.
 - 2. All fittings installed in concrete shall be watertight and rated for that use.
 - 3. All conduits crossing expansion joints shall utilize fittings approved for that application.
 - 4. All boxes shall be suitable for the environment where installed. See "Boxes, Enclosures and Cabinets" above for various applications.

3.02 INSTALLATION-RACEWAYS

- A. No raceway shall be installed exposed on the exterior of a building or on the roof unless explicitly directed to do so on the plans.
- B. Power raceways shall observe separation requirements from data cabling. See Division 26 Section "General Provisions for Electrical Work" Part 3 Installation paragraph "Network Cable Clearances".
- C. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- D. Complete raceway installation before starting conductor installation.
- E. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems".
- F. Install temporary closures to prevent foreign matter from entering raceways.
- G. Protect stub-ups from damage where conduits rise through new floor slabs with concrete. Arrange so curved portions of bends are not visible above the finished slab.
- H. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
 - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- J. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover. Use ties to resteel to ensure conduit maintains placement and separation from other conduits at no greater than 10 ft. intervals. For slabs without top and bottom resteel use conduit spacers to ensure placement and proper concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 2. All fittings shall be rated for installation in concrete and watertight.
 3. Space raceways laterally to prevent voids in concrete.
 4. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 5. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 6. Change from nonmetallic conduit to rigid steel conduit before exiting the floor or ceiling.
 7. Provide 2" thick by 2" tall concrete protection around portions of bends above slab. See "Stub-Up Connections" below for conduit exit from slab in exposed areas.
 8. Conduits shall not be installed beneath slabs on grade. For conduits that will not fit in the center 1/3 of the slab provide concrete encasement extending around conduits below slab with connections between encasement and slab for support of encasement or pour encasement as part of slab. Minimum 2 inch concrete cover in each direction. Conduit joints shall be water tight.
 9. Conduits installed in slabs on grade shall be water tight. Test each conduit using air pressure equivalent to water column extending from conduit up to grade. If a conduit terminates in a floor box then test it again after connection to the box. Minimum test pressure shall be 5 p.s.i. Test duration shall be four hours minimum. No perceptible pressure loss is permitted. See Specification Part 3 "Testing".
 10. No threadless fittings shall be permitted in concrete.
 11. Threaded conduit joints exposed to Wet, Damp, Corrosive or Outdoor Conditions: Apply listed compound to threads of raceway fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
1. Run parallel or banked raceways together on common supports.
 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

- L. Join raceways with fittings designed and approved for that purpose and make joints tight.
 - 1. Remove all burrs and install insulating bushings to protect conductors at all termination fittings.
 - 2. Solvent cements shall be used for all NMC installations with installation practices recommended by manufacturer to provide watertight connections.
- M. Tighten set screws of threadless fittings with suitable tools.
- N. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- O. Install pull wires in empty raceways after reaming. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- P. Optical Fiber and Communications Cable Raceways:
 - 1. Pathways shall comply with ANSI/ TIA-569-C
 - 2. 1 inch (25-mm) trade size and larger: Install raceways in maximum lengths of 100 feet (30.5 m).
 - 3. Install each length with a maximum of 180 degrees of bends (e.g. two 90 degree or three 60 degree or four 45 degree). Drawings may specifically require stricter limitations by note.
 - 4. Length limitations are measured between pull or junction boxes or terminations at distribution frames or cabinets to comply with the above requirements.
 - 5. No conduit body type fittings may be used.
 - 6. All bends shall be sweeping (bend radius shall be 10 times conduit inside diameter). All changes in direction regardless of angle shall be accomplished by raceway bends.

7. Pull and junction boxes shall be used only for straight through pathways. No bends or changes in direction permitted.

Q. Wall/Floor Penetrations

1. **Fire Rating Requirements**

See Section "Common Work Results for Electrical" for additional specific requirements related to fire ratings for penetrations and associated sleeves and seals. Likewise see that section for guidance on classification of walls and floors.

2. **Interior**

Non-Fire-Rated Interior Wall and Floor Penetrations: Seal annular space around raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants." Use only listed putty or similarly removable product to prevent cable damage when used in contact with communications and low voltage cables. For fire rated walls and all floors above grade see Section 26 05 00 item "Fire Rated Sleeve Seals" for fire rating requirements. Provide calculations for all fire rated penetration fittings demonstrating they meet 40% maximum raceway fill requirements and do not fall below minimum fill rating for the seal. For special conditions listed below install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed penetration systems including listed sealing compound. For concealed raceways, install each sealing fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

- a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces, heated to unheated, cooled to not cooled.
- b. Where underground service raceway enters a building or structure.
- c. Where otherwise required by NFPA 70.

3. **Exterior**

- a. Above grade. Provide U.L. approved weather resistant, sunlight resistant penetrations and sealants (inside and out) with fire rating equal to wall material (see Section 26 05 00 for fire rated penetration requirements). Penetrations shall be neat, uniform and no more than 1/4 inch larger than raceway. Trim, smooth and paint sealant. Seal annular space around raceway watertight. Install water-tight non adhering silicone inside raceway at the first exterior coupling to prevent water entry through the raceway. For penetrations visible in occupied spaces provide stainless steel escutcheons. Secure raceway to the wall with supports on both sides of the wall.

- b. Walls below grade and floors below or on grade. Provide watertight “link seal” type seals to provide a watertight seal around each raceway penetration through any existing wall or application where a wall pipe with waterstop has not been installed. Each raceway shall be installed in an individual wall pipe or sleeve unless grouping is clearly indicated on the drawings and U.L. Listed products are used to seal around all conduits in the group. New concrete walls shall have a wall pipe (per Division 07 Section “Penetration Firestopping” and Division 07 Section “Joint Sealants”). New concrete floors on or below grade shall encapsulate any horizontal conduit. Conduits are not permitted beneath slabs on or below grade. New conduit installation in existing concrete floors on grade are discouraged. If required by contract the conduit shall be pressure tested before and after concrete repair. See “Testing” paragraph below. Existing concrete and new or existing masonry wall penetrations shall have a U.L. Listed solution rated for the environment. It shall be similar to a new steel wall pipe installed with a circular epoxy ring installed around the interior wall annulus and the outside wall annulus to provide both a support structure and watertight seal around the exterior circumference of the wall pipe. Provide a seal between the wall pipe and the conduit as described above.
 - c. Provide a seal to prevent moisture inside the conduit from entering the building per NEC 300.5(G). Service raceways shall likewise be sealed to comply with NEC 230.8. Provide an OZ Gedney Type CRN, Cooper/Crouse Hinds or a field installed 3M Fire Barrier 2001 Silicone RTV Foam, Dow Corning 3-6548 Silicone RTV Foam or HRS RTV Silicon foam seal inside the conduit(s). All conduits that are sloped toward the building shall have a water trap immediately inside the building and after the seal. Water trap shall be either a pull box with drain or a weep hole with drain followed by a vertical rise in the raceway. No below grade exterior wall penetration shall be permitted to turn directly down into any electrical equipment, box, component or enclosure. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- R. **Roof-Penetration Sleeves:** Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work. Maintain all existing roof system warranties by use of materials and contractors recognized and approved by the roof system manufacturer. Roof penetrations other than those identified on the plans shall not be made without written permission from the Owner’s Representative.

- S. Stub-up Connections: Extend conduits through new above grade concrete floor for connection to freestanding or surface of the wall mounted equipment. For future equipment install with an adjustable top or coupling threaded inside with plugs set flush with finished floor. Where conduit is actually installed to equipment provide 1 inch minimum height concrete curb. Extend conductors to equipment with rigid steel conduit; LFMC (FMC in plenums only) may be used starting 6 inches (150 mm) above the floor (see flexible connection limits below). Install screwdriver-operated, threaded plugs flush with floor for future equipment connections. Where conduit radius cannot be contained within slab provide concrete curb adequate to contain radius. Provide width required for minimum 2" concrete thickness around conduit.
- T. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all transformers and motors. Use LFMC for all applications except FMC in air handling spaces and in plenums where PVC is prohibited. Install separate ground conductor across all flexible connections.
- U. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Use minimum 2 inch radius at bends. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. Plug-in Raceways: Raceway shall be supported on 2.5 feet spacing with bottom at 44 inches above finished floor unless otherwise noted on the plans. Installation shall comply with NEC Article 368 Busways.

3.03 INSTALLATION - BOXES

- A. Provide electrical boxes as shown on Drawings, and as required for wire pulling, equipment connection, and code compliance. All boxes shall be installed plumb to building lines. Electrical box locations shown on Drawings are approximate unless dimensioned. Verify location of outlets prior to rough in. Locate and install boxes to allow access and clearances per NEC.
- B. J-boxes shall be provided for branch circuits in excess of 100 feet.
- C. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal strap for supporting outlet boxes. Accessories shall be compatible with outlet boxes being used and shall meet requirements of individual situations.
- D. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation in non-fire-rated walls. Provide minimum 24-inch horizontal separation in acoustic-rated walls.

- E. Membrane penetration of 1-hour and up to maximum 2-hour fire rated walls and partitions by recessed steel electrical boxes that do not exceed 16 square inches in area are permitted, provided the aggregate area of the openings does not exceed 100 square inches in any 100 square feet of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch. Such boxes on opposite sides of the wall or partition shall be either separated by a horizontal distance of not less than 24 inches or separated by protecting both boxes by listed putty pads or other listed materials and methods.
- F. Set floor boxes level and flush with finished floor surface as designed by the manufacturer. Floor boxes shall be suitable for installation in concrete for new floors. In existing floors, boxes shall be fire rated, approved for specific application and installed per manufacturer's recommendations. See "Testing" below for requirements for slab on grade installations.
- G. Set floor boxes level. Trim after installation to fit flush with finished floor surface or with flange. See architectural floor treatment schedule.
- H. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- I. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry. Boxes shall not be permitted to move laterally. Boxes shall be secured between two studs. Boxes connected to one stud are not permitted.
- J. Provide knockout plugs for unused openings.
- K. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems as required by NEC and this document.
- L. Install boxes in walls without damaging wall insulation.
- M. Outlet boxes in plaster partitions shall be "shallow-type" set flush in wall so there is at least 5/8-inch plaster covering back of box.
- N. Switch boxes shall not be used as junction boxes.
- O. Typical outlet box centerline heights shall be as listed in the following table. Coordinate outlet heights with Architectural Drawings, millwork details, casework details and equipment installation. Specific location details on drawings shall take precedence over typicals in this table. Where discrepancies occur, ask for an interpretation from the Architect/Engineer and Owner.

A. Function	B. Receptacles	C. Telecommunications
D. Offices	E. 18-inches	F. 18-inches
G. Corridors	H. 18-inches	I. 18-inches
J. Exam Rooms	K. 48 or 18-inches	L. 48 or 18-inches
M. Millwork	N. Coordinate with millwork	O. Coordinate with millwork
P. Function	Q. Receptacles	R. Telecommunications
S. Casework	T. Coordinate with millwork	U. Coordinate with millwork
V. Headwalls	W. Refer to Architectural Drawings	X. Refer to Architectural Drawings
Y. Mechanical/Electrical Equipment Rooms	Z. 48-inches	AA. 48-inches
BB. Laboratories	CC. Coordinate with casework	DD. Coordinate with casework

- P. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of associated recessed luminaires, to be accessible through luminaire ceiling opening.
- Q. Outlet boxes supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures with separate supports, not from acoustic ceiling or ceiling tile wire.
- R. Lighting fixture outlets shall be coordinated with mechanical and architectural equipment and elements to eliminate conflicts and to provide a workable neat installation.
- S. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- T. Support pull and junction boxes independent of conduit. Combination box/conduit hangers from drop rod (like Caddy B18 Series) are acceptable only upon prior written approval from the Owner.
- U. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations. Set floor boxes level, and adjust floor box flush with finish flooring material. Final installation shall be watertight.

3.04 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.05 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes. Ream and bush all metal conduits. Clean all rough edges of nonmetallic conduits with a file.
- B. Blow out all water and debris from in slab conduit raceways. Perform a "go no-go test" with a flexible mandrel sized to match the conduit trade size under test. Conduit raceways shall be considered deficient if the mandrel cannot be pulled through the conduit with a 200# poly-line. Replace or repair all conduit sections that do not pass the mandrel test and repeat testing until all conduit raceways pass the test..

3.06 TESTING

- A. Conduits (service, feeder and branch circuit) installed in slabs on grade shall be water tight. Test each conduit using air pressure equivalent to water column extending from conduit up to grade. If conduit terminates in a floor box then test it again after connection to the box. Minimum test pressure shall be 5 p.s.i. Submit plan view drawing showing conduit, identifying use and verifying pressure test showing no leakage for four (4) hours and the pressure of the test. Testing shall be completed and approved prior to concrete pour and if terminated in a floor box, tested again after connection to the floor box..

3.07 NONCOMPLIANT INSTALLATIONS

- A. Installed conduits or boxes found to be not compliant with specified requirements shall be removed and compliant conduits or boxes installed. Conduits or boxes not installed according to above installation requirements shall be removed and installed to meet specified requirements. Such removal and reinstallation shall be done promptly to avoid further consequential remedial work. All such removal, including cast concrete, reinstallation and remediation shall be at the Contractor's expense.

END OF SECTION 26 05 33

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SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Ducts in direct-buried duct banks.
 - 2. Ducts in concrete-encased duct banks.
 - 3. Handholes and handhole accessories.
 - 4. Manholes and manhole accessories.
- B. Related Sections include the following:
 - 1. Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding electrodes, counterpoise conductors, clamps and connectors for grounding metallic manhole and handhole accessories, and testing of grounds.

1.03 SUBMITTALS

- A. In addition to the following specific requirements see Section "General Provisions For Electrical Work" for additional requirements.
- B. Product Data: For the following:
 - 1. Manhole and handhole hardware.
 - 2. Conduit and ducts, including elbows, bell ends, bends, fittings, and solvent cement.
 - 3. Duct-bank materials, including spacers and miscellaneous components.
 - 4. Warning tape.
- C. Shop Drawings: Show fabrication and installation details for underground ducts and utility structures and include the following:
 - 1. For manholes:
 - a. Duct sizes and locations of duct entries.
 - b. Reinforcement details.

- c. Manhole cover design.
 - d. Ladder and Step details.
 - e. Grounding details.
 - f. Dimensioned locations of cable rack inserts, pulling-in irons, lifting irons and sumps.
- 2. For precast manholes and handholes, Shop Drawings shall be signed and sealed by a qualified professional engineer, and shall show all of the above requirements for manholes and also the following:
 - a. Construction of individual segments.
 - b. Joint details.
 - c. Design calculations.
 - d. Pull-in ring locations and load ratings.
- D. Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures. Show existing grade and final grade. Include plans and sections drawn to scale, and show all bends and location of expansion fittings.
- E. Product Certificates: For concrete and steel used in underground precast manholes, according to ASTM C 858.
- F. Product Test Reports: Indicate compliance of manholes with ASTM C 857 and ASTM C 858, based on factory inspection.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories Including Ducts for Communications and Telephone Service: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete units at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.06 PROJECT CONDITIONS

- A. 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 Construction Manager at least five working days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Construction Manager's written permission.

1.07 COORDINATION

- A. Coordinate layout and installation of ducts, manholes, and handholes with final arrangement of other utilities and site grading, as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes and handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and to ensure duct runs drain to manholes and handholes, and as approved by Architect.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of amount installed. Minimum quantity of 2 for each item.

PART 2 PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Underground Polymer-Concrete Handholes:
 - a. Armorcast
 - b. Carson Industries LLC
 - c. Quazite: Hubbell Power Systems, Inc.
 - d. New Basis

2. Underground Fiberglass Handholes:
 - a. Carson Industries LLC
 - b. Christy Concrete Products
 - c. Nordic Fiberglass, Inc.
 - d. Quazite: Hubbell Power System, Inc.
3. Underground High-Density Plastic Handholes
 - a. Carson Industries LLC
 - b. Nordic Fiberglass, Inc.
 - c. PenCell Plastics
 - d. Quazite: Hubbell Power System. Inc.
4. Underground Precast Concrete Handholes, Manholes And Utility Structures:
 - a. Christy Concrete Products, Inc.
 - b. Elmhurst-Chicago Stone Co.
 - c. Oldcastle Precast Group
 - d. Rinker Group, Ltd
 - e. Riverton Concrete Products.
 - f. Utility Concrete Products, LLC.
 - g. Utility Vault Co.
 - h. Wausau Concrete Co.
5. Frames and Covers:
 - a. Campbell Foundry Co.
 - b. East Jordan Iron Works, Inc.
 - c. McKinley Iron Works, Inc.
 - d. Neenah Foundry Co.
6. Nonmetallic Ducts and Accessories:
 - a. Arnco Corp.
 - b. Beck Manufacturing Inc.
 - c. Cantex, Inc.
 - d. Certainteed Corp.; Pipe & Plastics Group.
 - e. Condux International, Inc.
 - f. ElecSys, Inc.
 - g. Electri-Flex Co.
 - h. Ipex, Inc.
 - i. Lamson & Sessions; Carlon Electrical Products.
 - j. Spiraduct/AFC Cable Systems, Inc.

2.02 CONDUIT

- A. Conduit and fittings are specified in Division 26 Section "Raceways and Boxes for Electrical Systems."

2.03 DUCTS

- A. Underground Plastic Utilities Duct: NEMA TC 2, Type EPC-40-PVC, UL 651, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 3 and UL 514B.
- B. Underground Plastic Utilities Duct: NEMA TC 2, Type EPC-80-PVC, UL 651, ASTM F 512 with matching fittings by the same manufacturer as the duct, complying with NEMA TC 3 and UL 514B.

2.04 HANDHOLES

- A. PVC Ground Access Well - 10 inch diameter Schedule 80 PVC 42" long with four (4) 27" long slots, cast iron ring and cast iron cover for highway load rating A-12.
- B. Cast-Metal Boxes: Cast aluminum, with outside flanges and recessed, gasketed cover for flush mounting and with nonskid finish and legend on cover. Unit, when buried, shall be designed to support AASHTO H10 loading.
- C. Precast Handholes: Reinforced polymer-concrete, monolithically poured walls and top frame and steel or fiberglass reinforcement. Cover shall be reinforced polymer-concrete and have nonskid finish and legend. Unit, when buried, shall be designed to support AASHTO H10 loading. Unit shall be 48 inch by 24 inch by 24 inch unless otherwise dimensioned on the plans.
- D. Fiberglass Handholes: Molded fiberglass, with polymer concrete frame and cover. Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer-concrete top ring and frame. Cover with nonskid finish and legend. Unit, when buried, shall be designed to support AASHTO H10 loading. See plans for dimensions.
- E. High Density Plastic Handholes: Injection molded of high-density polyethylene or copolymer-polypropylene. Cover shall be made of polymer concrete.
- F. Cover Legend: "ELECTRIC."

2.05 PRECAST MANHOLES

- A. Precast Units: ASTM C 478, with interlocking mating sections, complete with accessories, hardware, and features as indicated. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

- B. Design and fabricate structure according to ASTM C 858 using Class A Concrete.
- C. Design structure according to details on Drawings.
- D. Structural Design Loading: ASTM C 857, Class A-16.
- E. Joint Sealant: Continuous extrusion of asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- F. Source Quality Control: Inspect structures according to ASTM C 1037.

2.06 ACCESSORIES

- A. Duct Spacers: Rigid PVC interlocking spacers, selected to provide minimum duct spacings and cover depths indicated while supporting ducts during concreting and backfilling; produced by the same manufacturer as the ducts.
- B. Manhole Frames and Covers: Comply with AASHTO loading specified for manhole.
 - 1. Provide cast covers with cast-in legend:
 - a. "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
 - b. "ELECTRIC-HV" for duct systems with medium-voltage cables.
 - c. "COMMUNICATIONS" for communications, data, and telephone duct systems.
 - 2. Weatherproof gray cast iron complying with ASTM A 48/A 48M, Class 30B with cast-in legend "ELECTRIC" as indicated. Milled cover-to-frame bearing surfaces. Finish shall be non-skid with minimum 0.50 coefficient of friction.
 - 3. Manhole Frames: ASTM A 48; Class 30B gray iron, 30-inch (762-mm) size, machine-finished with flat bearing surfaces.
 - 4. Special Covers: Recess on cover designed to accept finish material in paved areas.
 - 5. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. Fr. Where packaged mix complying with ASTM C 387, Type M, may be used.
 - b. Seal joints watertight using preformed plastic or rubber conforming to ASTM C 990. Install sealing material according to the sealant manufacturers' printed instructions.

- C. Sump Frame and Grate: ASTM A 48/A 48M, Class 30B gray cast iron.
- D. Pulling Eyes in Walls: Eyebolt with reinforcing-bar fastening insert 2-inch- (50-mm-) diameter eye and 1-by-4-inch (25-by-100-mm) bolt.
 - 1. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.
- E. Pulling and Lifting Irons in Floor: 7/8-inch- (22-mm-) diameter, hot-dip-galvanized, bent steel rod; stress relieved after forming; and fastened to reinforced rod. Exposed triangular opening.
 - 1. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.
- F. Bolting Inserts for Cable Stanchions: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (30 mm) minimum at base.
 - 1. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.
- G. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch (13-mm) bolt, 5300-lbf (24-kN) rated pullout strength, and minimum 6800-lbf (30-kN) rated shear strength.
- H. Cable Stanchions: Hot-rolled, hot-dip-galvanized, T-section steel; 2-1/4-inch (57-mm) size; punched with 14 holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.
- I. Cable Arms: 3/16-inch- (5-mm-) thick, hot-rolled, hot-dip-galvanized, steel sheet pressed to channel shape; 12 inches (300 mm) wide by 14 inches (350 mm) long and arranged for secure mounting in horizontal position at any location on cable stanchions.
- J. Cable-Support Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- K. Grounding Materials: Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."
- L. Ladder: UL-listed, heavy-duty fiberglass specifically designed for electrical manhole use. Minimum length equal to distance from deepest manhole floor to grade plus 36 inches (900 mm). One portable required.

- M. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and of adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- N. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
- O. Concrete Warning Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 76 mm) in size, manufactured from 6000-psi (41-MPa) concrete.
 - 1. Color: Red dye added to concrete during batching.
 - 2. Mark each plank with "ELECTRIC" in 2-inch- (50-mm-) high, 3/8-inch- (10-mm-) deep letters.
- P. Concrete-Encasement Color Additive:
 - 1. Provide red dyed concrete for all power applications.
 - 2. Provide green dyed concrete for all data/telephone applications.
- Q. Cover Hooks: Heavy duty, designed for lifts 60 lbf (270 N) and greater. Quantity of one.

2.07 CONSTRUCTION MATERIALS

- A. Waterproofing: Comply with Division 07 Section "Bentonite Composite Sheet Waterproofing."
- B. Dampproofing: Comply with Division 07 Section "Bituminous Dampproofing."
- C. Mortar: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.
- D. Brick for Manhole Chimney: Sewer and manhole brick, ASTM C 32, Grade MS.
- E. Concrete: Use 3000-psi- (20.7-MPa-) minimum, 28-day compressive strength and 3/8-inch (10-mm) maximum aggregate size. Concrete and reinforcement are specified in Division 03 Section "Cast-in-Place Concrete."

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate layout of ducts, manholes, handholes and boxes with final arrangement of other utilities, site grading and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed and protect vegetation to remain according to Section 31 10 00 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 31 10 11 "Site Clearing."

3.02 UNDERGROUND DUCT APPLICATION

- A. Underground Ducts for Electrical Cables Higher Than 600 V: Type EPC-80-PVC, concrete-encased duct bank.
- B. Underground Ducts for Electrical Feeders: Type EPC-40, concrete-encased duct bank.
- C. Underground Ducts for Electrical Branch Circuits: Type EPC-40, direct-buried duct bank.
- D. Underground Ducts for Telephone Utility Service: Type EPC-40-PVC, direct-buried duct bank, except use Type EPC-80-PVC when crossing roads and railroads.
- E. Underground Ducts for Communication Circuits: Type EPC-40-PVC, direct-buried duct bank.
- F. Manholes: Underground precast concrete.
- G. Handholes: Precast Polymer Concrete.

3.03 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving" but do not use heavy-duty, hydraulic-operated, compaction equipment. Local grading near handhole and manhole access openings shall be sloped 1/8" per foot to drain surface water away from opening for at least a four foot radius.

- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 31 Section "Earth Moving" and Division 32 "Turf and Grasses" and "Plants."
- D. Restore disturbed pavement. Refer to Division 01 Section "Cutting and Patching."

3.04 CONDUIT AND DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use manufactured elbows for stub-ups at equipment and at building entrances. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 25 feet (7.5 m), both horizontally and vertically, at other locations.
- C. Use solvent-cement joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.
- D. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C. and any where the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- E. Duct Entrances to Manholes and Handholes: Space end bells approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Grout end bells into manhole walls from both sides to provide watertight entrances.
 - 3. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than $\frac{3}{4}$ inc (19mm).

- F. **Building Wall Penetrations:** Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Follow the appropriate installation instructions below:
1. **Concrete-Encased Ducts:** Install reinforcement in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall.
 2. **Direct-Buried, Non-encased Ducts at Non-waterproofed Wall Penetrations:** Install a Schedule 40, galvanized steel pipe sleeve for each duct. Calk space between conduit and sleeve with duct-sealing compound on both sides for moisture-tight seal.
 3. **Waterproofed Wall and Floor Penetrations:** Install a watertight entrance-sealing device with sealing gland assembly on the inside. Anchor device into masonry construction with one or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.
- G. **Concrete-Encased, Ducts:** Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:
1. **Width:** Excavate trench 6 inches (150mm) wider than duct bank on each side.
 2. **Separator Installation:** Space separators close enough to prevent sagging and deforming of ducts and secure separators to earth and to ducts to prevent floating during concreting. Stagger spacers approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 3. **Concreting:** Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application. Pour each run of envelope between manholes or other terminations in one continuous operation. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope. Comply with requirements in "Concrete Placement" Article in Section 03 30 00 "Cast-in-Place Concrete."

4. Reinforcement: Reinforce duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 6. Minimum Clearances between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
 7. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in nontraffic areas and at least 30 inches (750 mm) below finished grade in vehicular traffic areas, unless otherwise indicated.
 8. Color Additive: Unless specifically deleted provide color additives to concrete as indicated in Part 2 of this Specification.
- H. Direct-Buried Duct Banks: Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:
1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts. Use a minimum of five spacers per 20 feet (6m) of duct. Stagger spacers at least 6 inches between tiers.
 2. Install expansion fittings as shown on Shop Drawings.
 3. Trench Bottom: Continuous, firm, and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earthmoving" for pipes less than 6 inches (150 mm) in nominal diameter.
 4. Backfill: Install backfill as specified in Division 31 Section "Earthmoving." After installing first tier of ducts, backfill and compact. Repeat backfilling after placing each tier. Allow ducts to run freely along linear path to allow for expansion and contraction due to temperature changes. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, complete backfilling normally.
 5. Minimum Clearances between Ducts: 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.

6. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.
- I. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased duct banks. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank.
- J. Stub-ups: Use rigid steel conduit for stub-ups to equipment. For equipment mounted on outdoor concrete bases, extend steel conduit a minimum of 5 feet (1.5 m) from edge of base. Install insulated grounding bushings on terminations. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches (75 mm) of concrete.
- K. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- L. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.

3.05 MANHOLE AND HANDHOLE (CONCRETE) INSTALLATION

- A. Elevation: Install manholes with rooftop at least 15 inches (375 mm) below finished grade. Install handholes with bottom below frostline or as indicated on the plans.. Set lid surface 1 inch (25 mm) above grade.
- B. Drainage: Install drains in bottom of units where indicated. Coordinate with drainage provisions indicated.
- C. Access: Install cast-iron frame and cover.
 1. Install brick chimney to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
 2. Install precast collars and rings to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
 3. Set frames in paved areas and trafficways flush with finished grade. Set other frames 1 inch (25 mm) above finished grade.
- D. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. Apply according to Division 07 Section "Elastomeric Sheet Waterproofing." After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole and handhole chimneys after brick mortar has cured at least three days.

- E. Dampproofing: Apply dampproofing to exterior surfaces of concrete handholes after concrete has cured at least three days. Apply according to Division 07 Section "Bituminous Dampproofing." After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars.
- F. Hardware: Install removable hardware, pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
- G. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches (98 mm) for anchor bolts installed in manholes in the field. Use a minimum of two anchors for each cable stanchion.
- H. Grounding: Install ground rod through floor in each structure with top protruding 4 inches (100 mm) above floor. Seal floor opening against water penetration with waterproof nonshrink grout. Ground exposed metal components and hardware with bare-copper ground conductors with #1/0 minimum bare copper unless otherwise stipulated. Train conductors neatly around corners. Use cable clamps secured with expansion anchors to attach ground conductors.
- I. Precast Concrete Manhole Installation: Unless otherwise indicated, comply with ASTM C 891.
 - 1. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
 - 2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

3.06 INSTALLATION OF HANDHOLES (OTHER THAN CONCRETE)

- A. Install handholes plumb and with orientation and depth coordinated with connecting ducts and in accordance with any details on the plans. Use box extensions and seal extensions as required.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from ½ inch (12.5 mm) sieve to No. 4 (4.75 mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In pave areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
- D. Grounding: Provide grounding in accordance with Section 26 05 26 "Grounding and Bonding for Electrical systems" where indicated on the plans.

3.07 FIELD QUALITY CONTROL

- A. Testing: Demonstrate capability and compliance with requirements on completion of installation of underground ducts, manholes and handholes.
- B. Grounding: Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Test handhole grounding where provided. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Duct Integrity: Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of the duct. If obstructions are indicated, remove obstructions and retest.
- D. Correct installations if possible and demonstrate compliance. Remove and replace defective products.

3.08 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 05 43

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SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.03 SUBMITTALS

- A. Provide the detailed requirements below in addition to requirements in Section "General Provisions For Electrical Work".
- B. Product Data: For each electrical identification product indicated.
- C. Samples: For each type of label and sign to illustrate color, lettering style, and graphic features of identification products. Include fastener. Provide list of uses for each sample.

1.04 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 PRODUCTS

2.01 RACEWAY AND CABLE LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 - 1. Color: Black letters on orange field.
 - 2. Legend: Indicates voltage and service.
- B. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position (cable).

- C. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
 - 1. Not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick).
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend indicating type of underground line.
- D. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch- (0.4-mm-) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors (medium voltage cable, 600 volt feeders #1/0 and larger).
- E. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch (0.05 mm) thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application (medium voltage cable, 600 volt feeders #1/0 and larger).
- F. Brass or Aluminum Tags: 2 by 2 by 0.05-inch (51 by 51 by 1.3-mm) metal tags with stamped legend, punched for fastener (medium voltage cable, 600 volt feeders #1/0 and larger).

2.02 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 - 1. Engraved legend with black letters on white face (red face for emergency or standby power).
 - 2. Engraved legend with white letters on blue face for UPS power.
 - 3. Punched or drilled for mechanical fasteners.
- C. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.03 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength: 50 lb (22.3 kg) minimum.
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: According to color-coding.
- B. Paint: Formulated for the type of surface and intended use.
1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
 2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
 3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
 4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Circuits with More Than 600 V: Identify raceway and cable with "DANGER--HIGH VOLTAGE" in black letters 2 inches (51 mm) high, stenciled with paint at 10-foot (3-m) intervals over a continuous, painted orange background. Identify the following:
1. Entire floor area directly above conduits running beneath and within 12 inches (305 mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
 2. Wall surfaces directly external to conduits concealed within wall.
 3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
 4. Entire surface of exposed conduits.
- F. Install painted identification according to manufacturer's written instructions and as follows:
1. Clean surfaces of dust, loose material, and oily films before painting.

2. Prime surfaces using type of primer specified for surface.
 3. Apply one intermediate and one finish coat of enamel.
- G. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
 3. Apply the following colors to the systems listed below:
 - a. Fire Alarm System: Red.
 - b. Fire-Suppression Supervisory and Control System: Red and yellow.
 - c. Combined Fire Alarm and Security System: Red and blue.
 - d. Security System: Blue and yellow.
 - e. Mechanical and Electrical Supervisory System: Green and blue.
 - f. Telecommunication System: Green and yellow.
- H. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install engraved plastic labels identifying system voltage color scheme according to system. Install on exterior of door or cover.
- I. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly 12 inches above the cable, raceway or ductbank. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm) overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
- J. Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder and branch-circuit phase conductors:
1. 208/120-V Conductors:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 2. 480/277-V Conductors:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.

3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.
- K. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
 1. Legend: 1/4-inch- (6.4-mm-) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 2. Tag Fasteners: Nylon cable ties.
 3. Band Fasteners: Integral ears.
- L. Apply identification to conductors as follows:
 1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- M. Apply warning, caution, and instruction signs as follows:
 1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Provide signs at all service switches per NEC Articles 230.70 and 230.2.
 2. Emergency Operation: Install engraved laminated signs with black legend on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

N. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high lettering on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high. Use black lettering on white field for non power related equipment. Use Letter/Face colors as specified under "Nameplates and Signs" in Part 2 above for power related equipment. Label shall identify the labeled equipment, its load and its source. Apply labels for each unit of the following categories of equipment using mechanical fasteners:

1. Service disconnects
2. Panelboards, electrical cabinets, and enclosures.
3. Access doors and panels for concealed electrical items.
4. Electrical switchgear and switchboards and each compartment.
5. Electrical substations and each compartment.
6. Emergency system boxes and enclosures.
7. Motor-control centers and each compartment.
8. Disconnect switches.
9. Enclosed circuit breakers.
10. Motor starters.
11. Push-button stations.
12. Power transfer equipment.
13. Contactors.
14. Remote-controlled switches.
15. Dimmers.
16. Control devices.
17. Transformers.
18. Inverters.
19. Rectifiers.

20. Frequency converters.
21. Battery racks.
22. Power-generating units.
23. Telephone switching equipment.
24. Call system master station.
25. Fire alarm master station or control panel.
26. Security-monitoring master station or control panel.

END OF SECTION 26 05 53

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SECTION 26 05 73 - ELECTRICAL POWER SYSTEM ANALYSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Analysis. This Section includes computer-based, fault-current and arc flash analysis in addition to overcurrent protective device coordination studies, and the determination of settings or size selection for these devices. Subject of the analyses/studies are the oneline diagrams on the drawings and the companion specifications describing the devices shown on them. Oneline diagrams and log-log graphs containing annotation and calculated data for the above analyses are required for these analyses as further described below. Provide arc flash labels for each equipment item for which arc flash calculations are performed. Use data from the final approved report and install the labels.

- 1. Use of series-rated devices is not permitted.

- B. Implementation. The final settings, adjustments and modification results from these analyses shall be implemented into the power system when and as directed by the Engineer. See Testing Agency requirements below.

1.03 DEFINITIONS

- A. OCPD Overcurrent Protective Device
- B. NEC National Electrical Code – NFPA 70, 2014 Edition
- C. NFPA National Fire Protection Association
- D. NFPA 70E Electrical Safety in the Workplace, 2015 Edition
- E. PPE Personal Protective Equipment – Defined in NFPA 70E
- F. NETA InterNational Electrical Testing Association
- G. ATS NETA Acceptance Testing Specifications – 2007 Edition
- H. Settings Specific setpoints for adjustable long time, short time, instantaneous and ground fault functions of circuit breakers or size and type description for fuses.

1.04 SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Product Certificates: For coordination-study, arc flash and fault-current-study computer software programs, certifying compliance with IEEE 399.
- C. Qualification Resume: For coordination-study specialist.
- D. Other Submittals:
 - 1. Coordination, arc flash and fault study input data, including completed computer program input data sheets.
 - 2. Fault-study report and oneline diagrams. Oneline shall show all devices, incident fault current and regenerative fault current for each device, as well as switch positions and condition of devices (open/closed)
 - 3. Coordination-study report including coordination curves. Selective coordination selections and settings shall be provided for emergency and legally required standby systems and common feeders to multiple elevators and normal power systems (when specifically required in this section or on the one line diagrams). Provide a oneline diagram that identifies each device evaluated in the coordination study by tag name.
 - 4. Arc Flash-study report and oneline diagrams. Online shall show arc flash energy, hazard/PPE category for each device, as well as switch positions and condition of devices (open/closed)
 - 5. Equipment evaluation report.
 - 6. Settings/sizing report. Include input data on device size/type (fuses only) or actual devices approved, actual setting ranges available, default settings and recommended settings for circuit breakers. Settings (sizes) shall be provided for all OCPD's where selective coordination is required to provide that coordination. Settings shall be provided for all other adjustable OCPD's to provide optimum performance considering best combination of selectivity, equipment protection and arc flash protection for workers. Time current curves on log-log graph paper showing final OCPD curves and settings for all overcurrent protective devices. Typical situations need not be replicated but appropriate identification of each like situation should be noted.
 - 7. Executive summary with recommendations. Include recommended steps to reduce arc flash category "dangerous" and "category 4" conditions that can be achieved without significant capital expenditures. Conditions where coordination is required but cannot be achieved shall be listed along with potential solutions.

1.05 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- B. Coordination-Study Specialist Qualifications: An organization experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices. Person performing the study must be a registered Professional Engineer in the State of Ohio and provide such seal on the final approved study.
- C. Comply with IEEE 399 for general study procedures.
- D. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

PART 2 PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

- A. Computer Software Developers: Subject to compliance with requirements, provide computer software programs developed by one of the following:
 - 1. Operation Technology, Inc. (OTI); ETAP
 - 2. EDSA Micro Corporation.
 - 3. ESA
 - 4. SKM Systems Analysis, Inc.
 - 5. Power Analytics Corporation

2.02 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399 and IEEE 551.
- B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399, Table 7-4.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
 - 1. Optional Features:
 - a. Arcing faults.
 - b. Simultaneous faults.
 - c. Explicit negative sequence.
 - d. Mutual coupling in zero sequence.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions such as bracing, damage curves and withstand ratings. Devices required to be coordinated are those in all legally required systems devices and normal power system devices (when specified herein or on the one line diagrams) down to and including all 480 volt loads. It also includes the main and branch breakers in all 208 volt or 240 volt panelboards not fed by a single transformer of 112.5 kVA or less. See the One Line Drawings. This includes but is not limited to power systems feeding fire pumps, elevators, emergency systems (NEC 700) and legally required systems (NEC 701). It would also include Healthcare power systems such as Critical Branch, Life Safety Branch and Equipment System. It also includes Designated Critical Operations Areas power supply as defined in Critical Operations Systems, Article 708 of the NEC. Portions of the power system not legally required or specifically specified to be coordinated shall be adjusted to provide “best possible” condition only.
- B. Proceed with coordination study only after relevant equipment submittals have been assembled and approved and details of impedances within the installed system can be established. Overcurrent protective devices not submitted and approved may not be used in study.

3.02 STUDY SETUP REQUIREMENTS

- A. Medium Voltage Distributions Systems: Available fault current from the selected source in the study shall be the source fault current available either from the Utility or an existing engineering evaluation provided by the Owner. Inquire as to future plans to increase the available fault current before proceeding.
- B. Low Voltage (600V and below) Distributions Systems: Available fault current from the medium voltage source to the low voltage transformer shall be obtained, either from the Utility or a medium voltage system study. The actual present available medium voltage fault current shall be used for one evaluation case and an infinite available medium voltage fault current shall be used for a second case. Use the transformer impedance provided by the Utility or from equipment provided as part of the construction documents as appropriate.

3.03 POWER SYSTEM DATA

- A. Gather and tabulate the following input data to support all three studies:
 - 1. Product Data for overcurrent protective devices actually approved and installed as work of other Division 26 Sections and actual impedances of installed conductors, transformers and overcurrent protective devices. Use equipment designation tags that are consistent with electrical distribution system diagrams and overcurrent protective device submittals for input and output data, and recommended device settings.

2. Impedance of utility service entrance and any on site generation.
 - a. See Study Setup Requirements (above)
3. Electrical distribution system diagram showing the following:
 - a. Load current that is the basis for sizing continuous ratings of circuits for cables and equipment.
 - b. Circuit-breaker and fuse-current ratings and types.
 - c. Relays and associated power and current transformer ratings and ratios.
 - d. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - e. Generator kilovolt amperes, size, voltage, and source impedance.
 - f. Cables. Indicate conduit material, sizes of conductors, conductor insulation, and length.
 - g. Busway ampacity and impedance.
 - h. Motor horsepower and code letter designation according to NEMA MG 1. Only motors 25 horsepower and larger need to be included as fault current contributors in the fault current analysis
4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Magnetic inrush current overload capabilities of transformers.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Ratings, types, and settings of utility company's overcurrent protective devices.
 - e. Special overcurrent protective device settings or types stipulated by utility company.
 - f. Time-current-characteristic curves of devices indicated to be coordinated.
 - g. Manufacturer, frame size, interrupting rating in amperes RMS symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
 - h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
 - i. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes RMS symmetrical.

3.04 FAULT-CURRENT STUDY

- A. Source Impedance: As an infinite bus on primary side of utility transformer. Indicate actual utility fault current available for comparison.
- B. Study electrical distribution system from normal and alternate power sources including all possible connection scenarios throughout electrical distribution system for the Project and use approved computer software program to calculate values. Include studies of system-switching configurations and alternate operations that could result in maximum and minimum fault conditions. If parallel operation of sources is indicated on the drawings include that combined fault current option in the analysis. Provide a complete one line diagram showing computed fault currents at all buses, OCPD's and electrical components and loads. Provide separate one line diagrams for each variation of utility and on site sources.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141, 241 and IEEE 242 as appropriate. All OCPD's should be in conformance with:
 - 1. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
 - 2. Low-Voltage Fuses: IEEE C37.46.
 - 3. Medium –Voltage Circuit Breakers: IEEE C37.010.
- E. Study Report: Enter calculated X/R ratios and interrupting (5-cycle) fault currents on electrical distribution system diagram of the report. List other output values from computer analysis, including momentary (1/2-cycle), interrupting (5-cycle), and 30-cycle fault-current values for 3-phase, 2-phase, and phase-to-ground faults for medium voltage OCPD's and low voltage OCPD's in excess of 1000 amperes. Report shall include a complete oneline diagram showing all buses, OCPD's, conductors and fault currents flowing to the load and fault current contributions from loads at each OCPD. Sheet size shall be 24 inches by 36 inches minimum.
- F. Equipment Evaluation Report: Prepare a report on the adequacy of overcurrent protective devices and conductors by comparing fault-current ratings of these devices with calculated fault-current momentary and interrupting duties. Include the following in the Equipment Evaluation Report:
 - 1. For 600-V OCPD's ensure that interrupting ratings are equal to or higher than calculated ½ cycle symmetrical fault current.
 - 2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2–cycle symmetrical fault current.

3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short circuit withstand ratings are equal to or higher than 1/2 –cycle symmetrical fault current.

3.05 COORDINATION STUDY

- A. Perform coordination study and prepare a written report using the actual fault-current available and approved computer software program. Comply with IEEE 399. Clearly make note of any “Zone Selective Interlocking” schemes as well as other special arc flash reduction systems and show their curve shifting or energy reducing function to produce coordination.
 1. Calculate the maximum and minimum ½ cycle short-circuit currents.
 2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 cycles) short-circuit currents as well as maximum and minimum ground-fault currents for all medium voltage equipment.
- B. Comply with NFPA 70 for overcurrent protection of circuit elements and devices.
- C. Comply with IEEE 242 Buff Book recommendations for fault currents and time intervals.
- D. Transformer Primary Overcurrent Protective Devices:
 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 2. Device settings shall protect transformer according to IEEE C57.12.00, for fault currents.
- E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Verify adequacy of phase conductors at maximum three-phase bolted fault currents, equipment grounding conductors, and grounding electrode conductors at maximum ground-fault currents to withstand those without damage. Use cable manufacturer damage curves.
- F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
 1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.

- c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Special note shall be taken for all elevator power supplies, emergency and legally required power systems, fire pump power supply circuits and Uninterruptible Power Supply sources and loads in the report. Graphically illustrate that adequate time separation exists between each device and the device supplying power to it. There are two exceptional cases not requiring coordination. The first exception is transformer primary to secondary main OCPD's. The second exception is two OCPD's in series both of which serve only the same load. The coordination of non code required portions of the power system shall be evaluated including power utility company's upstream devices. The non code required portions of the power system shall be plotted as well as the legally required systems however nothing more than "best adjustment" possible is required. Show the following specific information:
 - a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
3. Completed data sheets for setting of overcurrent protective devices.
4. Summary of all uncoordinated conditions in systems required by the NEC to be coordinated.
5. Include imbedded portions of one line power diagram with coordination curves clearly marked to assist in understanding the coordination curves

3.06 ARC FLASH STUDY

- A. Using the actual fault current available as determined from the coordination study calculate the maximum arc flash energy conditions at each device whose function is to interrupt current with the following qualifications:
 1. OCPD's fed by a single transformer no larger than 112.5 KVA and whose secondary is 240 volts or less, three phase need not be evaluated and just labeled as Category 0. All fuses shall be sized and the type selected based upon the best solutions from the study. Likewise all circuit breakers trip settings shall be adjusted per conclusions of the coordination study. Evaluated devices would include but not be limited to OCPD's, automatic and manual transfer switches, disconnect switches, contactors and motor controllers. Separate scenarios shall be evaluated for all possible variations in sources of power and alternative pathways for power. Worst case results shall dictate the information provided on

equipment arc flash labels (provided as part of this work). Arc Flash boundary, limited, restricted and prohibited approach boundary distances shall be calculated. Each calculation point shall include the available energy in calories per square centimeter to determine the above distances and shall be the basis for included requirements for personal protective equipment categories per NFPA 70E. All work and results shall comply with NFPA 70E recommendations and requirements. All calculations shall be performed using IEEE STD 1584-2002 and 1584a-2004 guidelines.

- B. The report shall include tabular data coordinated with a oneline diagram so that calculated values for each point on the oneline diagram are easily located by organization using major equipment titles. Data shall clearly indicate causal conditions that produce “Category 4” and “Dangerous” determinations. Oneline diagrams shall be provided for each power supply alternative and shall indicate the fault energy available and PPE category at each evaluated device as defined above. Oneline diagrams shall be printed on 24 inch by 36 inch minimum size sheets.
- C. The report shall indicate if changes to OCPD types, settings or ratings can be implemented to reduce the “Category 4” and “Dangerous” determinations to a lower Category. Clearly identify any “Zone Selective Interlocked” circuit breakers and the curve shifting that occurs and the benefit provided. In a similar manner show effects of any arc flash detection system or maintenance selector switch upon available energy within their area of influence.
- D. Submit the report to the Engineer for Review. Submittal shall include sufficient copies to permit the Engineer to retain one copy. Implement and/or address all comments before issuing final copies and before production of Arc Flash Labels.
- E. Arc Flash labels shall meet NFPA 70E and NFPA 70 requirements and shall include all boundary distances, shock hazard, Arc Flash Energy level, PPE category and Glove Class. Include device label and required warnings and signs. Final approved report data shall be used to produce all labels. Assume that adjustments will be required after review of the submitted report and that an addition of calculation points and labels will be requested after review in the amount of 5% of those in the report.
- F. Provide 4 bound copies of the final approved reports to the Owner as well as a CD containing the data base. Provide 1 bound copy of the final approved reports to the Engineer.

3.07 OVERCURRENT PROTECTIVE DEVICE SETTING

- A. **Manufacturer's Field Service:** Engage a factory-authorized service representative, of electrical distribution equipment being set and adjusted, to set all overcurrent protective devices with adjustment capability that are part of legally required electrical systems. These adjustments are to be injection tested and verified. Provide recommended settings for other OCPD's that provide best available level of coordination and protection. See Testing Agent Qualifications requirements in Part 1.

- B. Testing: Perform the following device setting and prepare reports:
1. After installing overcurrent protective devices and during energizing process of electrical distribution system, the Contractor shall perform the following:
 - a. Verify that overcurrent protective devices and their settings meet parameters used in studies.
 - b. Adjust devices to values listed in study results after approval by the Engineer.
 2. Adjust devices for all legally required systems according to recommendations in NETA ATS Chapter 7, "Inspection and Test Procedures," and Tables 10.7 and 10.8 in NETA ATS.

END OF SECTION 26 05 73

SECTION 26 09 15 - ELECTRICAL POWER METERING – (STAND ALONE)

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes microprocessor based metering of electrical power circuits. Provide all wiring to make a complete and functional power meter.

1.03 DEFINITIONS

- A. C/T: Current transformer. Transformer used to reduce actual current to a lower current that represents actual line current.
- B. P/T: Potential (voltage) transformer used to reduce actual voltage to a lower voltage that represents actual line voltage.

1.04 SUBMITTALS

- A. Provide the detailed requirements below in addition to requirements in Section “General Provisions For Electrical Work”.
- B. Product Data: List of components for electric power meter, including dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes. Also included are C/T's, P/T's and associated wire and hardware necessary to provide a complete and functional electric power meter.
- C. 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 other items furnished as part of the power distribution system.
 - 3. Wiring Diagrams: Detail specific wiring to suit Project. Identify each wire between all system components. Coordinate nomenclature and presentation with a block diagram, and differentiate between manufacturer-installed and field-installed wiring.
- D. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. Startup Personnel Qualifications: Engage specially trained personnel who are directly employed by a manufacturer of meter system equipment devices to verify and test the installation before energizing.
- 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 indicated use and installation conditions.
- C. Comply with NEMA EI 21.1, IEEE C57.13.

1.06 COORDINATION

- A. Coordinate features of the electric system and the microprocessor based meter and the instrument transformers to form an integrated interconnection of compatible components.
 - 1. Match components and interconnections for optimum performance of specified functions.

1.07 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace electric power meter and instrument transformers that fail in materials or workmanship within specified warranty period.
- C. Special Warranty Period for Electrical Power Metering function and components: Two years from date of Substantial Completion.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Instrument transformer fuses: Quantity 2 each size.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide products by one of the following:

1. ABB Power T&D Company Inc.; Distribution Systems Division.
2. Cutler-Hammer Products; Eaton Corporation.
3. GE Electrical Distribution and Control.
4. Siemens Energy & Automation, Inc.
5. Square D Co.; Power Management Organization.

2.02 HARDWARE

- A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
1. Potential Transformers: Secondary voltage rating of 120V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
 2. Current Transformers: Ratios shall be as recommended by vendor with accuracy class and burden suitable for connected meter.
 3. Control-Power Transformers: Dry type, 3 KVA.
- B. Meter: Microprocessor-based unit suitable for three- or four-wire systems with nonvolatile memory and with the following features:
1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
 - a. Phase Currents, Each Phase: Plus or minus 1 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - d. Megawatts: Plus or minus 2 percent.
 - e. Megavars: Plus or minus 2 percent.
 - f. Power Factor: Plus or minus 2 percent.
 - g. Frequency: Plus or minus 0.5 percent.
 - h. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from 5 to 60 minutes.
 - i. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent. Accumulated values unaffected by power outages up to 72 hours.
 - j. Mounting: Display and control unit flush or semiflush mounted in enclosure door.

2.03 LOCAL METER DISPLAY

- A. Description: Microprocessor-based, self-contained device mounted integral to meter in NEMA 1 enclosure and arranged to display values of parameters metered. LCD characters with LED backlight, 7 characters 1/8 inch minimum. Touch navigation buttons. Provide imbedded surge protective device to protect solid state components that meets requirements of ANSI/UL 1449 3rd Edition.

2.04 ADDITIONAL COMPONENTS

- A. Current Transformers: For microprocessor based meter furnished under this Section. Provide integral with meter, in separate enclosure or for installation in other equipment as indicated on drawings. Split core units may be provided when connecting to existing power conductors
 - 1. Primary Rating: Equal to or more than that of associated circuit-breaker trip rating. Equip with shorting switches.
- B. Potential Transformers: Provide integral with meter, in separate enclosure or for installation in other equipment as indicated on drawings. Provide only when voltage exceeds meter voltage rating.
 - 1. Rating: Same as distribution system phase-to-neutral voltage.
 - 2. Protection: Current-limiting fuses.

2.05 ACCESSORIES

- A. Accessories, adapters, terminal strips, power supplies, mounting hardware, and connections required for functional performance indicated.

2.06 ENCLOSURES

- A. Transformers
 - 1. All transformers shall be in NEMA 1 enclosures with appropriate support provided and internal support for components and power conductors. Provide nameplates per Division 26 Section "Identification for Electrical Systems". Units installed in other equipment enclosures shall have adequate space for installation and maintenance and proper support to withstand fault current forces.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install equipment level and plumb. Anchor to building structural elements and support according to requirements in Division 26 Sections "Common Work for Electrical" and "Hangers and Supports for Electrical Systems".
- B. Mounting heights indicated are to bottom of unit for suspended items and to center of unit for wall-mounting (or panel mounted) items.

3.02 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
- B. Label each meter with a unique designation.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Engage a factory-authorized service representative to inspect, test, adjust, and startup equipment.
- B. Schedule visual and mechanical inspections and electrical tests with at least seven days' advance notice.
- C. Inspect components for defects and physical damage, labeling of testing laboratory, and nameplate compliance with the Contract Documents.
- D. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturer's recommended torque values.
- E. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
 - 1. Continuity tests of circuits.
 - 2. Operational Tests: Set and operate controls to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by the manufacturer. Note response to each test command and operation.
 - a. Metering Test: Provide load to metered conductors, measure loads on conductor with an RMS reading clamp-on ammeter, and simultaneously read indicated current on the same phase at the installed meter. Record and compare values measured at the two locations. Resolve discrepancies greater than 5 percent and record resolution method and results.
 - b. Record metered values, control settings, operations, cues, time intervals, and functional observations.
- F. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
- G. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- H. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.04 CLEANING

- A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.
 - 1. Train Owner's management and maintenance personnel in interpreting and using displays. Train them in troubleshooting, servicing, adjusting, and maintaining equipment. Provide a minimum of 2 hours training.
 - 2. Training Aid: Use the approved final versions of maintenance manuals as training aids.
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.06 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide one Project site visit, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in validating accuracy.

3.07 TELEPHONE TECHNICAL SUPPORT

- A. Hardware and Software: Within two years of date of Substantial Completion, provide unlimited response to user questions.
 - 1. Telephone Calls: Toll free.
 - 2. Availability: Eight hours per day, weekdays.
 - 3. Responder Qualifications: Engineer or technician thoroughly familiar with meter.

END OF SECTION 26 09 15

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Time switches.
 - 2. Outdoor and indoor photoelectric switches.
 - 3. Switch-box occupancy sensors.
 - 4. Indoor occupancy sensors.
 - 5. Outdoor motion sensors.
 - 6. Multipole contactors.
 - 7. Manual, modular dimmers.
 - 8. Emergency lighting relay control device.
 - 9. Lighting Control Panel
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for standard line voltage switches.

1.03 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.
- C. ELRCD: Emergency Lighting Relay Control Device.

1.04 SUBMITTALS

- A. Provide the detailed requirements below in addition to requirements in Section "General Provisions For Electrical Work".
- B. Product Data: For each type of product indicated. Controls for egress lighting shall clearly indicate that when they fail the lighting fails in the on condition.
- C. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Lighting plan showing location, orientation, and coverage area of each sensor.
 - 2. Interconnection diagrams showing field-installed wiring.

- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. 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.

1.06 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. See Section "Common Work Results for Electrical" for details of delivery requirements.
 - 1. Time Switches: One (1) for each variation provided on the project.
 - 2. Photoelectric switches, occupancy sensors, motion sensors, dimming controls and emergency lighting relay control devices: Five (5) percent of the number installed of each listed device but no less than two (2) of each listed device installed on the project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 LIGHTING CONTROL DEVICE SURGE PROTECTION REQUIREMENTS

- A. Line-Voltage Surge Protection is required for all lighting control devices specified in the section as an integral part of the devices for 120- and 277-Volt solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall be provided and shall comply with IEEE C62.41.1-2002 "Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits", IEEE C62.45-2002 "Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits" and IEEE C62.72-2007 "Guide for the Application of Surge-Protective Devices for Low-Voltage (1000V or Less) AC Power

Systems”. See Section “Surge Protective Devices” for detailed requirements. See Part 3 “Wiring Installation” below for specific application requirements.

2.03 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers:

1. Crestron
2. Hubbell
3. Eaton
4. Lutron
5. Leviton

B. Description: Solid state, with SPST dry contacts rated for LED rated, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

C. Description: Solid state, with SPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; and complying with UL 773.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Lightning Arrester: Air-gap type.
4. Mounting: Twist lock complying with IEEE C136.10, with base. Provide with stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

2.04 INDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers:

1. Crestron
2. Hubbell

3. Eaton
4. Lutron
5. Leviton

B. Ceiling-Mounting Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit mounted on luminaire, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.

1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
3. Light-Level Monitoring Range: 10 to 200 fc, with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on and off cycles.

2.05 SWITCH-BOX OCCUPANCY SENSORS

A. Manufacturers:

1. Crestron
2. Hubbell
3. Eaton
4. Lutron
5. Leviton

B. Description: PIR type with integral power-switching contacts rated for suitable for 277-V ac, suitable for LED light fixtures. Adjustable off delay 0 to 30 minutes.

1. Include ground wire.
2. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (215 to 2150 lx); keeps lighting off when selected lighting level is present.
3. For dual level applications, provide unit design for switching two (2) circuits similar to Hubbell's WS1277WS.

2.06 INDOOR OCCUPANCY SENSORS

A. Manufacturers:

1. Crestron
2. Hubbell

3. Eaton
 4. Lutron
 5. Leviton
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes. All egress lighting control units shall turn lights on when they fail.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 4. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 5. Bypass Switch: Override the on function in case of sensor failure.
 6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (215 to 2150 lx); keeps lighting off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch (150-mm) minimum movement of any portion of a human body that presents a target of at least 36 sq. in. (232 sq. cm).
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27 m) when mounted on a 10-foot- (3-m-) high ceiling.

- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. Detector Sensitivity: Detect a person of average size and weight moving at least 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on an 8-foot- (2.4-m-) high ceiling.
 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch (150-mm) minimum movement of any portion of a human body that presents a target of at least 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving at least 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.07 OUTDOOR MOTION SENSORS (PIR)

- A. Manufacturers:
1. Crestron
 2. Hubbell
 3. Eaton
 4. Lutron
 5. Leviton

- B. General Description: Suitable for operation in ambient temperatures ranging from minus 40 deg F (40 deg C) to 130 deg F (54 deg C), UL 773A rated as raintight.
1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes. Must fail lights “on” if used for egress lighting.
 2. Sensor Output: Lamp holders shall comply with UL 1598 for wet locations.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
 - b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc (11 to 215 lx); keeps lighting off during daylight hours.
- C. Detector Sensitivity: Detect occurrences of 6-inch (150-mm) minimum movement of any portion of a human body that presents a target of at least 36 sq. in. (232 sq. cm)
- D. Detection Coverage: Up to 35 feet (11 m), with a field of view of 90 degrees.

2.08 LIGHTING CONTROL PANEL AND MANUAL, MODULAR DIMMING CONTROLS

- A. Products: Subject to compliance with requirements, provide products by one the following:
1. Creston Electronics, Inc.
- B. General Dimming Device Requirements
1. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.

2. Dimmers and Dimmer Modules: Comply with UL 508.
 - a) Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference at any setting. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
 - b) Dimmer or Dimmer-Module Rating: As indicated, but not less than 125 percent of connected load.
- C. Panic Switch: Include where indicated or required by authorities having jurisdiction. Switch operation overrides dimmer settings and restores lights on connected output circuits to full brightness regardless of settings.
- D. Switches controlled by the Lighting Control Panel: Provide Crestron On/Off/Raise Lower, white color ganged together at switch location.
- E. Description: Factory-fabricated equipment providing one to four channels of manual dimming control. Integrate controls and dimmers for mounting in a two- or three-gang wall box under a single wall plate.
- F. Module Dimming Capability: Listed for control of type of lighting unit used.
 1. Unit Rating: 1900 W, minimum; with each dimming channel rated 600W, minimum.
 2. Wall-Plate Style and Finish: Coordinated with lighting controls specified in other Division 26 Sections.

2.09 EMERGENCY LIGHTING RELAY CONTROL DEVICE (ELRCD)

- A. Products: Subject to compliance with requirements, provide products by Crestron, integral with Lighting Control Panel.
- B. Where plans show an ELRCD it shall be rated for 120-277 volts, 60 Hz, 20 amperes or provide sufficient quantity to serve 20 amperes of load. Device shall be U.L. 924 listed.
- C. Provide testing provisions and install to facilitate testing of each unit. No special tools, software or products not provided shall be required to accomplish testing of all installed units.

2.10 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 26 Section "Low Voltage Electrical Power Conductors and Cables". All wiring shall be Crestron Lighting Control cables.

- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 26 Section "Low Voltage Electrical Power Conductors and Cables".
- C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Division 26 Section "Low Voltage Electrical Power Conductors and Cables".
- D. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Division 26 Section "Communications Horizontal Cabling".

PART 3 EXECUTION

3.01 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low Voltage Electrical Power Conductors and Cables". Minimum conduit size shall be 3/4 inch (20 mm).
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Install field-mounting voltage surge suppressors for all lighting control devices that do not have integral line-voltage surge protection. Category A Type 2 or 3 devices are acceptable installed per manufacturer's requirements. Install one SPD per circuit serving lighting control devices without integral protection.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- G. Use compression connectors for all wiring to screw terminals.

3.03 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems".
- B. Label time switches and contactors with a unique designation.

3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.05 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 26 09 23

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 KVA:
 - 1. Distribution transformers.
 - 2. Buck-boost transformers.
 - 3. Control and signal transformers.

1.03 SUBMITTALS

- A. Provide the detailed requirements below in addition to requirements in Section “General Provisions For Electrical Work”.
- B. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- C. Shop Drawings: Wiring and connection diagrams.
- D. Source quality-control test reports.
- E. Output Settings Reports: Record of tap adjustments specified in Part 3.

1.04 QUALITY ASSURANCE

- A. 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.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of wall-mounting and structure-hanging supports.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acme Electric Corporation; Power Distribution Products Division.
 - 2. Eaton; Cutler-Hammer.
 - 3. GE Electrical Distribution & Control.
 - 4. Siemens Energy & Automation, Inc.
 - 5. Hammond.
 - 6. Square D/Groupe Schneider NA.
 - 7. PQI.

2.02 MATERIALS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel, core and coil assembly shall be mounted on vibration pads and bolted to the enclosure.
- C. Coils: Continuous windings without splices, except for taps. Coils mounted vertically, one above another, will not be acceptable.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper.

2.03 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide energy efficient Department of Energy (DOE) Distribution Transformer Efficiency Regulations, 2016 compliant transformers. Meet current TP-1 requirements.
- C. Transformer Inrush Multiplier: Maximum transformer inrush current multiplier is 12. Any inrush multiplier that exceeds 12 shall require the Electrical Contractor to supply a primary overcurrent protective device that differs from that designed in the Contract Documents at the Contractor's expense.

- D. Cores: One leg per phase.
- E. Enclosure: Ventilated, dripproof, NEMA 250, Type 2. Provide with lifting eyes or brackets.
- F. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor-Corrosion Protection."
 - 1. Finish Color: Gray.
- G. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- H. Taps for Transformers Smaller Than 3 KVA: None.
- I. Taps for Transformers 4 to 14 KVA: One 5 percent tap above and two 5 percent tap below normal full capacity.
- J. Taps for Transformers 15 KVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- K. K-Factor Rating: Transformers to be K-factor rated are indicated on the One Line Diagram, shall utilize 220°C insulation system and comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall include electrostatic shielding. See below.
 - 2. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - 3. Indicate value of K-factor on transformer nameplate.
 - 4. Basic Impulse Level of all windings shall be 10 KV.
 - 5. The neutral terminal shall accommodate 200% of the rated current.
 - 6. The core flux density shall be well below the saturation point to prevent core saturation caused by the harmonics even with a 10% primary overvoltage.
 - 7. Transformers up to and including 112.5 KVA shall not exceed a 10% voltage THD differential between the primary and secondary of the transformer at the units K rating.
 - 8. Unit shall comply with requirements listed for distribution transformers including impedance and inrush requirements.

- L. Electrostatic Shielding: Provide on transformers indicated on One Line Diagram or as specified. Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding the shield.
 - 3. Shield Effectiveness:
 - a. Capacitance between Primary and Secondary Windings: Not to exceed 33 Pico farads over a frequency range of 20 Hz to 1 MHz.
 - b. Common-Mode Noise Attenuation: Minus 120 dBA minimum at 0.5 to 1.5 kHz; minus 65 dBA minimum at 1.5 to 100 kHz.
 - c. Normal-Mode Noise Attenuation: Minus 52 dBA minimum at 1.5 to 10 kHz.
- M. Wall Brackets: Manufacturer's standard brackets.
- N. Terminal compartment will be so designed to permit the use of 75°C wire. All terminals shall be marked "75°C only", "60/75°C" or listed for use of 75°C insulated conductors at full 75°C capacity. Terminals shall be front connected.

2.04 CONTROL AND SIGNAL TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.
- B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

2.05 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.

2.06 IDENTIFICATION

- A. Provide engraved equipment nameplates according to requirements in Section "Identification For Electrical Systems".

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls and floors for suitable mounting conditions where transformers will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer. Anchor to wall with anchor bolts and 1/4 inch thick spacers. This Contractor shall coordinate with the General Contractor to verify sufficient steel reinforcement in new concrete and masonry walls to support the transformer. For inadequately reinforced new and all existing concrete or masonry walls and for all other wall construction this Contractor shall provide P-1000 strut from floor to ceiling with anchors at the floor, ceiling and on 18 inch spacings along the wall. All wall mount attachment points on the enclosure shall connect to the strut. Clearance requirements shall be the same as for overhead mounting below. 45 KVA maximum.
- B. Install floor-mounting transformers level on concrete bases. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit and 4 inches (100 mm) high.
 - 1. All transformers floor mounted shall be mounted on 4" concrete pads, and provide the same clearance as required for overhead mounting below. Neoprene rubber vibration isolators shall be provided between transformer case and concrete pad, bracket or strut. Connections shall be made with flexible conduit. Vibration isolation pads shall be ribbed neoprene rubber.
- C. Install overhead mounted transformer level and plumb with 3/4" threaded rods on four corners of 1000 pound strut for all transformers under 100 KVA. Transformers 100 KVA to 150 KVA shall use 7/8" threaded rods and double 1000 pound strut for each trapeze. Transformers shall be visible and installed 7 feet minimum above finished floor and 12 inches from adjacent walls. Clearance to the wall behind the transformer shall not be less than manufacturer's minimum ventilation space requirement. The front side where internal connections are made shall have 30 inches clear. Threaded rods shall be attached to at least two separate joists or to concrete anchors approved by the Structural Engineer. Neoprene rubber vibration isolators shall be provided between transformer cage and bracket or strut. Connections shall be made with flexible conduit. Vibration isolation pads shall be ribbed neoprene rubber. If seismic criteria apply provide bi-directional cross bracing in both X and Y axis per seismic requirements. See Seismic Restraints.

3.03 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems". Bond secondary neutral to ground at the transformer using code compliant sized bonding conductor. Extend neutral and equipment ground conductor to load.

- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined in Section 26 01 04 "Tests, Observations and Inspections" Paragraph titled "System Voltages". Submit recording and tap settings as test results.
- B. Adjust buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 26 22 00

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, Division 26 Specification Sections including “Electrical Power System Analyses” apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Surge Protective Device panelboards. All emergency panelboards shall be provided with SPD's per NEC 700.8.

1.03 DEFINITIONS

- A. AFCI: Arc-Fault Circuit Interrupter.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. OCPD: Overcurrent protective device i.e. circuit breaker or fused switch.
- E. RFI: Radio-frequency interference.
- F. RMS: Root mean square.
- G. SPDT: Single pole, double throw.

1.04 SUBMITTALS

- A. See Section “General Provisions For Electrical Work” for submittal requirements in addition to the following listed requirements.
- B. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

- C. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Coordination curves for all panelboard main OCPD/branch OCPD coordination combinations. See “Selective Coordination” requirements in Part 2 and Part 3 of this section.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- D. Qualification Data: For testing agency.
- E. Field quality-control test reports including 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.
- F. Panelboard Load Data: Field measured currents by phase to each panelboard taken during occupied use after balancing by Contractor.
- G. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- H. Operation and Maintenance Data: For panelboards and components to include in emergency operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," and Division 26 Section “Operation and Maintenance of Electrical Systems” include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- 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.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Perform required NETA inspections and submit letter indicating all inspections found no deficiencies.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- B. Do not install until space is protected from moisture and construction debris or byproducts of construction work. Maintain energized condition except for shutdown while working within. Protect from condensation when not energized.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than 15 working days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

1.08 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 "Cast-in-Place Concrete".

1.09 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Three spares for each type of panelboard cabinet lock.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. Siemens Energy & Automation, Inc.
 - c. Square D.

2.02 MANUFACTURED UNITS

- A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 1. Rated for environmental conditions at installed location.
 - a. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat. Flush panels will be finished with prime coat only.
 4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase, Neutral and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- C. Conductor Connectors: Suitable for use with conductor material.
1. Main and Neutral Lugs: Compression type.
 2. Ground Lugs and Bus Configured Terminators: Compression type.
- D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main OCPD's.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- F. Panel Front Controls, Instruments and Indicators: General requirements. These general requirements are superseded by any detailed specific requirements whenever they conflict.
1. Elevation: Not to be installed more than 6 feet 6 inches above finished floor nor less than 24 inches above finished floor.
 2. Types:
 - a. Controls: Suitable for use with gloved hand. Includes circuit breaker and fused switch handles in addition to selector switches and metering operation buttons.
 - b. Indicator/Label Character Size: Digital indicators shall have characters 1/2 inch tall minimum. Analog indicators shall have 3 inch minimum length with 1/4 inch minimum height static characters.
 - c. Pilot lamps shall be LED type 1/2 inch minimum diameter with test function.

2.03 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to withstand 110 percent of the symmetrical short-circuit current available at terminals. See One-Line Diagram on plans for fault current available. Minimum withstand shall not be less than minimum interrupting ratings of overcurrent protective devices specified in this section or short circuit currents available as indicated on the plans whichever is greater.

2.04 SELECTIVE COORDINATION

- A. Provide selective coordination between all feeders and subfeeders, all feeders and panelboard main OCPD's and between all panelboard main OCPD's and branch circuit breakers in the emergency, optional standby power systems. See one line power diagram for identification of each system. Selective coordination requires interruption of an overcurrent or short circuit condition by the closest overcurrent protective device only.
- B. Contractor shall provide thermal magnetic molded case branch OCPD's unless otherwise specified. Main OCPD shall selectively coordinate with each branch circuit OCPD for all possible overcurrent and short circuit currents possible. Main OCPD shall be molded case and installed within the panelboard if possible. If electronic trip molded case main OCPD is required to meet this selective coordination requirement they may be installed inside or outside the panelboard. Local separate enclosure or installation at remote supply distribution or switchboard are permissible for this main OCPD. If remote located main OCPD is used provide a local molded case switch in the panelboard to act as a local main disconnect (provided adequate short circuit rating of molded case switch is available) And provide sign stating do not operate under load. For lockout tagout only
- C. Contractor shall submit evidence for every panelboard showing conformance with the selective coordination requirement. The evidence shall include time-current trip curves showing supply OCPD and each size feeder/branch circuit OCPD plotted from 0 current to maximum short circuit rating. Curves shall show maximum and minimum bands for each OCPD with clear separation between the curves. Select and indicate frame size and trip modules required to meet selective coordination requirements. All adjustable settings shall be clearly indicated to verify selective coordination. No panelboard or switchboard will be approved without this substantiating information included in the submittal.

2.05 DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- B. Main Overcurrent Protective Devices: Molded case electronic trip circuit breaker. Provide SE rating.
- C. Branch Overcurrent Protective Devices:
 - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on thermal magnetic circuit breakers.
 - 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Thermal magnetic bolt-on circuit breakers.

2.06 LIGHTING AND RECEPTACLE BRANCH-CIRCUIT PANELBOARDS

- A. Main Overcurrent Protective Devices: Molded case circuit breaker

- B. Branch Overcurrent Protective Devices: Bolt-on thermal magnetic circuit breakers, replaceable without disturbing adjacent units.
- C. Doors: Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.; secured with flush latch with tumbler lock; keyed alike.

2.07 SURGE PROTECTIVE DEVICE PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Devices: Thermal-magnetic circuit breaker.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.
- D. Bus: Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
- E. Refer to Surge Protective Device Section.
- F. Surge Protective Device: IEEE C62.41, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules. Provide panelboard extension.
 - 1. Minimum Single-Impulse Current Ratings:
 - a. Line to Neutral: 100,000 A.
 - b. Line to Ground: 100,000 A.
 - c. Neutral to Ground: 100,000 A.
 - 2. Protection modes shall be as follows:
 - a. Line to neutral.
 - b. Line to ground.
 - c. Neutral to ground.
 - 3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
 - 4. Maximum Category C Combination Wave Clamping Voltage: 1000 V, line to neutral and line to ground on 277/480 V systems.
 - 5. Maximum UL 1449 Clamping Levels: 800 V, line to neutral and line to ground on 277/480 V systems.
 - 6. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
 - 7. Accessories:
 - a. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module.

- b. Audible alarm activated on failure of any surge diversion module.
- c. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

2.08 OVERCURRENT PROTECTIVE DEVICES (OCPD)

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents. For 208/120V circuit breakers; provide 10,000 A.I.C. minimum, for 480/277V circuit breakers; 18,000 A.I.C. minimum. See plans, One Line Diagram, for fault current available, and exceed that number by at least 10% with interrupting rating. Series ratings may not be used to meet these requirements unless specifically noted on the plans or in the specifications.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger is required.
 - 2. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and shall include the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response (Where indicated as trip or alarm).
 - 3. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity for personnel protection; 30 mA trip sensitivity for equipment protection.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment type QOD-HID for high intensity discharge lighting.
 - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.09 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

- B. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Install overcurrent protective devices.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
 - 2. Final settings shall be as approved from Section "Electrical Power System Analyses" when the study is specified. When the study is not specified consult the O.R. for settings.
- E. Install filler plates in unused spaces. All "spaces" shall be equipped to accept added breakers as needed.
- F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- H. Provide architecturally approved finish on flush mounted panels.
- I. Panelboards installed directly on masonry walls shall be attached using 1/4 inch minimum spacers to permit air and moisture movement between the wall and the enclosure. Use 316 stainless steel hardware. This Contractor shall coordinate with the General Contractor to verify steel reinforcement is installed in new concrete and masonry walls to support the enclosure and to verify the resteel location. For unreinforced new and all existing concrete or masonry walls and for all other wall construction this Contractor shall provide P-1000 strut from floor to ceiling with anchors at the floor, ceiling and on 18 inch spacings along the wall. All wall mount attachment points on the enclosure shall connect to the strut.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems".

- B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. See Division 26 Section "Identification for Electrical Systems".

3.03 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems".
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".

3.04 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test continuity of each circuit.
- B. Perform the following field tests and inspections and prepare reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Do not perform contact resistance tests or insulation tests or insulator tests. Do perform neutral to ground resistance test with any link temporarily removed. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

5. Send final load balance report to Architect for each panelboard indicating phase currents measured to the panelboard and the date and time measured.

3.05 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

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SECTION 26 25 50 – GENERATOR CAMLOCK DOCKING STATION

PART 1 GENERAL

1.01 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. UL 1008 or ETL Listed to UL 1008 Standards.
- D. Comply with NEC 700.3(F)

1.02 GUARANTEE/WARRANTY

- A. The equipment installed under this contract shall be left in proper working order. Replace, without additional charge, new work or material which develops defects from ordinary use within one year.
- B. New materials and equipment shall be guaranteed against defects in composition, design or workmanship. Guarantee certificates shall be furnished.

PART 2 PRODUCTS

2.01 Generator Camlock Docking Station (65kA)

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1. TRYSTAR: Single Purpose Generator Docking Station (Portable Gen Only)

Basis of design is TRYSTAR. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid. Any alternates to this bid shall only be considered if a complete written description of the proposed system along with any variances with the specification, are received ten (10) days prior to bid due date. Any variances not specifically enumerated prior to bidding shall be considered non-responsive. Costs incurred to modify the building and/or interfacing equipment which are affected as a result of an alternate, shall be the responsibility of the contractor.

2.02 INTEGRATED CIRCUIT BREAKER(S)

- A. Circuits breakers shall be Square D or Siemens, LSI, UL 489 Circuit Breakers, Comply with UL 489 with interrupt capabilities to meet the available fault currents. Include mechanical lugs on tin plated copper busbar for line and load connections.

2.03 GENERAL REQUIREMENTS

- A. A set of Camlocks shall be provided for each of the following:
 - 1. Portable Generator
- B. Protective Caps
 - 1. All Camlocks shall be protected with spring loaded weather proof flip covers that are clear in color to allow for easy viewing of phase color and gender.
- C. Enclosures:
 - 1. Wall/Pad mount, Bottom or Side Cable Entry, NEMA 3R rain-tight, aluminum (non-corrosive) or stainless steel enclosure with rake system for cable entry at the bottom.
 - 2. Cable entry area at the bottom of the enclosure shall be covered by a hinged trap door.
 - a. It shall be possible to close and lock the front door to the enclosure with the trap door open, and power cables connected through the bottom of the enclosure. The enclosure shall maintain NEMA 3R integrity with power cables connected.
 - 3. Front Cover:
 - a. Hinged.
 - b. Gasketed.
 - c. Pad-lockable latch.
 - 4. Finishes:
 - a. Paint after fabrication. Powder coated Hammer Gray or Black.
- D. Phase, Neutral, and Ground Buses:
 - 1. Material: Silver-plated, Tin-plated or Hard-drawn copper, specified upon order.
 - 2. Equipment Ground Bus: bonded to box.
 - 3. Isolated Ground Bus: insulated from box.
 - 4. Ground Bus: 25%, 50% or 100% of phase size.
 - 5. Neutral Bus: Neutral bus rated 100 percent of phase bus.
 - 6. Round edges on bus.
- E. All hardware shall be stainless steel including all bolts, nuts, and hinges.
- F. Copper bus shall be silver plated.

- G. Lockable rake system with reinforced support struts to reduce cable theft.
- H. Permanent generator connectors shall be broad range set-screw type, located behind an aluminum barrier.
- I. Voltage & Phase shall be as shown on project one line drawing. Camlocks shall be color coded as appropriate for the specified voltage.
- J. Phase rotation meter shall be included and shall have LED's to annunciate improper phase rotation as well as a dry contact output for building management monitoring.
- K. Amperage rating shall be as shown on project one-line drawing.
- L. Extra depth shall be provided on all docking stations with pad mount leg kits to accommodate bottom cable entry.
- M. A set of temporary generator connection lugs shall be provide in addition to the portable generator camlocks and they shall be broad range set-screw type, located behind an aluminum barrier. These lugs shall be used in the event the portable generator is not supplied with camlock cables.
- N. The Dual purpose docking station shall include a locked access panel covering the portable generator Camlocks so that the portable generator cannot be connected to the load bus while the permanent generator is connected to the Load bus. It shall include a Kirk Key interlock block kit for installation (by contractor), to the permanent generator circuit breaker. Kirk Key system shall include dry contacts to annunciate at a remote location that the permanent generator is disconnected from the optional standby system.
- O. Portable generator connectors shall be Camlok style mounted on 45° angle plate or on gland plate (male for the portable generator and female for the portable load bank.
- P. Kirk key for mounting on permanent generator (or other circuit breaker)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive Generator Docking Station for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Surface, Flush or Base Mounted: Specified with order.
 - 1. Install anchor bolts to elevations required for proper attachment to Generator Docking Station.

- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.03 FIELD QUALITY CONTROL

- A. Generator Docking Station vendor shall be required to send a technical representative to the job site to inspect and review installation to ensure it meets the requirements of the consulting engineer.
- B. Prepare inspection report that identifies Generator Docking Station with notations of any remedial action taken to correct any issues.

END OF SECTION 26 25 50

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Single and duplex receptacles, receptacles with integral ground-fault circuit interrupters, receptacles with integral surge protection and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Weather resistant receptacles
 - 4. Snap switches and wall-box dimmers
 - 5. Wall switch/occupancy sensors
 - 6. Device wall plates and covers.
 - 7. Pin and sleeve connectors and receptacles.
 - 8. Pendant cord-connector devices.
 - 9. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.
 - 10. Solid state fan speed controls.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. PVC: Polyvinyl chloride.

- D. RFI: Radio-frequency interference.
- E. SPD: Surge Protective Device
- F. UTP: Unshielded twisted pair.

1.04 SUBMITTALS

- A. See Section “General Provisions For Electrical Work” for submittal requirements in addition to the following listed requirements.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- D. Field quality-control test reports.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- 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.
- C. Comply with NFPA 70.

1.06 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Service/Power Poles: One for every 10, but no fewer than one.
 - 2. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.
 - 3. Receptacles/Switches: One for every 30 of every rating, color, type combination installed, but no fewer than three (3) of each.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:
 - a. Bryant Electric, Inc./Hubbell Subsidiary.
 - b. Cooper; Eaton
 - c. Hubbell Incorporated; Wiring Device-Kellems.
 - d. Leviton Mfg. Company Inc.
 - e. Pass & Seymour/Legrand; Wiring Devices Div.
2. Poke-Through, Floor Service Outlets and Telephone/Power Poles:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Pass & Seymour/Legrand; Wiring Devices Div.
 - c. Square D/Groupe Schneider NA.
 - d. Thomas & Betts Corporation.
 - e. Wiremold Company (The).

2.02 RECEPTACLES

- A. Straight-Blade and Locking Type Receptacles: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, , UL 498 and FS W-C-596.
- B. Straight Blade Receptacle: Heavy duty, duplex, specification grade, 20 amp, 125 volt, back and side wired, 3 wire grounding, NEMA 5-20R, nylon face, Model No. 5362. Back wired receptacles shall utilize side screw for compression. Spring type compression back wired shall not be accepted.
- C. Locking Receptacle: Heavy duty, single, specification grade, 20 amp, 125 volt, back and side wired, 3 wire grounding, NEMA L5-20R, Model No. 2310. Back wired receptacles shall utilize side screw for compression. Spring type compression back wired shall not be accepted.
- D. Straight Blade Receptacle - 208 volt single phase: Heavy duty, single, industrial grade, 125/250 volt, side wired, 3 wire, phenolic, 20 amp (NEMA 10-20R), 30 amp (10-30R), or 50 amp (10-50R) non-grounding type as indicated on plans.
- E. GFCI Receptacles: Straight blade, non-feed-through type, Heavy-Duty specification grade, 20 amp, 125 volt, back and side wired, 3 wire grounding, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter. Back wired receptacles shall utilize side screw for compression. Spring type compression back wired shall not be accepted. Provide tamper-resistant GFCI where both requirements exist.
- F. USB Charger Receptacles: Heavy duty, duplex, specification grade, 20 amp, 125 volt, back and side wired, 3 wire grounding, NEMA 5-20R, nylon face, two (2) USB type 2.0 ports. Back wired receptacles shall utilize side screw for compression. Spring type compression back wire shall not be accepted.

1. Hubbell #USB20X
2. Bryant #USBB20C5
3. Leviton #T5B32

2.03 SWITCHES

- A. Single- and Double-Pole Switches: Comply with NEMA WD 1, UL 20 and FS W-S-896.
- B. Snap Switches: Heavy-Duty specification grade, quiet type, 20 amp, 120-277 volt, back and side wired. Motor rated 1-1/2 HP at 120 volt.
- C. Special Switches - Special switches are all variations of the snap switches specified above and shall meet all of the same electrical requirements.
 1. Momentary Contact Switch: 3 position center off switch. Up and down momentary positions meet electrical ratings for snap action switch. Spring action returns to center "null" position.
 2. Three Way Switch: Same electrical ratings as snap switch. One pole switches between two "traveler" poles.
 3. Four Way Switch: Same electrical ratings as snap switch. Two poles cross switch to two "traveler" poles.
 4. Keyed Switch: Same electrical ratings as snap switch. Requires portable operating "key" to operate either snap switch or three-way or four way switch.
 5. Lighted Toggle Switch: Same electrical ratings as snap switch. Toggle handle illuminates when load is off.
 6. Pilot Switch: Same electrical ratings as snap switch. Toggle handle illuminates when load is on.
 7. Two Pole Switch: Same electrical ratings as snap switch. Two independent poles open and close together.
- D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters. UL listed.
 1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.
 2. LED Lamp Dimmers: Modular, 120/277 V, 60 Hz with continuously adjustable slider; single pole and 3-pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch (130-mm) wire connecting leads. Rated 2000 watts LED and fits standard single gang box.

2.04 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 - 3. Material for Warehouse Spaces: Galvanized steel.
 - 4. Material for Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.05 IN USE COVERS

- A. Type: Extra Duty, PVC with gaskets, locking provisions to meet NEC requirements. Color shall match receptacle color. Units shall be U.L. rated for use in wet and damp locations.

2.06 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used. Unit shall have U.L. fire rating to match structural floor.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Round, die-cast aluminum with brushed aluminum satin finish. Service plate shall be listed and labeled to meet U.L. 514 scrub water resistance.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 6 jacks for UTP cable complying with requirements of Division 27.

2.07 FINISHES

- A. Color:
 - 1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70.
 - 2. Wiring Devices Connected to Standby Power System: Red.
 - 3. Wiring Devices Connected to UPS Power: Blue.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.
- C. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.
- D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- E. Remove wall plates and protect devices and assemblies during painting.
- F. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings. Do not exceed maximum installed density limit as listed by manufacturer.
- G. Maintain protective packaging/plastic film on devices for as long as possible.
- H. All 15 and 20 ampere receptacles installed in wet locations shall be listed weather-resistant type and shall include Extra Duty In-Use covers that comply with NEC Article 406.9(B)(1). This cover shall be weatherproof whether in use or not. See Section "General Provisions For Electrical Work for definition of wet locations.
- I. Provide Extra Duty In-Use covers where indicated in damp locations and where indicated for interior locations.

3.02 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems".
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot stamped or engraved machine printing with black-filled lettering on white face of nameplate, and durable wire markers or tags inside outlet boxes. Use black letters for "normal" source and red for "critical, emergency or standby" systems".

3.03 CONNECTIONS

- A. Use side connections on all devices with compression applied insulated locking spade terminals. Back wiring is not permitted unless side screws provide compression. Tap conductors for all through connections.

- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems". Tap ground conductor and connect to metallic device box. Tap ground conductor for connection to device ground connection at all through connections.
- C. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables".
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Use crimp/compression device in lieu of wire nut for all receptacle connections. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 26 27 26

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SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 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. Fuses are specified in Division 26 Section "FUSES". Likewise, Division 26 Sections 26 01 00 through 26 05 00 and 26 05 73 "Electrical Power System Analyses" apply to this Section.

1.02 SUMMARY

- A. This Section includes the individually mounted, enclosed switches and circuit breakers of the types listed below. See electrical power plans and One Line Diagrams to determine type, location and specific application information.
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Molded-case switches.
 - 5. Enclosures.

1.03 DEFINITIONS

- A. GD: General duty.
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. OCPD: Overcurrent Protective Device

1.04 SUBMITTALS

- A. See Section "General Provisions For Electrical Work" for submittal requirements in addition to the following listed requirements.
- B. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
 2. Current and voltage ratings.
 3. Short-circuit current rating.
 4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Shop Drawings: Diagram power, signal, and control wiring.
1. Show tabulations of installed devices, equipment features, and ratings. Included are the following:
 - a. Enclosure types and details.
 - b. Voltage, current, trip module, interrupting, withstand and accessory features and ratings.
 - c. Coordination curves for all OCPD's for all applications with NEC code required coordination requirements. Show coordination with upstream and downstream devices. Provide trip module settings that produce selective coordination.
- D. Field quality-control test reports including 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.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data", include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.05 QUALITY ASSURANCE

- A. 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.

- B. Comply with NFPA 70.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2010 m).

1.07 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Spares: For the following:
 - a. Potential Transformer Fuses: 3
 - b. Control-Power Fuses: 3
 - c. Fuses and Fusible Devices for Fused Circuit Breakers: 3
 - d. Fuses for Fusible Switches: 3
 - e. Fuses for Fused Power Circuit Devices: 3
 - 2. Spare Indicating Lights: Six of each type installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FUSIBLE AND NONFUSIBLE SWITCHES

A. Available Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Fusible Switch: NEMA KS 1, Type GD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch: NEMA KS 1, Type GD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.03 MOLDED-CASE CIRCUIT BREAKERS AND MOLDED CASE SWITCHES

A. Available Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
 6. GFCI Circuit Breakers: Single- and two-pole configurations with 30-ma trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 85 percent of rated voltage.
 7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
 8. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 10. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

2.04 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor, vault and manhole locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 4. Indoor Dry Locations: NEMA 250, Type 1.
- B. Enclosure Front Controls, Instruments and Indicators: General requirements. These general requirements are superseded by any detailed specific requirements whenever they conflict.
 - 1. Elevation: Not to be installed more than 6 feet 6 inches above finished floor nor less than 24 inches above finished floor.
 - 2. Types:
 - a. Controls: Suitable for use with gloved hand. Includes circuit breaker and fused switch handles in addition to selector switches and metering operation buttons.
 - b. Indicator/Label Character Size: Digital indicators shall have characters 1/2 inch tall minimum. Analog indicators shall have 3 inch minimum length with 1/4 inch minimum height static characters.
 - c. Pilot lamps shall be LED type 1/2 inch minimum diameter with test function.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. When installed directly on masonry walls the enclosure shall be attached using 1/4 inch minimum spacers to permit air and moisture movement between the wall and the enclosure. Use 316 stainless steel hardware. This Contractor shall coordinate with the General Contractor to verify steel reinforcement is installed in new concrete and masonry walls to support the enclosure and to verify the resteel location. For unreinforced new and all existing concrete or masonry walls and for all other wall construction this Contractor shall provide P-1000 strut from floor to ceiling

with anchors at the floor, ceiling and on 18 inch spacings along the wall. All wall mount attachment points on the enclosure shall connect to the strut.

- C. Mount floor mounted freestanding switches and circuit breakers with tops at uniform height supported by back-to-back P-1000 strut anchored to the floor in both the X and Y axis. Each support shall incorporate two vertical elements and two horizontal elements. Enclosed switches or breakers weighing more than 20 pounds shall require back-to-back P-1000 struts and at least one diagonal strut
- D. Mounting height shall be no less than 36 inches top to floor and no more than 54 inches top to floor unless otherwise indicated on the drawings. Heights shall be uniform throughout the contract and shall be approved by the Engineer prior to installation.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- F. Install overcurrent protective devices.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
 - 2. Final settings shall be as approved from Section "Electrical Power System Analyses" when it is specified. When it is not specified consult the O.R. for settings.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems",
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems".

3.04 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
 - 1. Inspect mechanical and electrical connections.
 - 2. Verify switch and relay type and labeling verification.
 - 3. Verify rating of installed fuses.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Infrared Scanning:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
 - b. Follow-Up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
 - c. Instruments, Equipment and Reports:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 2) Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
4. Equipment installed in power systems that have NEC required coordination with upstream and/or downstream OCPD'S. Provide injection testing to verify coordination curve performance.

3.05 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.06 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 28 16

SECTION 26 29 13 - ENCLOSED CONTROLLERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes ac general-purpose controllers rated 600 V and less that are supplied as enclosed units. See electrical power plans, One Line Diagrams and starter schedules to determine where enclosed controllers (starters) are to be provided by the Electrical Contractor.
- B. Related Sections include the following:
 - 1. Division 26 Section "Electrical Power Monitoring and Control" for monitoring and control of motor circuits.
 - 2. Division 26 Section Surge Protective Devices (SPD's) for low-voltage power, control, and communication surge suppressors.
 - 3. Division 26 Section "Fuses" for fuses in fusible switches.

1.03 SUBMITTALS

- A. See Section "General Provisions For Electrical Work" for submittal requirements in addition to the following listed requirements.
- B. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- C. Shop Drawings: For each enclosed controller.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details.
 - b. Nameplate legends.
 - c. Short-circuit current rating of integrated unit.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.

2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- D. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around enclosed controllers where pipe and ducts are prohibited. Show enclosed controller layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- E. Field Test Reports: Written reports specified in Part 3.
- F. Manufacturer's field service report.
- G. Maintenance Data: For enclosed controllers and components to include in maintenance manuals specified in Division 01. In addition to requirements specified in Division 01 Section "Closeout Procedures," include the following:
 1. Routine maintenance requirements for enclosed controllers and all installed components.
- H. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- I. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor nameplate currents. Any module changes required shall be at no cost to the Owner.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain, within 100 miles (160 km) of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Testing Agency Qualifications: An independent testing agency with the experience and capability to satisfactorily conduct the testing indicated, as documented according to ASTM E 548.
- C. Source Limitations: Obtain enclosed controllers of a single type 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 NFPA 70.
- F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, including clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.06 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner's Representative at least five working days in advance of proposed utility interruptions. Identify extent and duration of utility interruptions.
 - 2. Indicate method of providing temporary utilities.
 - 3. Do not proceed with utility interruptions without Owner's Representative written permission.

1.07 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."
- D. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- E. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Spare Fuses: Furnish one spare for every five installed, but not less than one set of three of each type and rating.
 - 2. Indicating Lights: Two of each type installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Manual and Magnetic Enclosed Controllers:
 - a. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
 - b. Eaton Corp.; Cutler-Hammer Products.
 - c. General Electrical Distribution & Control.
 - d. Rockwell Automation Allen-Bradley Co.; Industrial Control Group.
 - e. Siemens/Furnas Controls.
 - f. Square D Co.

2.02 MANUAL ENCLOSED CONTROLLERS

- A. Description: NEMA ICS 2, general purpose, Class A, with toggle action and overload element.

2.03 MAGNETIC ENCLOSED CONTROLLERS

- A. Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.
- B. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity. Fused secondary and both primary legs. Provide auxiliary control contacts, quantity as indicated on drawings. Minimum number shall be two. All contacts shall be convertible. Provide one spare minimum.
- C. Combination Controller: Factory-assembled combination controller and disconnect switch.
 - 1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by a nationally recognized testing laboratory.

- D. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 20 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting. Relay reset shall be selectable manual or automatic. Automatic restart shall only occur after loss of phase condition clears and adjustable time delay (initial setting is 3 minutes) times out. Only one restart attempt shall occur. Relay shall have a panel-front LED indication of “trip” condition.

2.04 ENCLOSURES

- A. Description: Flush- or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
1. Outdoor, vault and manhole locations: NEMA 250, Type 3R.
 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C
- B. Enclosure Front Controls, Instruments and Indicators: General requirements. These general requirements are superseded by any detailed specific requirements whenever they conflict.
1. Elevation: Not to be installed more than 6 feet 6 inches above finished floor nor less than 24 inches above finished floor.
 2. Types:
 - a. Controls: Suitable for use with gloved hand. Includes circuit breaker and fused switch handles in addition to selector switches and metering operation buttons.
 - b. Indicator/Label Character Size: Digital indicators shall have characters 1/2 inch tall minimum. Analog indicators shall have 3 inch minimum length with 1/4 inch minimum height static characters.
 - c. Pilot lamps shall be LED type 1/2 inch minimum diameter with test function.

2.05 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

- D. Control Relays: Auxiliary and adjustable time-delay relays.
- E. Elapsed Time Meters: Heavy duty with digital readout in hours.
- F. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy. Where indicated, provide transfer device with an off position. Meters shall indicate the following:
 - 1. Ammeter: Output current, with current sensors rated to suit application.
 - 2. Voltmeter: Output voltage.
- G. Surge protection device with EMI/RFI noise attenuation using 50 OHM (Ω) Insertion Loss Test; 50 dB at 100 KHZ per MIL-STD-220A methods.

2.06 FACTORY FINISHES

- A. Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard gray paint applied to factory-assembled and -tested enclosed controllers before shipping.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Schedules and control diagrams on plans indicate specific components and accessories required. Starters not identified in the schedules and control diagrams shall be combination magnetic type with control power transformer, H-O-A selector switch, push-to-test LED type red pilot light, elapsed time meter, current sensing solid state adjustable overload module with phase failure sensing relay in NEMA 1 enclosure.

3.03 INSTALLATION

- A. See Division 26 Sections "General Provisions For Electrical Work" and "Common work For Electrical" for general installation requirements.

- B. For size 2 and smaller control equipment on walls, ~~bolt units to wall or~~ mount on lightweight structural-steel channels bolted to wall. For larger controllers on walls and all controllers not at walls, provide freestanding racks complying with Division 26 Section ""Common Work Results For Electrical."
- C. Install freestanding floor mounted equipment on concrete bases complying with Division 03 Section "Cast-in-Place Concrete."
- D. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

3.04 IDENTIFICATION

- A. Identify enclosed controller components and control wiring according to Division 26 Section "Identification for Electrical Systems".

3.05 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
 - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
 - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.06 CONNECTIONS

- A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. All terminations shall be marked "75°C only", "60/75°C" or listed for use of 75°C insulated wire at full 75°C ampacity.

3.07 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed controller bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: Perform the following field quality-control testing:
 - 1. Perform each electrical test and visual and mechanical inspection indicated in NETA ATS, Sections 7.5, 7.6, and 7.16.
 - 2. Certify compliance with test parameters.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including pretesting and adjusting solid-state controllers.
- D. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.08 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.09 CLEANING

- A. Clean enclosed controllers internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.10 STARTUP SERVICE

- A. Verify that enclosed controllers are installed and connected according to the Contract Documents.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
- C. Complete installation and startup checks according to manufacturer's written instructions.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers and variable-frequency drives. Refer to Division 01 Section "Demonstration and Training".
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Division 01 Section "Operation and Maintenance Data."
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

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SECTION 26 32 13 - ENGINE GENERATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes packaged diesel-engine generator set(s) with ratings and installation meeting NFPA 110 2013 Edition requirements for emergency use using standby ratings only with the following features and accessories:
 - 1. Battery charger.
 - 2. Base Tank.
 - 3. Engine-generator set.
 - 4. Muffler.
 - 5. Exhaust piping external to set.
 - 6. NFPA 110 outdoor enclosure - Level 2 sound enclosure
 - 7. Remote stop switch.
 - 8. Starting battery.
- B. Related Sections include the following:
 - 1. Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.03 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- B. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.
- C. Emergency Generator. As defined to supply emergency power systems as defined in NFPA 70 Article 700 and as defined in NFPA 110 2013 Edition as a Level 1 Emergency Power Source (EPS).

- D. EPA definition of “Emergency Use” as applied to exhaust emissions. “Emergency Use” means only operated to replace a failed utility power source and only operated until the utility source returns. Standby ratings apply (see below). The term “emergency” here has no relationship to the NFPA Code definition. Its use relates to the loss of utility power only.
- E. LP: Liquid petroleum.
- F. Standby ratings. Controls and installation are designed for automatic use during failure of utility power and less than 100 hours of maintenance operation per year. Prime ratings are lower and are applicable for use when utility power is available and generators are being used by choice. Standby ratings are those that apply to generators classified by EPA as in “Emergency Use”. Many generators in Emergency Use only require Tier 2 or 3 rating. See current US EPA off road engine Tier Requirements.
- G. Legally required standby generator. As the defined power source for Legally Required Systems in NFPA 70 Article 701 and as described in NFPA 110 as a Level 2 Emergency Power Supply (EPS). Level 1 EPS may be used to supply legally required systems as well as emergency systems
- H. Generator Set Manufacturer
- I. Optional standby generator. Any on site generator that serves as an optional power source for loads as defined in NFPA 70 Article 702. These are loads chosen by the Owner as important for continued operation.
- J. Authorized Distributor

The equipment supplier shall be the local authorized distributor for the product supplied and the local source of immediate warranty support for the engine and the alternator. He shall maintain at his location spare parts for the engine-alternator assembly. The Authorized Distributor shall directly provide all warranty support, personnel and responsibility for the engine-alternator assembly and shall not delegate, subcontract or assign the warranty for the engine-alternator assembly to any other entity. Separate warranties or warrantors for engines, alternators or other components of the engine-alternator assembly are permitted. The Authorized Distributor shall be the responsible Installer of the engine-alternator assembly.

- K. Tier EPA Emissions Requirements. U.S. EPA mandated limitations on particulate and nitrogen oxide discharge limitations have been established in four “Tiers” or categories and vary based upon engine size and use. Tier 4 is the most restrictive. Tier rating for each generator is established at time of manufacture. All generator installations shall meet EPA Tier rules and requirements in force at the time of purchase. All generators used for other than “Emergency Use” shall be Tier 4. All generators shall be factory certified to meet current EPA Tier requirements for emergency use applications (see definition for Emergency Use). Field testing to establish Tier rating will not be accepted.

1.04 SUBMITTALS

- A. See Section “General Provisions For Electrical Work” for submittal requirements in addition to the following listed requirements.
- B. Product Data: Include the following:
1. Data on features, components, accessories ratings, and performance.
 2. Thermal damage curve for generator.
 3. Time-current characteristic curves for generator protective device.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Factory published specification sheet indicating standard and optional accessories, ratings, etc.
 2. Manufacturer's catalog cut sheets of all auxiliary components such as spring isolators, battery charger, silencer, exhaust flex, emergency main circuit breaker, etc.
 3. Dimensional elevation and layout drawings of the generator set, connections and related accessories.
 4. Weights of all equipment.
 5. Concrete pad recommendation, layout and drop down locations of electrical and fuel system connections. Gas and power connections shall be from above. Diesel fuel connections shall be from below.
 6. Interconnect wiring diagram of complete emergency power system, including generator, battery charger, jacket water heaters, batteries, ventilation louvers, control and signal from transfer switches and paralleling equipment.
 7. Engine mechanical data at varying loads up to full load, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc.
 8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
 9. Generator resistances, reactances and time constants.

10. Generator current decrement curve.
 11. Generator motor starting capability and voltage drop at each transfer switch load step.
 12. Generator thermal damage curve.
 13. Jacket water heater connection diagram.
 14. Control panel schematics.
 15. Manufacturer's and dealer's written warranty.
 16. Emissions data.
 17. Factory and Field Test Results
 18. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing generator mounting.
 19. Generator Mounting Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include weight deflection and isolator details.
 20. Non-Compliance: Submittal shall clearly identify any and all specified requirements with which the submitted equipment is not fully compliant.
- D. Welding certificates.
- E. Qualification Data: For Installer and manufacturer.
- F. Factory NFPA 110 Test. The manufacturer shall perform an NFPA 110 compliant test. The test shall include a 4 hour full load test at 0.8 power factor for all generator sets supplying power to an emergency power system (NFPA 110 Level 1). See NFPA 110 Section 7.13. If these test results have not been received and approved prior to on-site testing then an additional requirement for site full load test must include reactive load bank for 0.8 power factor full load and occur prior to "Demonstration". (See Part 3)
- G. Factory Prototype Testing:
- The system manufacturer must certify that the unit meets NFPA 110 2013 Edition general requirements (Section 5.2) and IEEE 115 by demonstrated performance of a prototype and that the engine, generator and controls have been tested as complete system of representative engineering models (not on equipment sold). The manufacturer shall supply equipment that is a current factory production model (not one of the actual prototypes).
- Prototype testing shall include:
- Fuel consumption at 1/4, 1/2, 3/4, and full load
 - Exhaust emissions
 - Mechanical and exhaust noise (breakdown by distance, frequency and composite sound power level)
 - Governor speed regulation at 1/4, 1/2, 3/4, and full load; and during transients
 - Motor starting KVA, voltage dips and recovery time at above load steps (record and display transient waveforms)

Meet NFPA 110 Section 5.6.9.8 and Section 7.13 Tests.
Generator temperature rise in accordance with NEMA MG1-22.40
Harmonic analysis, voltage waveform deviation and telephone influence factor
Generator short circuit capability
Cooling system performance
Generator revolving field assembly for 2 hours at 150% overspeed and 70°C, and each production unit tested at 125% overspeed at room temperature.

- H. Certified Test Reports: For equipment that is equivalent, but not identical, to those tested on prototype unit.
- I. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
- J. Test Reports:
 - 1. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
 - 2. Report of sound generation.
 - 3. Report of exhaust emissions showing compliance with applicable regulations. Verify compliance with EPA Tier requirements.
 - 4. Field quality-control test reports.
- K. NFPA 110 required deliverables to AHJ prior to acceptance test per Section 7.13.4.6 for emergency or legally required units.
 - 1. Evidence of a compliant prototype test.
 - 2. Certification that verifies the torsional vibration compatibility of the rotating element of the primer mover and generator for the intent of use of the energy converter.
 - 3. A letter from the energy converter supplier stipulating compliance and performance with NFPA 110.
 - 4. A manufacturer's certification of a rated load test at rated power factor with the ambient temperature, altitude and fuel grade recorded.
- L. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data", include the following:
 - 1. List of tools and replacement items recommended to be stored at the Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
- M. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

A. Equipment

The equipment supplied and installed shall be new and of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory trained service personnel.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of the units required for this Project.

1. **Maintenance Proximity:** Not more than four hours' normal response time from Installer's place of business to Project site.
2. **Engineering Responsibility:** Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

C. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 40 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs. Manufacturer shall have at least 10 years of experience building this type of equipment.

D. Contractor Testing Supervisor: The Contractor shall retain a person certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise the on-site testing specified in Part 3 of this Section. The Contractor may, in lieu of the above qualifications, submit the resume of an experienced field generator startup technician citing training and startup and testing of installations similar in size and complexity to this project for consideration and approval prior to the Site Testing Organizational Meeting described in Part 3.

E. Testing: Provide a factory test, on-site tests and a code official demonstration test. See Part 2 under "Source Quality Control" and Part 3 of this section under "Field Quality Control" and "Demonstration".

F. Testing Consumables: The Contractor shall provide all consumable products required to satisfactorily meet testing requirements as well as demonstration requirements. Consumables shall include fuel, coolant, lubricants and filters. Consumables that are used, diminished or polluted during testing or demonstrating the equipment shall be replaced with new prior to final acceptance. Owners' on hand quantities of such items shall be at maximum capacity when the Owner accepts the equipment.

G. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

- H. Product Options: Drawings indicate size, profiles, and dimensional requirements of packaged generator sets and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- I. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX for welding exhaust and cooling system piping.
- J. 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.
- K. Comply with NFPA 30 and 37.
- L. Comply with NFPA 70, Article 700 "Emergency Systems".
- M. Comply with NFPA 70, Article 701 "Legally Required Systems".
- N. Comply with NFPA 70, Article 702 "Optional Standby Systems".
- O. Comply with NFPA 99.
- P. Comply with NFPA 110 2013 Edition requirements for Level 1 emergency power supply.
- Q. Listed by U.L. to meet UL 2200. Generator sets whose voltage exceeds 600 volts shall comply with all applicable portions of UL 2200 and all applicable ANSI standards.
- R. Engine Exhaust Emissions: Comply with applicable federal, state and local government requirements for Emergency Use operation.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Outdoor Temperature: -20 to 95 deg F.
 - 2. Surrounding Space Temperature (Generator Off) within indoor room or within outdoor enclosure: 40°F to 100°F.
 - 3. Relative Humidity: 0 to 95 percent.
 - 4. Altitude: Sea level to 1000 feet (300 m).

1.07 COORDINATION

- A. Work items requiring coordination between Contractors is listed below. Items not on this list are understood to be furnished, installed and connected by Division 26.

Division of work shall be as indicated below:

ITEM	SPECIFICATION DIVISION		
	FURNISHED UNDER	INSTALLED UNDER	CONNECTED UNDER
1. Muffler, Exhaust Flex Connectors	26	23	23
2. Wall/Roof Thimble Exhaust Piping and Insulation	23	23	23

ITEM	SPECIFICATION DIVISION		
	FURNISHED UNDER	INSTALLED UNDER	CONNECTED UNDER
3. Cooling/Combustion Air System Sheetmetal, Louvers, Motor- Operated Dampers **	23	23	23
4. Concrete Housekeeping Pads	26*	26*	26*

* Electrical Contractor is responsible for coordinating the concrete pad requirements with the General Trades Contractor and meeting Division 03 Section "Miscellaneous Cast-In-Place Concrete".

** Electrical connections by Electrical Contractor

B. Coordinate size and location of roof curbs, equipment supports and roof penetrations for remote radiators. These items are specified in Division 07 Section "Roof Accessories".

1.08 WARRANTY

A. Five Year Comprehensive Warranty

The manufacturer's standard warranty shall in no event be for a period of less than five (5) years from date of substantial completion of the installed system or 3000 hours whichever comes first. This warranty shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Submittals received without written warranties as specified will be rejected in their entirety. The system is connected to only operate in standby mode during failure of the normal power source and results in significant building load curtailment. It is not practical or suitable to operate in any continuous mode. Warranty shall be a document executed directly between the Manufacturer and his Authorized Distributor and the Owner and shall not involve the Contractor.

B. One Year Warranty

The Contractor shall provide his standard one year warranty that covers installation defects for one year after acceptance of the equipment by the Owner.

1.09 MAINTENANCE SERVICE

- A. Preventive Maintenance Service:** Beginning at Substantial Completion, provide 12 months' full maintenance by Manufacturer trained employees of manufacturer's Authorized Distributor. Include monthly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts and supplies as used in manufacture and installation of original equipment. Keep all records on site to demonstrate preventive maintenance, unit exercising and repair maintenance suitable for demonstrating compliance with all OSHA, NFPA 110 and NFPA 99 requirements..

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
- 1. Kohler Co; Generator Division**
 - a. Basis of Design: Model 600REOZVB w/ 5M4032 Alternator**
 - 2. Caterpillar; Engine Div.**
 - 3. Cummins Power Generation**

2.02 ENGINE-GENERATOR SET

- A.** The generator set shall be a Kohler model 600REOZVB with a 5M4032 alternator. It shall provide 750.00 kVA and 600.00 kW when operating at 277/480 volts, 60 Hz, 0.80 power factor. The generator set shall be capable of a 130°C Standby @40C rating while operating in an ambient condition of less than or equal to 104 °F and a maximum elevation of 1000 ft above sea level. The standby rating shall be available for the duration of the outage.
- B.** Factory-assembled and tested, packaged engine-generator set shall be a coordinated assembly of compatible components.
- C.** Output Connections: Three phase, four wire.
- D.** Safety Standard: Comply with ASME B15.1.
- E.** Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, and model and serial number of component.

- F. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components.
 - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

2.03 GENERATOR SET PERFORMANCE (FOR SENSITIVE LOADS AND DIESEL ENGINE)

- A. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
 - 1. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
- B. Alternator
 - 1. The alternator shall be salient-pole, brushless, 2/3-pitch, with 4 bus bar provision for external connections, self-ventilated, with drip-proof construction and amortisseur rotor windings, and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a vacuum pressure impregnated, fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to 130°C Standby @40C. The PMG based excitation system shall be of brushless construction controlled by a digital, three phase sensing, solid- state, voltage regulator. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
 - 2. The alternator shall have a maintenance-free bearing, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
 - 3. The generator shall be inherently capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.
 - 4. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 2,200.00 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE Standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip, i.e., engine, alternator, voltage regulator, and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.

- C. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
- C. Steady-State Voltage Modulation Frequency: Less than 1 Hz.
- D. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 3 seconds.
- E. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
- F. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- G. Transient Frequency Performance: Less than 3-Hz variation for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
- H. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
- I. Provide permanent magnet excitation for power source to voltage regulation.

2.04 SERVICE CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: -20 deg to 95 deg F.
 - 2. Relative Humidity: 0 to 95 percent.
 - 3. Altitude: Sea level to 1000 feet (300 m).
- B. Unusual Service Conditions: Engine-generator equipment and installation are required to operate under the following conditions:
- C. Physical Unit Restrictions

2.05 ENGINE

- A. Fuel: Fuel oil, Grade DF-2 ASTM D975.
- B. The minimum 16.12 liter displacement engine shall deliver a minimum of 903 HP at a governed engine speed of 1800 rpm, and shall be equipped with the following:
 - 1. Electronic isochronous governor capable of 0.25% steady-state frequency regulation

2. 24-volt positive-engagement solenoid shift-starting motor
 3. 80-ampere automatic battery charging alternator with a solid-state voltage regulation
 4. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain
 5. Dry-type replaceable air cleaner elements for normal applications
 6. Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel
 7. The turbocharged engine shall be fueled by diesel
 8. The engine shall have a minimum of 6 cylinders and be liquid-cooled
- C. The engine shall be EPA certified from the factory
- D. The generator must accept rated load in one-step

2.06 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
- B. Radiator: Rated for specified coolant.
1. Radiator Core Tubes: Nonferrous-metal construction other than aluminum.
 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 3. Fan: Driven by multiple belts from engine shaft.
- C. Coolant: Solution of 50 percent biodegradable antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
- D. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- E. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
1. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

2.07 FUEL SUPPLY SYSTEM

- A. Comply with NFPA 30.

- B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features in addition to double wall with alarm and contacts shall include the following:
1. Tank level indicator with high/low tank alarm contacts (2 each) and local alarms.
 2. Capacity: Fuel for 48 hours' continuous operation at 100 percent rated power output.
 3. On tanks larger than 1320 Gallons, Provide a 95% fuel shutoff which will close via a solenoid once to prevent fuel fill after the tank has reached or exceeded 95% full
 4. Containment Provisions: Comply with requirements of authorities having jurisdiction. Provide overfill capture and elevated external vent (12 feet above grade).
 5. Provide heater to maintain 40°F fuel at -20°F ambient for unit installed on outdoor concrete pad.
 6. Provide OSHA compliant stairs, platform and handrail for all tanks in excess of 18 inches in height to permit access to the Control and Monitoring Panel.
 - a) Pre-engineered, prefabricated, steel stairs and platform shall be provided for both the left- and right-hand sides of the generator.
 - b) Stairs and Platform shall incorporate a 37'' tall handrail.
 - c) Platform shall be the max height of the tank and extend the length of the unit to grant easy access into all doors of the generator set.
 - d) Platform shall be 36'' in width from the generator enclosure to the handrail.
 7. Tank shall be tested and demonstrated to be free of leaks as required by the local Fire Code Official.

2.08 ENGINE EXHAUST SYSTEM

- A. Connection from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe
- B. Muffler: Critical type, sized as recommended by engine manufacturer.
1. Minimum sound attenuation of 25 dB @ 500 Hz.
 2. Sound level measured at a distance of 23 feet (7 m) from exhaust discharge shall be 76 dBA or less.
- C. Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock. Extend to floor drain.

2.09 COMBUSTION-AIR INTAKE

- A. Description: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

2.10 STARTING SYSTEM

- A. Description: 12V Electric, with negative ground and including the following items:
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions".
 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 4. Battery: Lead Acid storage battery set of the heavy duty diesel starting type. Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article to provide specified cranking cycle at least three times without recharging.
 5. Battery Cable: Size as recommended by engine manufacturer for installed cable length indicated. Include required interconnecting conductors and connection accessories.
 6. Battery Rack

A battery rack shall be provided for the batteries and shall conform to NEC 480-8. It shall be treated to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over battery electrolyte shall be contained within the tray to prevent a direct path to ground. Provide matching cover.
 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 10 A (20A on large generators-see recharge requirements) shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again. Charger(s) shall be sized to meet NFPA 110 requirement for total recharge within 24 hours.

- b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
- c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
- d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
- e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
- f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
- g. Provide LaMarche or equal.
- h. Capacity shall be sufficient to provide full charge rate plus support local and remote engine annunciator and power transfer switch remote annunciators.

2.11 CONTROL AND MONITORING

- A. Automatic Functional Description: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches or transfer switch remote annunciator and control panel initiate starting and stopping of the generator set. When mode-selector switch is switched to the on position, the generator set starts. The off position of the same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set. Coordinate with automatic transfer switch vendor drawings.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- C. Instrument transformers, generator disconnect switch or circuit breaker, shall be grouped in an attached or separate enclosure. Control and monitoring panel shall be isolated from power sections by steel barriers and vibration isolated.
 - 1. Current and Potential Transformers: Instrument accuracy class.

- D. Provide both local and remote indicating and protective devices and controls which shall include those required by NFPA 110 for a Level 1 system, and the following:
1. AC voltmeter.
 2. AC ammeter.
 3. AC frequency meter.
 4. DC voltmeter (alternator battery charging).
 5. Engine-coolant temperature gage.
 6. Engine lubricating-oil pressure gage.
 7. Running-time meter.
 8. Ammeter-voltmeter, phase-selector switch(es).
 9. Generator-voltage adjusting rheostat.
 10. Start-stop switch.
 11. Overspeed shutdown device.
 12. Coolant high-temperature shutdown device.
 13. Coolant low-level shutdown device.
 14. Oil low-pressure shutdown device.
 15. Fuel tank derangement alarm.
 16. Fuel tank high/low-level shutdown of fuel supply alarm.
 17. Generator overload. (Allows 105% for 1 minute).
- E. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Division 26 Section "Electrical Power Monitoring and Control."
- F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel. Provide remote shutdown with keyed lock protection.
- G. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Coordinate with Building Automation System.
1. Engine high-temperature shutdown.
 2. Lube-oil low-pressure shutdown.
 3. Overspeed shutdown.
 4. Remote emergency-stop shutdown.
 5. Engine high-temperature prealarm.
 6. Lube-oil low-pressure prealarm.
 7. Fuel tank, low-fuel level.
 8. Low coolant level.
 9. Overcrank shutdown.
 10. Coolant low-temperature alarm.
 11. Control switch not in auto position.
 12. Battery-charger malfunction alarm.
 13. Battery low-voltage alarm.

- H. Remote Emergency-Stop Switch: Surface; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation by clear lift-up cover with local audible alarm. See plans near generator location. Locate in main electric room.

2.12 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breakers: Molded-case, electronic-trip type; 100 percent rated; SE label, complying with UL 489. Install in separate enclosure if necessary to achieve 100% rating.
 - 1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous. Coordinate with alternator protection curve and downstream OCPD's.
 - 2. Trip Settings: Matched to generator thermal damage curve as closely as possible.
 - 3. Mounting: Adjacent to or integrated with control and monitoring panel, whichever is required to obtain 100% rating.
- B. Ground-Fault Indication: Comply with NFPA 70, Article 700-7(D) prohibiting shutdown of code required emergency systems. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.13 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1 and specified performance requirements. Note when selecting generator that it will be tested for 105% rated output for 1 minute.
- B. Drive: Generator shaft shall be directly connected to engine shaft.
- C. Electrical Insulation: Class H. Temperature rise shall not exceed 130°C over 40°C ambient.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Excitation shall use no slip or collector rings, or brushes, and shall be arranged to sustain generator output under short-circuit conditions as specified. It shall be permanent magnet (PMG) type.
- G. Enclosure: Drip proof.

- H. Voltage Regulator: Shall be microprocessor controlled, full wave rectified and utilize a FET-based design providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance (X''_d) that restricts fault currents: 12 percent maximum for alternators up to 1200 KVA and 20 percent maximum for units larger than 1200 KVA. Transient reactance (X'_d) that restricts recovery to steady state shall not exceed 25 percent for units up to 1200 KVA and 30 percent for units larger than 1200 kVA.

2.14 OUTDOOR GENERATOR-SET ENCLOSURE (NFPA 110, 2013)

- A. Description: Vandal-resistant, acoustic, weatherproof insulated steel housing (R-15 minimum insulation rating), rated to withstand wind up to 100 mph (160 km/h). Provide Level 2 sound rating. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be insulated (R 15 Minimum) and removable by one person without tools. Instruments and control shall be mounted within enclosure. Provide electric unit heater sized to maintain 40°F minimum inside enclosure. Provide seals around all panels and on damper blades. Provide insulating electric operated inlet air damper with blade tip seals and spring open electric close radiator discharge damper with insulated blades. Provide thermostatically controlled jacket water heater and battery heater. Provide electric load center with separate circuit breakers (10 KAIC) for unit heater, water jacket heater, battery charger, interior light and service receptacle. Unit sound level at 7 feet shall not exceed 76 db. See plan for foundation requirements. See above for fuel tank requirements.
 - 1. Muffler Location: Within enclosure.
- B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 100 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
 - 1. Louvers: Fixed-engine cooling-air inlet and discharge. Storm-proof and drainable louvers to prevent entry of rain and snow.
- C. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
 - 1. AC lighting system and connection point for operation when remote source is available.
 - 2. DC lighting system for operation when remote source and generator are both unavailable.

- D. Convenience Outlets: Factory wired GFCI. Arrange for external electrical connection.

2.15 FINISHES

- A. Outdoor Enclosures and Components: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

2.16 SOURCE QUALITY CONTROL

- A. Factory Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories as prototype.
1. Tests: Comply with NFPA 110, Level 1 energy converters in Chapter 7 Section 7.13.
 2. Generator Tests: Comply with IEEE 115.
 3. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype shall have been factory tested to demonstrate compatibility and reliability.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Test shall include all NFPA 110 factory test requirements as a minimum. Include the following tests which may exceed these requirements:
1. 4 hour full load run. Record voltage, current, engine water temperature and radiator air in and out temperature. All at 15 minute intervals.
 2. 105% maximum power rating for 1 minute. (Exceeds 110 requirements, select larger unit if necessary to comply).
 3. Voltage regulation. See Part 2 "Generator Set Performance".
 4. Transient and steady-state governing. See Part 2 "Generator Set Performance".
 5. Single-step [Two 50% load pickup steps]load pickup (cold start).
 6. Alarms and Safety shutdowns.
 7. Observation of Factory Tests: Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

- C. Report factory test results within 10 days of completion of test. Do not ship equipment until factory tests are approved by the Owner's Representative.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Entry of the equipment into and through the building to its final location shall be the joint responsibility of the Electrical Contractor and the Equipment Manufacturer. Use properly skilled riggers. If disassembly of unit is required it shall be the responsibility of the generator supplier to disassemble and reassemble the unit. All rigging and connections of rigging to building structural elements shall be analyzed by the Contractor and Manufacturer. They shall submit the results of their analysis and obtain approval of the loads and stresses placed upon building elements in order to support and move the generator. Such approval shall be required from the Structural Engineer/Architect prior to the generator entering the building or rigging connected to the building structural elements.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than ten working days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

3.03 CONCRETE BASES

- A. Provide a new concrete base. Length and width shall be greater than generator base rails and shall be two inches tall minimum. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete in Section 03 30 00.

3.04 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generators level on concrete base.
- C. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

3.05 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems". Disconnect neutral-ground bond at generator load connection when connected supplying three pole transfer switch(es) with solid neutral.
- B. Connect external control and annunciation wiring required by this section according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Provide load shed/add wiring and paralleled generator control wiring when such features are specified in this specification. See Division 26 Section "Transfer Switches" for remote transfer switch control and/or monitor wiring.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Balance single phase loads and adjust voltage according to Section 26 01 00.

3.06 IDENTIFICATION

- A. Identify system components according to Divisions 22 and 23 Sections "Identification for Mechanical Systems" and Division 26 Section "Identification for Electrical Systems".
- B. Provide a sign at the service entrance equipment per NEC Article 700.
- C. If solid neutral transfer switch is used provide a sign at the service entrance ground bus per NEC Article 700.

3.07 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 to conduct in field testing. Report results in writing prior to scheduling Field Test Organizational Meeting.
 - 1. Startup Service
 - a. Engage a factory-authorized service representative to perform startup service.

- b. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - c. Complete installation and startup checks according to manufacturer's written instructions. This shall include such items as phase rotation, voltage set, alarms, safeties, load pickup, voltage regulation etc.
- B. **Field Test Organization Meeting:** The Contractor shall provide the Construction Manager with one week minimum notice to coordinate scheduling the Field Test Organization Meeting. The Contractor's Testing Supervisor (see Part 1 of this specification) shall present a testing plan for review with the Engineer. The plan shall cite each test requirement and its paragraph from the specification before explaining how the test is to be performed, by whom and when. The sequence of tests shall be clearly stated. A listing of acceptable ranges for measured parameters (coolant temperature, oil pressure, fuel supply/return temperature, DC bus voltage, electrical output parameters etc.) shall be provided indicating the times into the test when readings are to be made. Each test shall be described including the test equipment to be used, the configuration of attachment, measurements to be made and responsible parties who will be conducting the tests and making the measurements. The test plan shall include starting and ending clock times as well as pretest conditions that are required e.g. cold engine, full fuel tanks, special connections and special test instruments. All test instruments shall bear indications of valid calibration. Dates for beginning the testing shall be coordinated at this meeting but **in no case shall the testing begin less than one week** following the organization meeting. See requirements in Part 1 Paragraph "Testing Consumables" of this specification for additional test requirements.
- C. **Perform the following field tests and inspections and prepare test reports:**
 - 1. Perform each electrical visual and mechanical inspection stated in NETA ATS, Sections 7.15.2.1 and 7.22.1
 - 2. Certify compliance with test parameters. Provide voltage, current, engine water temperature, radiator air in and out temp for all transient tests and every 15 minutes for all continuous tests.
 - 3. Perform tests recommended by manufacturer.
 - 4. **NFPA 110 Acceptance Tests:** Perform tests required by NFPA 110 that are additional to those specified here using a load bank including, but not limited to, the following:
 - a. For diesel engines 400 KW and below single-step full-resistance load pickup test. (cold start) For spark ignited engines and diesels in excess of 400 KW use two single steps of 50% full resistive load pick-up. (cold start)
 - b. 8 hour full load test at unity power factor (if factory test has been run with reactive load bank).
 - c. NFPA 110 Acceptance Test per Section 7.13.4.1 through 7.13.4.5.

- d. 105% maximum power rating for 1 minute. Increase engine and/or alternator size if necessary to pass this test.
 - e. Voltage regulation and transient response. See Part 2 "Generator Set Performance:"
 - 5. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 - 6. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - 7. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - 8. Exhaust Emissions Test: Comply with applicable government test criteria.
 - 9. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for step-load increases of zero to 50%, 50 to 100% and decreases of 100 to 50% and 50 to zero percent. verify that performance is as specified. See Part 2 "Generator Set Performance."
 - 10. Harmonic-Content Tests: Measure harmonic content of output voltage fewer than 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits. See Part 2 "Generator Set Performance".
 - 11. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at 4 locations on the property line, and compare measured levels with required values.
- D. Coordinate tests with tests for transfer switches and run them concurrently.
- E. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request. Test equipment shall be designed for use at required voltages and currents. Field adaptation not recommended by test equipment manufacturer is not permitted.

- F. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- H. Test and adjust controls, alarms and safeties. Replace damaged and malfunctioning controls and equipment.
- I. Remove and replace malfunctioning units and retest as specified above.
- J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- L. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to demonstrate the operation of the system for code official acceptance, for Owner Acceptance and to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. This demonstration will require use of a load bank and/or the building load. It cannot be scheduled until successful completion of the Field Testing (NETA, NFPA 110 Acceptance, Battery/Charger System, Exhaust, Transient Stability, etc.) described above. See requirements in Part 1 Paragraph "Testing Consumables" of this specification for additional test requirements. Refer to Division 01 Section "Demonstration and Training". Provide NFPA 110 required deliverables to the AHJ prior to demonstration. See Part 1 "Submittals" for list of four NFPA 110 deliverables.

1. Coordinate this demonstration and training with that for transfer switches, Low Voltage Paralleling Switchgear and Electrical Power Monitoring and Control System.

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SECTION 26 36 00 - TRANSFER SWITCHES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:
 - 1. Automatic transfer switches (ats).
 - 2. Remote annunciation and engine start system.
 - 3. Remote annunciation and control system.
 - 4. Wiring from ats to engine generator.
- B. Related Sections include the following:
 - 1. Division 21 Section "Electric-Driven, Centrifugal Fire Pumps" for automatic transfer switches for fire pumps.
 - 2. Division 26 Section "Engine Generators".

1.03 SUBMITTALS

- A. See Section "General Provisions For Electrical Work" for submittal requirements in addition to the following listed requirements.
- B. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
- C. Shop Drawings: Dimensioned plans, sections, and elevations showing minimum clearances, required maintenance access space, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified. Indicate all specified accessories and confirm specified settings of adjustable parameters.
 - 1. Wiring Diagrams: Single-line diagram. Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch. Show all control wiring showing internal and external connections. Coordinate with Engine Generators Section to meet remote wiring requirements.

- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Features and operating sequences, both automatic and manual.
 - 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
- B. Contractor Testing Supervisor: The Contractor shall retain a person certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise the on-site testing specified in Part 3 of this Section. In lieu of the above the Contractor may submit the resume of an experienced startup engineer/technician citing training and startup and testing of installations similar in size and complexity to this project for consideration and approval prior to the Site Testing Organizational Meeting described in Part 3.
- C. Source Limitations: Obtain automatic transfer switches, bypass/isolation switches, nonautomatic transfer switches, remote annunciators, and remote annunciator and control panels through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for emergency service under UL 1008, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NEMA ICS 1, 2.
- F. Comply with NFPA 70. The applicable edition is that adopted and codified by the local Authority Having Jurisdiction (AHJ).
- G. Comply with NFPA 99.
- H. Comply with NFPA 110 2013 Edition.
- I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.05 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
 - 1. Notify Construction Manager no fewer than 20 days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

1.06 COORDINATION

- A. Coordinate hardware and cabling materials for Building Management Systems Integrated. All hardware and cabling shall be provided by this Contractor.

1.07 WARRANTY

- A. Provide a no deductible warranty. Warranty shall cover all parts, labor and travel. It shall be for a period of 3 years from the date of substantial completion. Keep a log of all repair work performed. Warranty shall be a document executed directly between manufacturer and Owner and void of any participation by the Contractor.

1.08 MAINTENANCE

- A. Provide preventive maintenance on products installed as work of this section for a period of 12 months from the date of substantial completion. Maintain appropriate records of PMS work as well as repair work. See WARRANTY.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Contactor Transfer Switches:
 - a. Emerson; ASCO Power Technologies, LP.
 - b. Cummins Power Generation; Industrial Business Group.
 - c. Russelectric, Inc.
 - d. Kohler Co.; Generator Division

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated. See One Line Diagram for ampere ratings and indication of required switch types (open transition, closed transition, neutral position, bypass).
- B. Provide Service Entrance Rated.
- C. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Testing and Approval

As a condition for approval, the manufacturer of the automatic transfer switches shall verify that his switches are listed by Underwriters Laboratories, Inc., Standard UL-1008 with 3 cycle short circuit closing and withstand as follows:

RMS Symmetrical Amperes @ 480 VAC		
Amperes	3 Cycle Closing & Withstand	30 Cycle Closing & Withstand
100 - 400	42,000	30,000
600 - 800	65,000	42,000
1000 - 1200	85,000	65,000
1600 - 4000	100,000	85,000

- 2. During the 3 cycle closing and withstand tests, there shall be no contact welding or damage. The 3 cycle tests shall be performed without the use of current limiting fuses or circuit breakers, and oscillograph traces across the main contacts shall be furnished to verify that contact separation has not occurred, and there is contact continuity across all phases after completion of testing. Test procedures shall be in accordance with UL-1008, and testing shall be certified by Underwriters' Laboratories Inc.
- 3. When conducting temperature rise tests to UL-1008, the manufacturer shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.
- 4. Manufacturer shall provide copies of test reports upon request.
- 5. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

- D. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels have communication capability matched with remote device. Shall communicate with Building Automation System.
- E. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- F. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- G. Neutral Terminal: Solid and fully rated, unless otherwise indicated. Four pole switches shall have overlapping neutral contacts.
- H. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.
- I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by numbered or lettered wire and cable tape markers at terminations.
 - 1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with insulated fork connectors suitable for connection to terminal strips.
- J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- K. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Switch Action: Double throw; mechanically held in both directions.
 - 2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

2.03 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

- C. Manual Switch Operation: Under load, with door or subpanel barrier closed and with either or both sources energized. Transfer time is same as for electrical operation. Switches which allow contact “teasing” are not acceptable. Contact speed shall be independent of handle speed.
- D. Standard Open Transition Switch
 - 1. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Designs relying on electrical interlocks only are not acceptable. Main contacts shall be mechanically locked in position in both the normal and emergency positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungsten alloy. Main contacts on all size switches shall be segmented, and shall have separate arcing contacts with magnetic blowouts for positive arc-quenching and maximum contact life. Interlocked molded case circuit breakers or contacts are not acceptable.
 - 2. The automatic transfer switch shall be double throw, actuated by one or two electrical operators, momentarily energized and connected to the transfer mechanism by a simple over-center type linkage, providing inherent “quick-break”, “quick-make” operation when operated electrically or manually, with a total transfer time not to exceed one-half second.
 - 3. Obtain voltage for main contact operating solenoid from source to which load is being transferred.

2.04 AUTOMATIC TRANSFER SWITCH FEATURES

A. General

All timing and adjustable level setpoints shall be digitally determined and user adjustable via LCD or LED display and keypad adjustment. Provide display and keypad. Analog devices shall not be acceptable.

- 1. Provide remote monitor/control of the transfer switch via Building Automation System link. See Remote Annunciator/Control requirements in this section.
- B. Voltage Sensing. Undervoltage Sensing for each phase of normal and emergency source: Senses low phase-to-ground voltage on each phase. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Initial setting for pickup is at 90 percent and dropout at 85 percent. Provide over voltage sensing for each phase. Pickup voltage is adjustable from 110 percent to 120 percent. Drop out is adjustable from 105 to 115 percent. Set at 110 percent dropout and 108 percent pickup.
- C. Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustment from zero to six seconds is required. Set engine start delay to 1 second.

- D. Voltage/Frequency Lockout Relay: Prevents premature transfer to generator. Pickup voltage is adjustable from 85 to 100 percent of nominal on all three phases. Startup setting is for pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Startup setting is for pickup at 96.6 and 103.3 percent and dropout at 95 and 105 percent. Set transfer delay for 1 second after relay pickup.
- E. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and initial setting is for 10 minutes. Provides automatic defeat of delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
- F. Preferred Source Switch: When selection is between two normal power sources provide a preferred source selector switch. Label both source options by name and provide a pilot light for each to indicate source is available.
- G. Test Switch: Simulates normal-source failure.
- H. Load/No Load Test Selector Switch.
- I. Switch-Position Pilot Lights: Indicate source to which load is connected. Lamps shall be LED type.
- J. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits. Lamps shall be LED type.
 - 1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
- K. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
- L. Pretransfer Contact: One normally open dry contact to close 50 to 60 seconds prior to transfer onto emergency power when performing test under load or back to normal power. This contact shall change state immediately after transfer.
- M. Transfer Return Auto-Manual Selector: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source as long as generator source is available. Pilot light indicates override status.
- N. Retransfer Button: Button causes return to normal when manual return is selected.
- O. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 2 A at 30-V dc minimum.
- P. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

- Q. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
1. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 2. Push-button programming control with digital display of settings.
 3. Integral battery operation of time switch when normal control power is not available.

2.05 FINISHES

- A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

2.06 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

2.07 NAMEPLATES

- A. Provide engraved nameplates for all equipment, enclosures, components, controls, meters and operator instructions and warnings. See Section "Identification For Electrical Systems".

PART 3 EXECUTION

3.01 APPLICATION

- A. Three-pole (S/N) Switches: Where three-pole switches are indicated use solid neutral.

3.02 INSTALLATION

- A. Install where shown. Arrange for normal, emergency and load connections coordinated with manufacturer's specific layout requirements. Provide code required working clearances. Make straight and level.
- B. Floor Mounted Switch: Anchor to wall with anchor bolts and 1/4 inch thick spacers. This Contractor shall coordinate with the General Contractor to verify sufficient steel reinforcement in new concrete and masonry walls to support the switch. For inadequately reinforced new and all existing concrete or masonry walls and for all other wall construction this Contractor shall provide P-1000 strut from floor to ceiling with

anchors at the floor, ceiling and on 18 inch spacing along the wall. All wall mount attachment points on the enclosure shall connect to the strut.

- C. Identify components according to Division 26 Section "Identification for Electrical Systems."

3.03 WIRING TO REMOTE COMPONENTS

- A. Provide wire and raceways for engine and transfer switch controls and annunciation of transfer switches. Match type and number of cables and conductors to control and communication requirements of transfer switches as specified and as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring. For all engine start wiring and controls for emergency transfer switches that extends outside a fire rated generator room in high rise buildings and places of assembly for 1000 people or more provide Type MI cable or rigid conduit in 2 inch NEC compliant concrete encasement. Support from 3 hour rated structures. Coordinate with engine generator vendor. See plans for equipment locations. Coordinate routing with General Trades Contractor and include proposed route on shop drawing submittals.

3.04 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables." All wiring shall be identified at each termination within the enclosure with numbered plastic sleeve type labels.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. Provide insulated fork type compression connectors on all control and monitor wiring. All in and out wiring shall be landed on terminal strips.

3.05 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 to assist in field testing. Report results in writing.
- B. Field Test: The supplier shall in concert with the Contractor provide a Contractor Testing Supervisor (See Part 1) who shall make all necessary provisions for testing the complete system including operated equipment, field sensors or devices required for feedback or inputs. He shall work with the Contractor to insure that all necessary support from the Contractor including utilities, processes, produced products etc. are available to facilitate a 100% complete test. The Contractor Testing Supervisor shall demonstrate operator interfaces, control, screen graphics functions, data storage, emergency operation, and manual controlled testing, transfer and stopping etc. A site pretest meeting shall be completed as described in the "Tests and Inspections" Section of the specifications.

- C. Perform the following field tests and inspections and prepare test reports:
1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.22.3. Certify compliance with parameters.
 3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
 4. After energizing circuits, test and demonstrate interlocking sequence, control wiring, remote annunciator and operational function for each switch at least three times in the presence of the Owner's Representative.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
 5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
 - b. Observe reaction of circuit-alarm devices when simulated fault current is applied at sensors.
- D. Coordinate repeats of above tests with performance tests of generator and run them concurrently in the presence of a Code Official. See Division 26 Section "Tests, Observations and Inspections" for field tests requirements for acceptance of equipment and systems and in particular the pretest meeting requirement.

- E. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- F. Remove and replace malfunctioning units and retest as specified above.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to demonstrate operation along with engine generator to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01 Section "Demonstration and Training."
 - 1. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 00

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SECTION 26 41 13 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 and Division 26 05 26 apply to this Section.

1.02 SUMMARY

- A. Section includes lightning protection for structures.
- B. The following specifications and standards form a part of this specification:
 - 1. Lightning Protection Institute Materials and Components Standard, LPI-176.
 - 2. Lightning Protection Institute Installation Code, LPI 175-2008.
 - 3. National Fire Protection Association Lightning Protection Code, NFPA 780-2008.
 - 4. Underwriters' Laboratories, Inc., Installation Code, UL 96A.
- C. The lightning protection system shall conform to the requirements of the Lightning Protection Institute (LPI), National Fire Protection Association, and Underwriters' Laboratories, Inc. standards for lightning protection systems. Upon completion, application shall be made to the Underwriters' Laboratories, Inc. and the Lightning Protection Institute for inspection, certification and labeling.
- D. The system to be furnished under this specification shall be standard product of a manufacturer and Installer regularly engaged in the production of lightning protection systems (a minimum of 5 years) and shall be the latest approved design.
- E. The completed system shall be labeled by Underwriters' Laboratories, Inc. as a Master Label Lightning Protection System and labeled by LPI.
- F. Locations, devices, routings, etc., shown on the drawings are schematic only. This Contractor/Installer shall relocate/add such devices, cables, etc. as required to make the system (in its entirety) compliant to the above standards, and to achieve the Master Label and certification. Vertical down leads must be installed within exterior building walls, architectural column or wall coverings or shafts. Exposed vertical down leads will not be acceptable. The Contractor/Installer must coordinate with the General Trades Contractor. Provide bonding connections to all metal building components as required.

by NFPA 780 Chapter 4. Submit distance calculations and drawings showing bonding connections. If for some reason, it is physically impossible to install a vertical down lead where shown, written approval for relocation must be obtained from the Architect/Engineer prior to movement/installation.

- G. The Installer must be a U.L. listed installer, and the installed materials must be U.L. listed. The installer shall also be a member of the Lightning Protection Institute (LPI) and qualified by them to apply their system label.
- H. Related Sections include the following:
 - 1. Division 26 Section "Raceways and Boxes for Electrical Systems".
 - 2. Division 26 Section "Surge Protective Devices".

1.03 SUBMITTALS

- A. See Section "General Provisions For Electrical Work" for submittal requirements in addition to the following listed requirements.
- B. Submit written evidence of installer certification.
- C. Submit complete cut sheet Shop Drawings showing all equipment, materials, etc. Also include 1/8" = 1'-0" scale drawings showing type and locations of all air terminals, cable routings, and all details shown on the Engineer's drawings pertaining to this installation of this system. Include the Architect's drawings showing penetrations and location of down runners in structure. Also show connections to any existing lightning protection system on existing adjacent structure(s) as part of the Lightning Protection System. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.
- D. Contractor is to submit shop drawings and obtain their approval prior to start of installation. Note that interior down conductors require early submittals and approvals to permit inclusion in construction of the structural system.
- E. Contractor is urged to expedite the shop drawing submittal process for this system to provide early detection of downrunner coordination problems.
- F. Certification, signed by the Roofing Contractor, that roof adhesive is approved by manufacturer of roofing material.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Certified by UL and LPI as a Master Installer/Designer, trained and approved for installation of units required for this project. Provide evidence of compliance.

B. System Certificate:

1. UL Master Label.
2. LPI Certification.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

1.05 COORDINATION

- A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.
- B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and installer.
- C. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.

1.06 WARRANTY

- A. The Installer shall provide a written two year warranty from the date of acceptance directly to the Owner covering all materials and installation. Repair/replacement of any damaged or deteriorated parts shall be made at no cost to the Owner.

PART 2 PRODUCTS

2.01 STANDARD

- A. All equipment used in this installation shall be U.L. listed, comply with NFPA 780 and be properly labeled.
- B. All equipment shall be new, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI, UL, and NFPA code requirements.
- C. Cable to be all copper.
- D. Ground ring conductor to be provided. See Division 26 Section "Grounding and Bonding for Electrical Systems" for requirements.
- E. Class 2 air terminals shall be 1/2" diameter copper minimum and of the anti-impalement type. Class 1 air terminals shall be 3/8" diameter copper minimum and of the anti-impalement type. Use Class 2 terminals above 75 feet and Class 1 below 75 feet. Rods must be of sufficient length to extend a minimum of 10" above surrounding area. Provide protective roofing pads.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. East Coast Lightning Equipment Inc.
 - b. ERICO International Corporation.
 - c. Harger.
 - d. Heary Bros. Lightning Protection Co. Inc.
 - e. Independent Protection Co.
 - f. Preferred Lightning Protection.
 - g. Robbins Lightning, Inc.
 - h. Thompson Lightning Protection, Inc.
2. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in Division 07 roofing sections.

F. Provide ground rods per Division 26 Section "Grounding and Bonding of Electrical Systems".

2.02 EQUIPMENT

- A. All materials shall be copper and bronze and of the size, weight and construction to suit the application where used in accordance with LPI, UL, and NFPA code requirements for this type structure and as per manufacturer's recommendations.
- B. Aluminum material may not be used except on roofs that require aluminum components in order to be compatible with aluminum roofing materials. Suitable transition joints, properly installed by trained personnel are required between aluminum and copper conductors.
- C. Connections
 1. All below grade copper to copper connections, connections to ground rod and connections to building steel shall be made by "CADWELD", "Thermoweld" or "Heliarc" welding process.
 2. All above grade aluminum to aluminum and aluminum to copper transitions shall be made with approved mechanical connections and installed by trained personnel.
 3. All accessible secondary connections shall use approved bolted type mechanical connections.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The installation shall be accomplished by an experienced installation company that will submit master label application for a Master Label for the installation, and an employer of Certified Master Installers of Lightning Protection Systems. A Certified Master Installer shall directly supervise the work. Install lightning protection components and systems according to U.L. 96A and NFPA 780.
- B. All equipment shall be installed in neat, workmanlike manner. The system shall consist of a complete cable network on the roof including all air terminals, connections, and bonds with copper cable downloads routed down the inside of the building and exiting the building, terminating into a proper ground electrode. Ground rods are preferred (see Plans). Seal all penetrations. Down runners shall be cadwelded to column foundation resteel or to ground rod (see Plans) provided by the Electrical Contractor. Electrical Contractor is also required to bond exterior columns at their base and connect to main ground bus. Down runners shall extend from ground electrode to ground ring.
- C. All roof mounted metallic equipment shall be bonded to the nearest cross-run conductor to provide two paths of discharge.
- D. Install conductors with two direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.
- E. Where indicated on the plans, conceal the following conductors:
 - 1. Exterior Down Conductors
 - 2. Exterior Bonding Conductors
 - 3. Interior Down Conductors
 - 4. Interior Bonding Conductors
 - 5. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.
- F. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.
- G. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.
- H. Bond extremities of vertical metal bodies exceeding 60 feet (18 m) in length to lightning protection components. This requirement includes vertical steel columns and reinforced concrete columns.
- I. All anchors, attachments and fittings shall withstand a 200 lb. pulling force.

- J. Provide a counterpoise (ground ring) installation based on requirements in Division 26 Section "Grounding and Bonding for Electrical Systems".
 - 1. Bond down runners to ground electrodes then to counterpoise conductor.
 - 2. Bond grounded metal bodies on building within 12 feet (3.6 m) of ground to counterpoise conductor.
 - 3. Bond grounded metal bodies on building within 12 feet (3.6 m) of roof to roof loop to down conductors.
 - 4. Bond grounded ring to building power system ground bus.
- K. Bond lightning protection components and down runners with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot vertical (18-m) intervals (maximum).
- L. All down runners shall be protected from damage and from touch access from persons or moving equipment to a height of 12 feet. Maximum down runner spacing is 100 feet.

3.02 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.03 COORDINATION

- A. The lightning protection installer shall work with other trades to insure a correct, neat and unobtrusive installation. The installer shall coordinate with the General Contractor and the roofing installer to prevent water entering the structure.
- B. It shall be the responsibility of the lightning protection installer to assure interconnection with all other ground systems.

3.04 FIELD QUALITY CONTROL

- A. Notify Owner's Representative at least 48 hours in advance for inspection before concealing lightning protection components.
- B. UL Inspection: Meet requirements to and obtain a UL Master Label for system.
- C. Provide LPI system certification.

3.05 COMPLETION

- A. Upon completion of the installation, the lightning protection installer shall secure and deliver to the Owner, the Master Label. The system will not be accepted without the U.L Master Label and LPI certification.

END OF SECTION 26 41 13

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SECTION 26 43 13 - SURGE PROTECTIVE DEVICES (SPDs)

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. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. Refer to related sections for applications. Note that all emergency power system switchboards and panelboards shall be provided with SPD'S per NEC 700.8.

1.03 RELATED SECTIONS

- A. Division 26 Section - "Secondary Unit Substations"
- B. Division 26 Section - "Low Voltage Switchgear"
- C. Division 26 Section - "Switchboards"
- D. Division 26 Section - "Panelboards"
- E. Division 26 Section - "Motor Control Centers"
- F. Division 26 Section - "Lightning Protection For Structures"

1.04 REFERENCES

- A. SPD units and all components shall be designed, manufactured, and tested in accordance with ANSI/UL 1449 3rd Edition. SPD units shall be listed in U.L 96 as approved devices.
- B. Comply with IEEE C62.41.1-2002 "Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits", IEEE C62.45-2002 "Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits" and IEEE C62.72-2007 "Guide for the Application of Surge-Protective Devices for Low-Voltage (1000V or Less) AC Power Systems".

1.05 SUBMITTALS - FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
 - 1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_n).
 - 2. External SPD units are required. Provide electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
- B. Where applicable, the following additional information shall be submitted to the Engineer:
 - 1. Descriptive Bulletins
 - 2. Product Sheets

1.06 OPERATION AND MAINTENANCE MANUALS

- A. The following information shall be submitted for record purposes:
 - 1. Final as-built drawings and information for items listed in Section 1.04 and shall incorporate all changes made during the manufacturing process. See Section "Operation and Maintenance Manuals".

1.07 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.09 WARRANTY

- A. General Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within the first year from date of Substantial Completion. Also, see Special Warranty below.
- B. Special Warranty: The manufacturer shall provide a full ten (10) year warranty from the date of shipment to replace any SPD part that fails when installed in compliance with manufacturer's written instructions and applicable national or local code. The manufacturer shall provide a separate written warranty directly between himself and the Owner and exclusive of any involvement of the Contractor.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Provide one (1) spare complete unit of each type installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Cutler-Hammer
- B. Current Technologies
- C. Liebert Corporation
- D. PQI
- E. Square D

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 VOLTAGE SURGE SUPPRESSION - GENERAL

A. Electrical Requirements

1. Unit Operating Voltage - Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) - The MCOV shall not be less than 125% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards. Unit shall be of the sine-wave-tracking type.
4. Protection Modes - The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

Configuration	Protection Modes			
	L-N	L-G	L-L	N-G
Wye	•	•	•	•
Delta	N/A	•	•	N/A
Single Split Phase	•	•	•	•
High Leg Delta	•	•	•	•

5. Nominal Discharge Current (I_n) - All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.
6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) - The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

MODES	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

B. SPD Design

1. **Maintenance Free Design** – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. **Balanced Suppression Platform** – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. **Electrical Noise Filter** – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable to meet this specification shall not be accepted.
4. **Internal Connections** – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. **Monitoring Diagnostics** – Each SPD shall provide the following integral monitoring options:
 - a. **Protection Status Indicators** - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
 - i. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
 - ii. For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

- iii. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
 - b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
 - c. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
 - d. Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of $50 \pm 20A$ occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
 - i. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.
6. Overcurrent Protection
- a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design – All of the SPD’s components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
8. Safety Requirements
 - a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
 - b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors factory installed. Disconnection and replacement of unit shall require no more than Category 2 PPE.
 - c. External SPDs shall be factory sealed in order to prevent access to the inside of the unit. External SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.03 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested according to IEEE Std. C62.45-2002 “Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V or Less) AC Power Circuits” and demonstrate suitability for application within ANSI/IEEE C62.41.1 Category C, B, and A environments.
- B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41.1 location category			
CATEGORY	Application	Per Phase	Per Mode
C	Service Entrance Locations Main Entrance)	240 kA	125 kA
B	Switchboards, Switchgear, Distribution Panelboards	160 kA	80 kA
A	Panelboards, MCCs	120 kA	60 kA

- C. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs. Type 3 and Type 4 are not permitted in distribution equipment. Type 4 will only be accepted in factory assembled utilization equipment See Nominal Discharge Current (In) under “Electrical Requirements” above

2.04 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments. The SPD shall be contained in a segregated barriered panel extension or by conduit to a connected enclosure. Connection, disconnection or other maintenance shall require no more than category 2 PPE.
1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
 2. SPDs shall be connected immediately following the load side of the main breaker. SPDs installed for main lug only panelboards shall be connected immediately following the incoming main lugs.
 3. The panelboard shall be capable of re-energizing upon removal of the SPD.
 4. The SPD shall be connected to a 30A minimum circuit breaker provided with the SPD for disconnecting purposes. Actual size provided shall be as recommended by the Manufacturer. It shall be installed using short lengths (6 ft. maximum) of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the circuit breaker.

B. External Mounting Applications Installation

1. Lead length between the breaker and suppressor shall be kept as short as possible (6 ft. maximum) to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices. Contractor shall secure approval from the Owner's Representative for every proposed location to insure the best possible protection. Servicing shall require Category 2 PPE or less.

2.05 SWITCHGEAR, SWITCHBOARD, MCC, MAIN PANELBOARD AND BUSWAY REQUIREMENTS

- A. The SPD application covered under this section is for switchgear, switchboard, Main panelboard and MCC locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41.1 Category C environments.
- B. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
- C. The SPD shall be connected through a disconnect (30A circuit breaker minimum). Actual size provided shall be as recommended by the SPD Manufacturer. The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
- D. The SPD shall be in a separate enclosure adjacent to switchgear, switchboard, panelboard and MCC. Ground lead length shall be as short and straight as possible (6 feet maximum). Servicing shall require Category 2 PPE or less.
- E. All monitoring and diagnostic features shall be visible from the front of the equipment and be between 3 and 6 feet above the floor.

2.06 ENCLOSURES

- A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted (sidemount/panel extension units or separate enclosures only permitted). Provide enclosures suitable for locations as indicated on the drawings to match protected equipment and as described below:
 1. NEMA 1 – Constructed of a polymer or steel, intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).

2. NEMA 4 – Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure.
3. NEMA 4X – Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection.

PART 3 EXECUTION

3.01 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.02 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings. Note that every installation shall be approved in the field (prior to installation) by the Owner's Representative to insure shortest lead and ground wire lengths possible.

3.03 TRAINING/QUALITY CONTROL

- A. The manufacturer's factory trained application specialist shall provide two (2) 3 hour training sessions (schedule at two different times) at the job site following his review of every installed unit on the project. The specialist shall provide recommendations to the Owner's Representative and the Contractor to bring each installation to its best, most effective condition. He shall train the Owner's staff on operation, monitoring, maintenance and replacement of each installed unit.

END OF SECTION 26 43 13

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures with lamps and ballasts.
 - 2. Lighting fixtures mounted on exterior building surfaces.
 - 3. Emergency (egress) lighting units.
 - 4. Exit signs.
 - 5. Accessories, including occupancy sensors.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for manual wall-box dimmers.
 - 2. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.03 DEFINITIONS

- A. BF: Ballast factor. Ratio of light output of a given lamp(s) operated by the subject ballast to the light output of the same lamp(s) when operated on an ANSI reference circuit.
- B. Building Structural Element: A component of the designed support system for the building walls, floors, roof and structural ceilings whose design has been approved by the building manufacturer or a registered structural engineer.
- C. CCT: Correlated color temperature
- D. CRI: Color rendering index.
- E. CU: Coefficient of utilization.
- F. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:
 - 1. LER is equal to the product of total rated lamp lumens times BF times luminaire efficiency, divided by input watts.

- G. Lumen: Measured output of lamp and luminaire. See IES Handbook
- H. Luminaire: Complete lighting fixture, including ballast housing if provided.
- I. Light Fixture: A complete artificial lighting source with associated parts necessary to provide controlled artificial light when electric power is applied. Often used interchangeably with luminaire or lamp holder.
- J. RCR: Room cavity ratio.
- K. LED: A package consisting of an assembly of one or more semiconductor light emitting diodes, wire bonded connections, thermal, mechanical and electrical interfaces designed to generate light based upon injection luminescence when used in conjunction with a driver.
- L. LED Driver: An auxiliary electronic component designed to modify A/C power to a controlled DC current and appropriate voltage to operate the LED(s) at optimum brightness and color for the maximum possible time. It must also produce minimum harmonics, maximum power factor, minimize electromagnetic interference, limit inrush current and maintain voltage reference to the line. LED dimming shall be incorporated as an integral junction of the driver where specified.

1.04 SUBMITTALS

- A. See Section “General Provisions For Electrical Work” for submittal requirements in addition to the following listed requirements.
- B. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, available colors and the following:
 - 1. Physical description of fixture, including materials of construction, light distribution curves, dimensions and verification of indicated parameters.
 - 2. Color chart sample for each fixture.
 - 3. Emergency lighting unit battery and charger.
 - 4. Energy-efficiency data.
 - 5. Life, output and energy efficiency data for lamps.
 - 6. Photometric data, in IESNA format, based on laboratory tests of each fixture configuration.
 - 7. Installation and support details, methods and requirements.
 - 8. Wiring Diagrams: Power, signal, and control wiring.

- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Lighting fixtures.
 - 2. Suspended ceiling components.
 - 3. Structural members to which lighting-fixture suspension systems will be attached.
 - 4. Other items in finished ceiling, including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Access panels.
 - 5. Perimeter moldings.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.
- F. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.06 WARRANTY

- A. Special LED Luminaire/Driver Warranty: Five years full replacement of LED luminaire and driver upon failure of 5% or more of the LED's in any luminaire listed in the Fixture Schedule.

1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. See Section “Common Work Results for Electrical” for details of delivery described under “Spares/Loose Deliverables”.
 - 1. LED’s and Drivers: 1 for every 10 of each type and rating installed. Furnish at least one of each type.
 - 2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Battery and Charger Data: One for each emergency lighting unit.
 - 4. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 FIXTURES AND COMPONENTS, GENERAL

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support components to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.

F. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is scheduled.
 - b. UV stabilized.
2. Glass: Annealed crystal glass, unless otherwise indicated.

2.03 EXIT SIGNS

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 1. Lamps for AC Operation: Light-emitting diodes, 50,000 hours minimum of rated lamp life.
 2. Additional Lamps for DC Operation: Two minimum, bayonet-base type, for connection to external dc source.

2.04 LED LUMINAIRES

- A. An assembly of LED's, supporting strata, heat syncs, connections and associated driver(s). Special applications may require remote drivers. See fixture schedule for details. Enclosure, lens, access mechanism, mounting connection, light level sensor or occupancy sensor components may be required parts of the luminaire.
 1. LED: Unless otherwise specified LED's shall be provided as mixed color sources to provide maximum efficiency, longer life and color change options. LED's shall have negligible UV content below 400 nm and infrared above 800 nm. Standard color temperature per ANSI C78.377 shall be 3500K. Provide active feedback system to maintain color across LED operating temperature. LED end of life (70% lumens) shall occur at 50,000 hours.
 2. Driver: Unless otherwise specified efficiency shall be 85% minimum, maximum current distortion shall not exceed 33%, power factor shall be 90% or better and EMI shall not exceed standards of IEC EN 61000-6-3. Line voltage shall be 100-277 volts. The Unit shall have inrush current limitation and be UL listed and have end-of-life indication (70%) at 50,000 hours.
 3. Dimming: Dimming LED luminaires shall utilize a driver as specified above but with added feature of dimming from full lumen output to 10% of lumen output. Dimming drivers shall not be loaded in excess of 60% of their rated output.

2.05 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for slotted-channel and fabricated supports. All individual support elements shall be rated no less than 150% of their apportioned fixture weight. All safety support elements shall be rated no less than 300% of the total fixture weight.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage.
- E. Wires For Wet or Damp Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- H. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.
- I. Chain: Steel, hot-dip galvanized, rated to support 300 lb.

2.06 FINISHES

- A. Fixtures: Manufacturers' standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.
 - 3. Color: Architect selected from minimum of eight (8) colors unless stipulated on plans.

2.07 LIGHTING CONTROL DEVICES

- A. Light Level Sensor: Detect changes in ambient lighting level and provide dimming range of 20 to 100 percent in response to change.
 - 1. Sensor Capacity: At least 40 LED electronic dimming fixtures.
 - 2. Adjustable Ambient Detection Range: 10 to 60 fc.

- B. Occupancy Sensors: Adjustable sensitivity and off delay time range of 5 to 15 minutes.
 - 1. Device Color:
 - a. Wall Mounted: Ivory.
 - b. Ceiling Mounted: White.
 - 2. Occupancy detection indicator.
 - 3. Ultrasonic Sensors: Crystal controlled with circuitry that causes no detection interference between adjacent sensors.
 - 4. Infrared Sensors: With daylight filter and lens to afford coverage applicable to space to be controlled.
 - 5. Combination Sensors: Ultrasonic and infrared sensors combined.
 - 6. Occupancy sensor control contacts shall be fail closed.

2.08 SOURCE QUALITY CONTROL

- A. Provide services of a qualified, independent testing and inspecting agency to factory test a sample of each fixture-ballast-lamp combination and control device prior to shipping any fixtures. Include all dimmer control and dimmed fixture combinations. Certify proper function including absence of flicker and verification of operation over voltage supply range of $\pm 10\%$ of rated and verify electrical ratings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support as well as direct supports.
 - 1. Install a minimum of four support rods or wires as direct supports for each fixture that extend directly from the fixture to a building structural element. Locate fixture support connections not more than 6 inches (150 mm) from fixture corners. Rods or wires shall connect directly to a building structural element or to a trapeze installed per Division 26 Section "Hangers and Supports for Electrical Systems".
 - 2. Support Clips for grid support: Fasten to fixtures and to ceiling grid members at or near fixture corner with clips that are UL listed for the application. Advise ceiling contractor in writing to support grid within six inches of each corner of each fixture. Report absence of any of these required ceiling supports to the O.R.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees. Fixtures in excess of 25 lb shall have a rod or wire connected from each metal support channel directly to a building structural element or to a trapeze installed per Division 26 Section "Hangers and Supports for Electrical Systems".

C. Suspended Fixture Support: As follows:

1. Pendants, chains, cables and Rods: Where longer than 48 inches (1200 mm), brace laterally to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use approved wiring at one point and pendant, chain, cable or rod for suspension for each unit length of fixture chassis, including one at each end.
4. All pendants, rods, stems, support wires, chains and cables must connect directly to a building structural element or trapeze or to a raceway box that is rigidly connected directly to a building structural element or trapeze rated for the load. The trapeze shall be as specified in Division 26 Section "Hangers and Supports for Electrical Systems". See "Connections" (below) to Luminaire Outlet Boxes.

D. Wall Mounted Fixture Support (flush, surface or less than 12 inch arm) as follows:

1. Fixtures less than 10 lb may be installed on any wall system for which they have approved manufacturer hardware and are installed according to the manufacturer's requirements. Other than approved manufacturer hardware and applications shall meet the requirements of Division 26 Section "Hangers and Supports for Electrical Systems".
2. Fixtures between 10 and 20 lb. Installation on walls other than concrete and masonry shall employ manufacturer's hardware and strut supported Backboxes. Strut shall be as specified in Division 26 Section "Hangers and Supports for Electrical Systems" and extend between building structural elements.
3. Fixtures above 20 lb. Installation on walls other than concrete and masonry shall only be permitted if support detail is submitted with registered engineer's seal or is sealed and approved by the Design Structural Engineer of Record.
4. Fixtures installed on new or existing concrete or masonry walls shall utilize the "above 20 lb." solution above or be approved by the Design Structural Engineer of Record.

- E. Wall Mounted Fixture Support (over 12 inch arm): As Follows:
 - 1. Only permitted where support is independent of the wall surface material and uses manufacturer approved hardware or is a sealed and approved structural engineer designed system. Approval of support is on a case by case basis and depends upon determination by the Engineer that the solution fits the application.
- F. Air-Handling Fixtures: Install with dampers closed and ready for adjustment.
- G. Adjust aimable fixtures to provide required light intensities.

3.02 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. All fixture connections shall be $\frac{3}{4}$ inch LFMC not exceeding 6 feet in length. Only if fixture $\frac{3}{4}$ inch KO is not available may $\frac{1}{2}$ inch LFMC be used.
- C. All fixtures shall be connected to branch circuit ground conductor.
- D. Luminaire Outlet boxes shall be supported by all-thread, strut or other rigid support members that provide fine adjustment. Support shall not be wire, cable or raceway. Lateral support may be provided by wires, clips, ceiling grid etc. See Sections "Raceways And Boxes for Electrical Systems" and "Hangers and Supports for Electrical Systems".
- E. Luminaires suspended from ceilings by cables and using flexible power cords that penetrate a ceiling shall have cord enter directly into a luminaire outlet box using ceiling canopy as cover or comply with NEC 410.62 (C)(1)(2) c. with integral box and qualifying listed assembly raceway (maximum 6 inch).

3.03 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after installation.
- C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

- F. Burn-in: Perform a 48 hour continuous operation of all interior luminaires. This test is intended to locate and resolve any weak or faulty components. Repair or replace all luminaires that fail to produce full light output during the test. Retest until all luminaires pass the test. Provide a report to the O.R. after each test indicating the failed fixtures and the cause of each. Inform the O.R. before the next test as to all repairs and replacements and the beginning time for the next test. Failure of more than 10% of the luminaires of any specific fixture designation from the fixture schedule during any test shall require a written inquiry of the manufacturer as to the cause and the proposed remedy before proceeding to the next test. After a luminaire is repaired it shall not be repaired again. It must be replaced if it fails again. Any failure common to more than 10% of a specific fixture designation from the fixture schedule shall be deemed a systemic failure and a solution must be pursued from the manufacturer. If the Contractor and his manufacturer cannot resolve the systemic problem the Contractor shall replace all fixtures of that fixture designation (e.g. CL1, R6 etc.).
- G. Space by Space Functional Test: Perform functional test of the lighting system in each space. The functional test shall include lighting level performance measurements as well. A space is defined as an area of the facility with its own identifiable control system (or sub-system). Control may be exerted locally, remotely or both. The test shall demonstrate the full range of control variations and shall include measurements of lighting levels within the space under each control variation. The Contractor shall verify his understanding of the control functions prior to the test, verify his test method to demonstrate compliance and verify the expected results with the O.R. This shall include desired lighting levels. If there are specified requirements for lighting levels that the Contractor is obligated to meet (e.g. daylight harvesting) then the results shall be used to determine his compliance. Natural light shall be removed from the space for these measurements unless it is a component of the control system (e.g. daylight harvesting). The number of field measured lighting levels within a space shall be one for every two luminaires in the space. If lighting level performance standards are included by reference in this specification Section then they shall be listed for each space by the Contractor as part of the test preparation. Examples of testing based upon space controls are:
1. A standard single switch in a space shall only require on-off operation and measured lighting levels within the space. Single switch with remote "off" sweeps requires local switch operation and remote off control operation. Measured lighting levels within the space would be required for the on condition.
 2. In-board/Out-board lamps with two local switches and remote "off" sweeps requires each local switch operation, both switches operated and "off" sweep operation. Measured lighting levels within the space would be required for each condition.

END OF SECTION 26 51 00

SECTION 26 56 00 - EXTERIOR LIGHTING

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. Likewise, Division 26 Sections 26 01 00 through 26 05 00 apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Exterior luminaires with lamps and ballasts.
 - 2. Luminaire-mounted photoelectric relays.
 - 3. Poles and accessories.
- B. Related sections include the following:
 - 1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.
 - 2. Division 26 Section "Lighting Control Devices" for automatic control of lighting including time switches, photo electric relays, occupancy sensors and multi-pole lighting relays and contactors.

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. HID: High-intensity discharge.
- D. LER: Luminaire efficacy rating.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.
- F. Pole: Luminaire support structure, including tower used for large area illumination.
- G. Standard: Same definition as "Pole" above.
- H. LED: A package consisting of an assembly of one or more semiconductor light emitting diodes, wire bonded connections, thermal, mechanical and electrical interfaces designed to generate light based upon injection luminescence when used in conjunction with a driver.

- I. LED Driver: An auxiliary electronic component designed to modify A/C power to a controlled DC current and appropriate voltage to operate the LED(s) at optimum brightness and color for the maximum possible time. It must also produce minimum harmonics, maximum power factor, minimize electromagnetic interference, limit inrush current and maintain voltage reference to the line. LED dimming shall be incorporated an integral function of the driver where specified.

1.04 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports and supporting structure, applied as stated in AASHTO LTS-4.
- B. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M.
- C. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4-M.
 - 1. Wind speed for calculating wind load for poles 50 feet (15 m) or less in height is 110 mph (177 km/h).

1.05 SUBMITTALS

- A. See Section “General Provisions For Electrical Work” for submittal requirements in addition to the following listed requirements.
- B. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. For luminaires indicated in fixture schedule, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - b. Photometric data shall be certified by manufacturer’s laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 6. Ballasts, including energy-efficiency data.
 - 7. Lamps, including life, output, and energy-efficiency data.
 - 8. Materials, dimensions, and finishes of poles.

9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
10. Anchor bolts for poles.
11. Manufactured pole foundations.
12. Photoelectric relays.

C. Shop Drawings:

1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
2. Design calculations, certified by a qualified professional engineer, indicating strength of anchor bolt arrangement and concrete foundations as well as soil conditions on which they are based.
3. Wiring Diagrams: Power and control wiring.
4. Site plan to scale showing point by point illumination footcandle levels on a 4 ft. by 4 ft. grid above zero footcandles. Where areas requiring specific illumination performance are identified on the site plan provide average footcandles, average to minimum, maximum to average and maximum to minimum footcandles ratios. See Part 3 for required Photometric Performance Testing in these areas.

- D. Samples for Verification:** For products designated for sample submission in Exterior Lighting Device Schedule. Each sample shall include lamps and ballasts.
- E. Pole and Support Component Certificates:** Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- F. Qualification Data:** For agencies providing photometric data for lighting fixtures.
- G. Field quality-control test reports.**
- H. Operation and Maintenance Data:** For luminaires and poles to include in emergency, operation, and maintenance manuals.
- I. Warranty:** Special warranty specified in this Section.

1.06 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications:** Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- 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.
- C. Comply with IEEE C2, "National Electrical Safety Code".**

- D. Comply with NFPA 70.
- E. Testing. See Part 3 "Field Quality Control".

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with non-metallic finishes, handle with web fabric straps.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
 - 4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.
 - 5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.
- B. Special LED Luminaire/Driver Warranty: Five years full replacement of LED luminaire and driver upon failure of 5% or more of the LED's in any luminaire.

1.09 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. LED's and Drivers: 1 for every 10 of each type and rating installed. Furnish at least one of each type.
 - 2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 1 for every 10 of each type and rating installed. Furnish at least one of each type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In Lighting Fixture Schedule on the plans, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Refer to Fixture Schedule on plans.

2.02 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens. Provide aging resistant gaskets to prevent dirt and bugs from entering.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.

- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Factory-Applied Finish for Steel Luminaires: Color as selected by Architect. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- M. Factory-Applied Finish for Aluminum Luminaires: Color as selected by Architect. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.03 ADDITIONAL REQUIREMENTS FOR LED LUMINAIRES

- A. An assembly of LED's, supporting strata, heat syncs, connections and associated driver(s). Special applications may require remote drivers. See fixture schedule for details. Enclosure, lens, access mechanism, mounting connection, or light level sensor components may be required parts of the luminaire.
 - 1. LED: Unless otherwise specified LED's shall be provided as mixed color sources to provide maximum efficiency, longer life and color change options. LED's shall have negligible UV content below 400 nm and infrared above 800 nm. Standard color temperature per ANSI C78.377 shall be 4000K. Provide active feedback system to maintain color across LED operating temperature. LED end of life (70% lumens) shall occur at 50,000 hours.
 - 2. Driver: Unless otherwise specified efficiency shall be 85% minimum, maximum current distortion shall not exceed 33%, power factor shall be 90% or better and EMI shall not exceed standards of IEC EN 61000-6-3. Line voltage shall be 100-277 volts. The Unit shall have inrush current limitation and be UL listed and have end-of-life indication (70%) at 50,000 hours.

2.04 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4. Poles on the plans have been selected based solely upon mounting height, finish and compatibility with luminaire. Verify that poles submitted meet structural loading requirements.
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
 - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
 - 3. Poles shall be rated with 100 miles per hour with fixture EPA.

- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated. Anchor bolt size and installation details shall be certified by a Professional Engineer. See submittal requirements.
 - 3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped with minimum clear opening of 2-1/2 by 5 inches with cover secured by stainless-steel captive screws.
- E. Pole Foundations (Concrete): Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." See "Light Pole Base Detail" on the drawings.

2.05 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); 1-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 - 1. Shape: Square, straight.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation.
- B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole and bracket, then bolted together with galvanized-steel bolts.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - 3. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.

- F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
- J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Color shall be as selected by Architect.

2.06 POLE ACCESSORIES

- A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type. Provide where indicated on plans.
 - 1. Surface mounted 12 inches (300 mm) above finished grade.
 - 2. Nonmetallic polycarbonate plastic or reinforced fiberglass cover, Color to match pole, that when mounted results in NEMA 250, Type 4X enclosure.
 - 3. With cord opening.
 - 4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.
- B. Where receptacle is indicated but 120 volt circuit is not indicated, provide minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.
- C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.
- D. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept indicated accessories.

PART 3 EXECUTION

3.01 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.

- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming.

3.02 POLE (OR BOLLARD) INSTALLATION

- A. If pole arm direction is not indicated align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
 - 1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
 - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
 - 3. Trees: 15 feet (5 m).
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Grout void between pole base and foundation with nonshrink grout. Provide ½ inch diameter drain tube through grout. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- D. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 2-inch- (50-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab. Caulk opening after settlement.
- E. Raise and set poles using web fabric slings (not chain or cable).

3.03 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.04 CORROSION PREVENTION

- A. Steel Conduits: Comply with Division 26 Section "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.05 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding rod for each pole, unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to wired grounding system.

3.06 FIELD QUALITY CONTROL

- A. Observe final installation looking for damage to installed equipment and paint. Replace damaged components and repair paint to O.R. satisfaction.
- B. Illumination Observation: Verify normal operation of lighting units and controls after installation is complete and after circuits are tested.
- C. Burn-in: Perform a 48 hour continuous operation of all exterior luminaires. Repair or replace all luminaires that fail to produce full light output during the test. Retest until all luminaires pass the test. Provide a report to the O.R. after each test indicating the failed fixtures and the cause of each. Inform the O.R. before the next test as to all repairs and replacements and the beginning time for the next test. Failure of more than 10% of the luminaires during any test shall require a written inquiry of the manufacturer as to the cause and the proposed remedy before proceeding to the next test. After two tests no fixture may be repaired. All failed fixtures occurring during the third or subsequent test shall be replaced.
- D. Photometric Performance Test: Lighting that is specified to provide specified photometric results shall be tested to demonstrate satisfactory performance. The appropriate IESNA photometric testing guide (LM-5, LM-50, LM-52, LM-64, LM-72 or LM-79) shall be applied to determine compliance. Readjust as required and retest. Submit a detailed report citing the specific detailed performance requirements and the actual measured data demonstrating compliance.

END OF SECTION 26 56 00

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes fire alarm systems.
- B. Related Sections include the following:
 - 1. Division 23 Section “Air Duct Accessories” for smoke dampers and combination heat/smoke dampers.

1.03 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
- E. AHJ: Authority Having Jurisdiction
- F. Noncoded, addressable system; multiplexed signal transmission dedicated to fire alarm service only.
- G. Non-coded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission dedicated to a fire-alarm service only.

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72, State Building Code and Local Building Code.
- B. Premises protection includes Construction Type “2B”; Type “B” and “A-3” Use Group.
- C. Fire alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.

3. Smoke detectors.
 4. Automatic sprinkler system water flow.
 5. Duct smoke detectors
- D. Fire alarm signal shall initiate the following actions:
1. Alarm notification appliances shall operate continuously.
 2. Identify alarm at the FACP and remote annunciators.
 3. De-energize electromagnetic door holders.
 4. Transmit an alarm signal to the remote alarm receiving station.
 5. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
 6. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
 7. Record events in the system memory.
- E. Supervisory signal initiation shall be by one or more of the following devices or actions:
1. Operation of a fire-protection system valve tamper.
 2. Low-air-pressure switch of a dry pipe sprinkler system.
- F. System trouble signal initiation shall be by one or more of the following devices or actions:
1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
 2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at the FACP.
 4. Ground or a single break in FACP internal circuits.
 5. Abnormal ac voltage at the FACP.
 6. A break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at the FACP or annunciator.
 9. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- G. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators. Record the event on system printer.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
1. Shop Drawings shall be prepared, stamped and signed by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. Fire alarm certified by NICET, minimum Level III.

2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 3. Device Address List: Coordinate with final system programming.
 4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
 5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Include voltage drop calculations for notification appliance circuits. Show wiring color code.
 6. Batteries and power supply: Size calculations.
 7. Floor Plans: Indicate final outlet locations showing address of each addressable device.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.
- F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 01 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- G. Documentation:
1. Approval and Acceptance: Comply with the "Records" Section of the "Inspection, Testing and Maintenance Chapter in NFPA 72. Provide to, Owner's Representative.
 2. Record of Completion Documents: Provide "Record of Completion Documents" according to NFPA 72 Article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter to Owner's Representative. Format of the written sequence of operation shall be the optional input/output matrix.

- a. Hard copies on paper to Owner's Representative.
 - b. Electronic media may be provided to Owner's Representative.
3. Record copy of site-specific fire alarm system operating software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 Article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting fire alarm control unit.
7. Software operating and upgrade manuals.
8. Program Software Backup: On magnetic media or compact disk, complete with data files.
9. Device address list.
10. Printout of software application and graphic screens.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level IV technician.
- C. 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 location and application.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.

3. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

1.09 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. 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. FACP and Equipment:
 - a. Edwards Systems Technology Inc.
 - b. Gamewell Company, a Honeywell Company.
 - c. NOTIFIER; a Honeywell Company.
 - d. Siemens Building Technologies, Inc.; a Cerberus Division.
 - e. SimplexGrinnell LP; a Tyco International Company.
 2. Wire and Cable:
 - a. Comtran Corporation.
 - b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
 - c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
 - d. West Penn Wire/CDT; a division of Cable Design Technologies.
 3. Audible and Visual Signals:
 - a. Amseco; a division of Kobishi America, Inc.
 - b. Commercial Products Group.
 - c. Gentex Corporation.
 - d. System Sensor; a Honeywell Company.
 - e. Wheeloc

2.02 FACP

A. General Description:

1. Modular, power-limited design with electronic modules, UL 864 listed.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Circuits:

1. Signaling Line Circuits: NFPA 72, Class A, Style 6.
 - a. System Layout: Install no more than 50 addressable devices on each signaling line circuit.
2. Notification-Appliance Circuits: NFPA 72, Class A, Style Z.
3. Actuation of alarm notification appliances annunciation, and actuation of suppression systems shall occur within 10 seconds after the activation of an initiating device.

D. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.

E. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

- F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.
 - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
 - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- G. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory signal shall be powered by the 24-V dc source.
 - 1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
 - 2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."
- I. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
 - 2. Battery and Charger Capacity: Comply with NFPA 72.
 - 3. See Submittals for required calculations.
- J. Surge Protection:
 - 1. Install surge protection on normal ac power for the FACP and its accessories. Comply with Division 26 Section "Surge Protective Devices (SPD's)" for auxiliary panel suppressors.
 - 2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.

- K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- L. Enclosures: Provide suitable NEMA 1 enclosures. Color shall be red unless otherwise indicated. Provide recessed, semi-recessed or surface mount hardware indicated on plans.

2.03 SYSTEM PULL STATIONS

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
 - 2. Station Reset: Key- or wrench-operated switch.

2.04 SYSTEM SMOKE DETECTORS

- A. General Description:
 - 1. UL 268 listed, operating at 24-V dc, nominal.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - 3. Detectors shall be two wire type.
 - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist lock module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
 - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
 - 7. Enclosure: Provide NEMA 1 enclosure. Provide beige color with no cost change to white at Architect's option.
- B. Photoelectric Smoke Detectors:
 - 1. Sensor: LED or infrared light source with matching silicon-cell receiver.

2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
3. Detector address shall be accessible from fire alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
4. An operator at fire alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.)

C. Duct Smoke Detectors:

1. Photoelectric Smoke Detectors:
 - a. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
2. UL 268A listed, operating at 24-V dc, nominal.
3. Detector address shall be accessible from fire alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
4. An operator at fire alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
5. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
7. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
8. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.

9. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station where indicated.
10. Each sensor shall have multiple levels of detection sensitivity.
11. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied. If the vendor's detector/sampling tube coverage limitation requires multiple tubes and or detectors the vendor shall determine the number and installation geometry to satisfy the AHJ and provide them at no additional cost.
12. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.05 HEAT DETECTORS

- A. General: UL 521 listed. Provide beige enclosure with no cost change to white at Architect's option.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate-of-rise of temperature that exceeds 12 deg F (7 deg C) per minute, unless otherwise indicated.
 1. Mounting: Twist lock base, interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- C. High Temperature Heat Detector, Combination Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C) or a rate of rise temperature that exceeds 12 deg F (7 deg C) per minute, unless other wise indicated. Only to be used where specifically identified as "Fixed Temperature" either in an application these specifications or on the plans.
 1. Mounting: Twist lock base, interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.06 NOTIFICATION APPLIANCES

- A. Description: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections. Provide red enclosure with no cost change to beige or white with red letters at Architect's option.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

- B. Horns: 24-V DC; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn using the coded signal described in UL 464 test protocol. Horn shall have an alternative field adjustable setting for a lower sound level at the same voltage. Sleeping room sound-pressure level must be 15 db above ambient or 5 db above max sound level , whichever is greater at the bed.
 - 1 Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.
- C. Visible Alarm Notification Appliances: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens. Strobes shall be synchronized as required by NFPA 72.
 - 1. Rated Light Output: 110 candela. Each strobe shall be individually field adjustable to 110, 75 or 30 candela.
 - 2. Strobe Leads: Factory connected to screw terminals.

2.07 REMOTE ANNUNCIATOR

- A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing. Provide red enclosure with no cost change to beige at Architect's option.
 - 1. Mounting: Flush cabinet, NEMA 250, Class 1.
- B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

2.08 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Listed and labeled according to UL 632 by an NRTL.
- B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.
- C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

- D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
- E. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both telephone lines are available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire alarm control unit.
- F. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Zone of the supervisory signal.
 - 3. Zone of the trouble-initiating device.
 - 4. Loss of AC supply or loss of power.
 - 5. Low battery.
 - 6. Abnormal test signal.
 - 7. Communication bus failure.

2.09 RADIO ALARM TRANSMITTER

- A. Listed and labeled according to NFPA 1221 by an NRTL. Comply with 47 CFR 90.
- B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; and ready for installation and operation.
 - 1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 - 2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
 - 3. Normal Power Input: 120-V ac.
 - 4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 - 5. Antenna: Omni directional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a gust factor of 1.3 without failure.
 - 6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.

7. Antenna-Cable Connectors: Weatherproof.
 8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
- C. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP or from its own internal sensors or controls, and automatically transmits signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages correspond to standard designations for the fire-reporting system to which the signal is being transmitted and include separately designated messages in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
 3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
 4. Local Fire Alarm System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
 5. Local Fire Alarm System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
 6. Local Alarm System Supervisory Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

2.10 GUARDS FOR PHYSICAL PROTECTION

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
1. Factory fabricated and furnished by manufacturer of the device.
 2. Finish: Paint of color to match the protected device.

2.11 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG.
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70 Article 760, Classification CIC, for power-limited fire alarm signal service. UL listed as Type FPL, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating. Radix Duralife or ComTran Cable when installed in conduit according to U.L. FHIT-28A and 40 respectively.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
 - 3. Multiconductor Armored Cable: NFPA 70 Type MC,RSCC Vitalink, copper conductors, TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, UL 2196 listed with a 2 hour rating for fire alarm and power use ,cable tray, pipe clamp or trapeze installation, plenum rated, according to U.L. FHIT No. 120 listing.
 - 4. Multiconductor Mineral Insulated: NFPA 70 Type MI, Pentair Pyrotenax, copper conductors, UL 2196 listed with a 2 hour rating for fire alarm and power use, cable tray, pipe clamp or trapeze installation, ;lenum rated, according to U.L. FHIT No. 1850 listing.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire alarm equipment.
 - 1. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 2. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 3. Install anchor bolts to elevations required for proper attachment to supported equipment.

- B. Equipment Mounting: Install fire alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- D. Smoke or Heat Detector Spacing:
 - 1. Smooth ceiling spacing shall not exceed 30 feet (9 m) or the rating of the detector, whichever is least.
 - 2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
 - 3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.
- E. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
- F. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.
- H. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- I. Audible Alarm Notification Appliances: Install not less than 6 inches (150 mm) below the ceiling and no lower than 82 inches above the floor. Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- J. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- K. FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- L. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.
- M. Addressable Interface Device: Devices shall be powered from the loop. Provide local emergency power connection to emergency panelboard if not loop powered.

3.02 WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
- B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes for Electrical Systems".
 - 1. Fire alarm circuits (24 volt) and equipment control wiring associated with the fire alarm system shall be installed in a single dedicated raceway system. This system shall not be used for any other wire or cable.
 - 2. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
- C. Wiring:
 - 1. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
 - 2. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same raceway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.03 CONNECTIONS

- A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated air conditioning duct systems.
2. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
3. Supervisory connections at valve supervisory switches.
4. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems".
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.05 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.06 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 to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. Invite Owner's Representative to attend this test with 7-day advance written notice.
 - a. Demonstrate performance of every device in preparation for code official.
 - b. Include the existing system in tests and inspections.
 3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.

4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - a. Detectors that are outside their marked sensitivity range shall be replaced.
 - b. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - c. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - d. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Code Official Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70. Demonstrate satisfactory operation of every device and system function.

3.07 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.
- B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.
- C. Semiannual Test and Inspection: Six months after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- D. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semiannual, and annual periods. Use forms developed for initial tests and inspections.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 01 Section "Demonstration and Training".

END OF SECTION 28 31 00