



State of West Virginia  
 Department of Administration  
 Purchasing Division  
 2019 Washington Street East  
 Post Office Box 50130  
 Charleston, WV 25305-0130

# Request for Quotation

RFQ NUMBER
GSD096429

PAGE
1

ADDRESS CORRESPONDENCE TO ATTENTION OF
KRISTA FERRELL
304-558-2596

VENDOR

RFQ COPY  
 TYPE NAME/ADDRESS HERE

SHIP TO

DEPARTMENT OF ADMINISTRATION  
 VARIOUS LOCALES AS INDICATED  
 BY ORDER

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B.	FREIGHT TERMS
02/10/2009				

BID OPENING DATE: 02/26/2009 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
				ADDENDUM NO. 3		
				THIS ADDENDUM IS ISSUED TO:		
				1.) ANSWER RECEIVED TECHNICAL QUESTIONS,		
				2.) EXTEND THE DEADLINE FOR TECHNICAL QUESTIONS,		
				DEADLINE DATE IS EXTENDED TO: 02/17/2009		
				DEADLINE TIME REMAINS: 5:00 PM		
				3.) EXTEND THE DEADLINE FOR SUBSTITUTIONS,		
				SUBSTITUTION REQUEST DATE IS EXTENDED TO: 02/17/2009		
				SUBSTITUTION REQUEST TIME REMAINS: 5:00 PM		
				4.) EXTEND THE BID OPENING DATE,		
				BID OPENING DATE IS EXTENDED TO: 02/26/2009		
				BID OPENING TIME REMAINS: 1:30 PM		
				5.) ADD THE FOLLOWING LANGUAGE:		
				"IN ALL INSTANCES OF MANUFACTURERS SPECIFICALLY BEING		
				REFERRED TO OR SUGGESTED IN ANY PART OF THE PROJECT		
				MANUAL, PLEASE INSERT THE WORDS "OR EQUAL" AFTER		
				THE REFERENCE."		
				6.) ADD THE FOLLOWING LIST OF DOCUMENTS TO THE		
				SPECIFICATIONS:		
				GSD096429 ADDENDUM NO. 3 COVER STATEMENT		
				GSD096429 REVISED TABLE OF CONTENTS		
				GSD096429 SECTION 02630-STORM DRAINAGE		
				GSD096429 SECTION 02741-HOT MIX ASPHALT PAVING		
				GSD096429 SECTION 07412-METAL WALL PANELS		
				GSD096429 SECTION 15060-HANGERS AND SUPPORTS		
				GSD096429 SECTION 15083-PIPE INSULATION		

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE	TELEPHONE	DATE
-----------	-----------	------

TITLE	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE
-------	------	-----------------------------------

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

## GENERAL TERMS & CONDITIONS REQUEST FOR QUOTATION (RFQ) AND REQUEST FOR PROPOSAL (RFP)

1. Awards will be made in the best interest of the State of West Virginia.
2. The State may accept or reject in part, or in whole, any bid.
3. All quotations are governed by the *West Virginia Code* and the *Legislative Rules* of the Purchasing Division.
4. Prior to any award, the apparent successful vendor must be properly registered with the Purchasing Division and have paid the required \$125 fee.
5. All services performed or goods delivered under State Purchase Order/Contracts are to be continued for the term of the Purchase Order/Contracts, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise available for these services or goods, this Purchase Order/Contract becomes void and of no effect after June 30.
6. Payment may only be made after the delivery and acceptance of goods or services.
7. Interest may be paid for late payment in accordance with the *West Virginia Code*.
8. Vendor preference will be granted upon written request in accordance with the *West Virginia Code*.
9. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.
10. The Director of Purchasing may cancel any Purchase Order/Contract upon 30 days written notice to the seller.
11. The laws of the State of West Virginia and the *Legislative Rules* of the Purchasing Division shall govern all rights and duties under the Contract, including without limitation the validity of this Purchase Order/Contract.
12. Any reference to automatic renewal is hereby deleted. The Contract may be renewed only upon mutual written agreement of the parties.
13. **BANKRUPTCY:** In the event the vendor/contractor files for bankruptcy protection, this Contract may be deemed null and void, and terminated without further order.
14. **HIPAA BUSINESS ASSOCIATE ADDENDUM:** The West Virginia State Government HIPAA Business Associate Addendum (BAA), approved by the Attorney General, and available online at the Purchasing Division's web site (<http://www.state.wv.us/admin/purchase/vrc/hipaa.htm>) is hereby made part of the agreement. Provided that, the Agency meets the definition of a Cover Entity (45 CFR §160.103) and will be disclosing Protected Health Information (45 CFR §160.103) to the vendor.
15. **WEST VIRGINIA ALCOHOL & DRUG-FREE WORKPLACE ACT:** If this Contract constitutes a public improvement construction contract as set forth in Article 1D, Chapter 21 of the West Virginia Code ("The West Virginia Alcohol and Drug-Free Workplace Act"), then the following language shall hereby become part of this Contract: "The contractor and its subcontractors shall implement and maintain a written drug-free workplace policy in compliance with the West Virginia Alcohol and Drug-Free Workplace Act, as set forth in Article 1D, Chapter 21 of the West Virginia Code. The contractor and its subcontractors shall provide a sworn statement in writing, under the penalties of perjury, that they maintain a valid drug-free work place policy in compliance with the West Virginia and Drug-Free Workplace Act. It is understood and agreed that this Contract shall be cancelled by the awarding authority if the Contractor: 1) Fails to implement its drug-free workplace policy; 2) Fails to provide information regarding implementation of the contractor's drug-free workplace policy at the request of the public authority; or 3) Provides to the public authority false information regarding the contractor's drug-free workplace policy."

---

### INSTRUCTIONS TO BIDDERS

1. Use the quotation forms provided by the Purchasing Division.
2. **SPECIFICATIONS:** Items offered must be in compliance with the specifications. Any deviation from the specifications must be clearly indicated by the bidder. Alternates offered by the bidder as **EQUAL** to the specifications must be clearly defined. A bidder offering an alternate should attach complete specifications and literature to the bid. The Purchasing Division may waive minor deviations to specifications.
3. Complete all sections of the quotation form.
4. Unit prices shall prevail in case of discrepancy.
5. All quotations are considered F.O.B. destination unless alternate shipping terms are clearly identified in the quotation.
6. **BID SUBMISSION:** All quotations must be delivered by the bidder to the office listed below prior to the date and time of the bid opening. Failure of the bidder to deliver the quotations on time will result in bid disqualifications: Department of Administration, Purchasing Division, 2019 Washington Street East, P.O. Box 50130, Charleston, WV 25305-0130



State of West Virginia  
 Department of Administration  
 Purchasing Division  
 2019 Washington Street East  
 Post Office Box 50130  
 Charleston, WV 25305-0130

# Request for Quotation

RFQ NUMBER
GSD096429

PAGE
2

ADDRESS CORRESPONDENCE TO ATTENTION OF
KRISTA FERRELL 304-558-2596

VENDOR

RFQ COPY  
 TYPE NAME/ADDRESS HERE

SHIP TO

DEPARTMENT OF ADMINISTRATION  
 VARIOUS LOCALES AS INDICATED  
 BY ORDER

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B.	FREIGHT TERMS
02/10/2009				

BID OPENING DATE: 02/26/2009 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
	GSD096429	SECTION	15160	-STORM DRAINAGE PIPING		
	GSD096429	SECTION	15430	-PLUMBING SPECIALTIES		
	GSD096429	SECTION	16430	-SWITCHGEAR		
	GSD096429	SECTION	16440	- PROTECTIVE DEVICE STUDY		
	GSD096429	DRAWING	SD1			
	GSD096429	DRAWING	R1-R1			
	GSD096429	DRAWING	E2			
	GSD096429	DRAWING	E3			
	GSD096429	DRAWING	ED1-R1			
	***** END ADDENDUM NO. 3 *****					
0001	1	JB	968-42			
	ELECTRICAL UPGRADE, COURTYARD, BLDGS #5,6,7					
	***** THIS IS THE END OF RFQ GSD096429 ***** TOTAL:					

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE	TELEPHONE	DATE
-----------	-----------	------

TITLE	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE
-------	------	-----------------------------------

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

**RFO#GSD096429**  
**Bldgs 5,6,7 Electrical Upgrade**

**Technical Question & Answers**

**Question #1:** Will a specification for the formed metal siding be provided?

**Answer#1:** See Addendum #3, Addition of Section 07412.

**Question#2:** Please clarify the framing dimensions for the doors, given that the original schedule calls for 8' doors, but the detail calls for 8' frames.

**Answer#2:** See Addendum #3, GSD096429 Addendum No. 3 Cover Statement, Page 3, Item #5, revising dimensions of Door Frame Type 1 to 8'4".

**Question#3:** The existing pair of doors calls for new hardware set #2, yet the specifications lack a "hardware set #2." Please clarify.

**Answer#3:** See Addendum #3, GSD096429 Addendum No. 3 Cover Statement, Page 3, Item#2: "REVISE Door Hardware Set for door no. 02 to read Hardware Set No. 1"

**Question#4:** Does the rebar referred to 1S1 on Drawing S1 extend into the masonry wall?

**Answer#4:** See Addendum #3, GSD096429 Addendum No. 3 Cover Statement, Page 3, Item#4.

**Question#5:** The roof spec. for this project is an SBS Modified Bitumen roof. It calls for the various layers of the roofing to be installed with cold adhesive as well as hot adhesive, specifically, 1st layer with cold, 2nd layer with hot and third and final layer with cold. Please verify that this is what the architect intended. Also, for the insulation, only a layer of 1/2" fibreboard is called for in the specifications. Should there not be a base layer of 1-1/2" Iso insulation or something similar?

**Answer#5:** The roofing material layering and adhering sequence specified is intended. Only a one-half inch layer of roofing cover board substrate, and not any roof insulation, is called for, being that this roof is not covering any heated space. The one half inch thick cover board substrate called for is the minimum required by the roofing manufacturers suggested in the specifications in order to satisfy warranty requirements.

**Question#6:** At what elevation is the part of the North wall to be removed?

**Answer#6:** Per GSD096429 Addendum No.3 Cover Statement, Page 3, Item 3.B.:  
"Remove Top 8 Inches of Existing Concrete Foundation Wall and Extend New Concrete Floor Slab to Cover."

**Question#7:** How does the new sidewalk tie into the existing sidewalk?

**Answer#7:** The new sidewalk ties into the existing generator pad for convenience of electrical staff. It is not an entrance to the Courtyard and does not need to connect to the street sidewalk.

**Question#8:** What is the thickness of the slabs that support the electrical equipment?

**Answer#8:** Per GSD096429 Addendum No.3 Cover Statement, Page 3, Item 3.C.:  
“Existing Concrete Slab is Nominally 6 inches Thick. Slab Thickness May Vary in Equipment Areas.”

**Question#9:** AIA Document A305 – 1986, Contractor’s Qualification Statement, is included in the specifications. Does this need to be included when bids are submitted, or only by the low bidder after the opening of bids?

**Answer#9:** The AIA A305 – 1986 Contractor’s Qualification Statement does not need submitted with the bid, but may be required of the low bidder prior to contract award.

**Question#10:** The Request For Quotations, Dated 1/21/09, Page 4, indicates that the Builder’s Risk Insurance is to be provided by the owner. Specifications, Supplementary Conditions, Page 7, substitutes “Contractor” for “Owner” under the property insurance section. Please clarify.

**Answer#10:** The Request for Quotations does not require the Contractor to provide Builder’s Risk insurance (it is not checked as a requirement); thus, the sections of the AIA A201 and its Supplementary Conditions referring to Builder’s Risk insurance do not apply to this project.

February 4, 2009

## ADDENDUM NO. 3

RE: Electrical Courtyard Expansion  
State Office Building Nos. 5,6, &7  
West Virginia Capitol Complex  
Charleston, West Virginia  
Architect's Project No. 0807

TO: Prospective Bidders

FROM: ZMM, Inc. Architects And Engineers

This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents.

**ATTACH THIS ADDENDUM TO THE FRONT COVER OF THE PROJECT MANUAL AND ACKNOWLEDGE RECEIPT OF THIS ADDENDUM IN THE SPACE PROVIDED ON THE BID FORM.**

### CHANGES TO SPECIFICATIONS:

1. REPLACE Table Of Contents with Table Of Contents as attached to this Addendum.
2. ADD the following Specification sections as attached to this Addendum
  - A. Section 02630 – Storm Drainage dated 01/29/09
  - B. Section 02741 – Hot Mix Asphalt Paving dated 02/02/09
  - C. Section 07412 – Metal Wall Panels dated 02/03/09
  - D. Section 15060 – Hangers And Supports dated 02/04/09
  - E. Section 15083 – Pipe Insulation dated 02/04/09
  - F. Section 15160 – Storm Drainage Piping dated 02/04/09
  - G. Section 15430 – Plumbing Specialties dated 02/04/09
  - H. Section 16430 – Switchgear dated 02/03/09
  - I. Section 16440 – Electrical System Protective Device Study dated 02/03/09
3. Section 15050 – Basic Mechanical Materials and Methods: REPLACE paragraph 1.1B with the following:
  - B. Related Documents: All general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to Work of all Division 15 Sections. Specification Divisions and Sections relating closely to the Work of Division 15 Sections include the following:
    1. Division 1 – General Requirements, in particular the following Sections:

- a. Section 01100 – Summary of Work.
  - b. Section 01310 – Project Management And Coordination for general coordination provisions, Coordination Drawings, and ongoing cleaning and protection.
  - c. Section 01731 – Cutting and Patching for procedural requirements for cutting and patching, maintaining existing warranties, and, if applicable, patching schedule.
  - d. Section 01250 – Contract Modification Procedures.
  - e. Section 01290 – Payment Procedures.
  - f. Section 01330 – Submittal Procedures for procedural requirements for submitting product data, shop drawings, samples, and test reports.
  - g. Section 01400 – Quality Requirements for requirements related to testing/quality-control services.
  - h. Section 01421 – Reference Standards and Definitions for industry standards and definitions of general specification terms.
  - i. Section 01500 – Temporary Facilities and Controls for general requirements for temporary utilities, support facilities, security and protection.
  - j. Section 01600 – Product Requirements for procedural requirements governing the Contractor's selection, delivery, storage and handling of products for use in the Project.
  - k. Section 01631 – Substitutions for procedural requirements for handling requests for substitutions made after award of the Contract.
  - l. Section 01740 – Warranties for general requirements governing manufacturers standard warranties on products and special warranties.
  - m. Section 01770 – Contract Closeout for general inspection procedures, record drawings and specifications, operation and maintenance manuals, submittal of warranties and final cleaning.
- 2. Section 02630 – Storm Drainage for exterior storm water removal.
  - 3. Section 05500 – Metal Fabrications for steel framing and supports for mechanical equipment.
  - 4. Section 07552 – Roofing for installation of roof curbs, furnished under Division 15.
  - 5. Section 07841 – Through-Penetration Firestop Systems for firestopping penetrations through fire-rated floors, roofs, walls and partitions.
  - 6. Section 07920 – Joint Sealants for requirements for joint sealants between equipment and fixtures and adjoining walls, floors or counters.
  - 7. Section 09910 – Painting for painting exposed bare and covered pipes and ducts, hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
  - 8. Section 16050 – Basic Electrical Materials and Methods and related Division 16 Sections for electrical connections for mechanical equipment, including disconnect switches, motors, starters and spare breakers in electrical panels for control equipment.
- 4. Section 15900 – Building Automation System – REPLACE paragraph 1.2E with the following:  

The Building Automation System shall be Trane Tracer or approved equal.

REPLACE first paragraph of 1.5A with the following:

"The local authorized Trane Tracer dealer/installer shall extend the existing Tracer system located in the Penthouse of adjacent Building No. 5. For this project the system shall consist of the following components:
- 5. REPLACE Specification Section 16440 - Electrical System Protective Device Study with revised Section 16440 dated 2/3/09 as attached to this Addendum.

**CHANGES TO DRAWINGS:**

1. ADD Drawing SD1 having revision date of 02/04/09 as attached to this Addendum.
2. Drawing No. A1 – REVISE Door Hardware Set for door no. 02 to read Hardware Set No.1.
3. Drawing No. A-2 – Make the following revisions:
  - A. Building Elevation 'C' - REVISE Note reading: "Windows With Aluminum Frames" to read: "Existing Aluminum Canopy".
  - B. Building Section 1 – ADD Note at base of existing masonry wall to be removed to read: "Remove Top 8 Inches Of Existing Concrete Foundation Wall And Extend New Concrete Floor Slab To Cover. Portions Of Existing Concrete Foundation Wall Need To Be Removed For Installation Of Underground Utilities".
  - C. Building Section 1 – ADD Note to existing concrete slab to read: "Existing Concrete Slab Is Nominally 6 inches Thick. Slab Thickness May Vary In Equipment Areas".
  - D. Building Section 2 – ADD Note to lower left are of section to read: "Existing Basement Tunnel To Remain; Tunnel Roof Conditions Vary".
4. Drawing No. S-1 – Detail 1 – Typical Foundation Wall - ADD Note to read: "See Foundation General Notes, Including Note No. 9, And Vertical Wall Reinforcement Schedule For Reinforcing In Masonry Wall Above. Reinforcing Bar Sizes Are To Match Reinforcing Bar Sizes In Wall Above".
5. Drawing No. A-3 – Door Frame Type 1: REVISE dimension reading 8'-0" to read: 8'-4".
6. REPLACE Drawing No. E1 with Drawing No. E1-R1 dated 2/3/09 as attached to this Addendum.
7. ADD Informational Reference Drawing Nos. E2 and E3 Existing Distribution Riser Diagrams dated 2/3/09 as attached to this Addendum.
8. See attached Revised Drawing No. ED1-R1 dated 2/3/09.

**End Of Addendum**

Attachments: *Table Of Contents*

*3 pages*

**ADDENDUM No. 3**

**Page 3 of 4**



<i>Specification Section 02630 – Storm Drainage</i>	<i>5 pages</i>
<i>Specification Section 02741 – Hot Mix Asphalt Paving</i>	<i>5 pages</i>
<i>Specification Section 07412 – Metal Wall Panels</i>	<i>8 pages</i>
<i>Specification Section 15060 – Hangers And Supports</i>	<i>7 pages</i>
<i>Specification Section 15083 – Pipe Insulation</i>	<i>10 pages</i>
<i>Specification Section 15160 - Storm Drainage piping</i>	<i>5 pages</i>
<i>Specification Section 15430 – Plumbing Specialties</i>	<i>4 pages</i>
<i>Specification Section 16430 – Switchgear</i>	<i>13 pages</i>
<i>Specification Section 16440 – Electrical System Protective Device Study</i>	<i>3 pages</i>
<i>Drawing No. SD1</i>	
<i>Drawings Nos. E1-R1, E2, E3, and ED1-R1</i>	

# CONTENTS

## BIDDING REQUIREMENTS

<i>Document</i>	<i>Description</i>	<i>Pages</i>	<i>Date</i>
00030	Advertisement for Bids .....	1	
00100	Information And Instructions to Bidders .....	6	09/04/08
	<i>Request for Substitution (Prior to Bid)</i> .....	1	
AIA A305	Contractor's Qualification Statement.....	4	1986
00300	Bid Form .....	3	07/24/08
	Bid Bond .....	1	
	<i>Bid Bond Preparation Instructions</i> .....	1	02/01/90
	List Of Proposed Subcontractors And Equipment/Material Suppliers .....	2	07/24/08

## CONTRACT FORMS

<i>Document</i>	<i>Description</i>	<i>Pages</i>	<i>Date</i>
AIA A101	Standard Form of Agreement Between Owner and Contractor .....	6	1997
	Performance Bond and Acknowledgements .....	2	10/30/95
	<i>Acknowledgement Preparation Instructions</i> .....	1	
	Labor and Material Payment Bond and Acknowledgements .....	2	10/30/95
	<i>Acknowledgement Preparation Instructions</i> .....	1	
AIA G701	Change Order .....	1	2001
AIA G702	Application and Certificate for Payment.....	1	1992
AIA G703	Continuation Sheet.....	1	1992
AIA G704	Certificate of Substantial Completion .....	1	2000
AIA G706	Contractor's Affidavit of Payment of Debts and Claims .....	1	1994
AIA G706A	Contractor's Affidavit of Release of Liens .....	1	1994
AIA G707	Consent of Surety to Final Payment .....	1	1994
AIA G707A	Consent of Surety to Reduction in or Partial Release of Retainage .....	1	1994
AIA G709	Work Changes Proposal Request.....	1	2001
AIA G710	Architect's Supplemental Instructions .....	1	1992
AIA G714	Construction Change Directive.....	1	2001

## CONTRACT CONDITIONS

<i>Document</i>	<i>Description</i>	<i>Pages</i>	<i>Date</i>
AIA A201	General Conditions of the Contract for Construction .....	39	1997
	State of West Virginia Supplementary Conditions .....	9	2004
<del>00900</del>	<del>Special Conditions .....</del>	<del>1</del>	<del>07/24/08</del>
	<i>Sample Certificate Of Liability Insurance</i> .....	1	

## SPECIFICATIONS

<i>Section</i>	<i>Description</i>	<i>Pages</i>	<i>Date</i>
<i>Division 1 - General Requirements</i>			
01100	Summary of Work.....	1	07/24/08
01250	Contract Modification Procedures .....	2	07/24/08
01270	Unit Prices.....	2	07/24/08
01290	Payment Procedures.....	3	07/24/08

<i>Section</i>	<i>Description</i>	<i>Pages</i>	<i>Date</i>
01310	Project Management And Coordination .....	2	07/24/08
01330	Submittal Procedures .....	5	07/24/08
	<i>Submittal Cover Sheet</i> .....	1	
	<i>Submittal Deviation Sheet</i> .....	1	
01352	LEED Requirements .....	3	07/24/08
01400	Quality Requirements .....	6	07/24/08
01421	Reference Standards and Definitions .....	3	07/24/08
01500	Temporary Facilities And Controls.....	4	07/23/08
01524	Construction Waste Management .....	4	07/23/08
01600	Product Requirements .....	4	09/04/08
01631	Substitutions.....	3	07/23/08
	<i>Substitution Request Cover Sheet (After Bid)</i> .....	1	
01700	Execution Requirements .....	4	07/23/08
01731	Cutting and Patching.....	4	07/23/08
01732	Selective Demolition.....	5	07/23/08
01740	Warranties .....	2	07/23/08
01770	Closeout Procedures.....	3	07/23/08
<b><i>Division 2 - Site Construction</i></b>			
02230	Site Clearing.....	3	05/16/08
02300	Earthwork.....	11	07/23/08
02361	Termite Control.....	3	07/23/08
02630	Storm Drainage .....	5	01/21/09
02741	Hot-Mix Asphalt Paving.....	5	02/02/09
02920	Lawns and Grasses.....	7	07/23/08
<b><i>Division 3 - Concrete</i></b>			
03300	Cast-In-Place Concrete .....	12	05/07/08
<b><i>Division 4 - Masonry</i></b>			
04810	Unit Masonry Assemblies .....	13	05/07/08
04851	Stone Panels .....	6	07/23/08
<b><i>Division 5 - Metals</i></b>			
05120	Structural Steel.....	6	05/07/08
05210	Steel Joists.....	4	05/07/08
05310	Steel Deck .....	4	05/07/08
05500	Metal Fabrications .....	5	05/07/08
<b><i>Division 6 - Wood and Plastics</i></b>			
06105	Miscellaneous Carpentry.....	5	05/07/08
<b><i>Division 7 - Thermal and Moisture Protection</i></b>			
07552	SBS Modified Bituminous Membrane Roofing.....	9	07/22/08
07620	Sheet Metal Flashing And Trim.....	6	07/22/08
07720	Roof Accessories .....	3	05/16/08
07841	Through-Penetration Firestop Systems.....	7	08/07/08
07920	Joint Sealants .....	7	05/16/08
<b><i>Division 8 - Doors and Windows</i></b>			

<i>Section</i>	<i>Description</i>	<i>Pages</i>	<i>Date</i>
08110	Steel Doors and Frames .....	6	05/16/08
08520	Aluminum Windows .....	6	05/22/08
08712	Door Hardware .....	11	07/23/08
08800	Glazing.....	6	07/22/08
<b><i>Division 9 - Finishes</i></b>			
09111	Non-Load Bearing Steel Framing .....	3	05/19/08
09910	Painting .....	10	05/19/08
<b><i>Division 10 - Specialties</i></b>			
10200	Louvers .....	6	05/16/08
10523	Fire Extinguishers .....	3	07/24/08
<b><i>Division 15 – Mechanical</i></b>			
15050	Basic Mechanical Materials and Methods .....	9	08/07/08
15060	Hangers and Supports .....	7	02/04/09
15083	Pipe Insulation .....	10	02/-4/09
15160	Storm Drainage Piping.....	5	02/04/09
15430	Plumbing Specialties.....	4	02/04/09
15815	Metal Ducts.....	6	08/07/08
15820	Duct Accessories.....	5	08/07/08
15838	Power Ventilators.....	5	08/07/08
15900	Building Automation System.....	5	08/07/08
<b><i>Division 16 - Electrical</i></b>			
16050	Basic Electrical Materials And Methods.....	6	07/25/08
16060	Grounding And Bonding .....	5	07/25/08
16073	Hangers And Supports For Electrical Systems .....	6	07/25/08
16075	Electrical Identification .....	7	07/25/08
16120	Conductors And Cables .....	4	07/25/08
16124	Medium Voltage Cables.....	6	07/25/08
16130	Raceways And Boxes .....	7	07/25/08
16140	Wiring Devices .....	4	07/25/08
16211	Electricity Metering .....	2	07/25/08
16271	Medium Voltage Transformers .....	7	07/25/08
16341	Medium Voltage Switchgear .....	19	07/25/08
16430	Switchgear .....	13	02/03/09
16440	Electrical System Protective Device Study .....	3	02/03/09
16450	Enclosed Bus Assemblies .....	4	07/25/08
16511	Interior Lighting.....	5	07/25/08

## END OF CONTENTS

## SECTION 02630 - STORM DRAINAGE

### 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 storm drainage outside the building as indicated on drawings.

#### 1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Cleanouts.
- B. Shop Drawings: Include plans, elevations, details, and attachments for the following:
- C. Coordination Drawings: Show concrete structures, pipe sizes, locations, and elevations. Include details of underground structures and connections. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between piping and proximate structures.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

### 2.2 PIPES AND FITTINGS

- A. PVC Sewer Pipe and Fittings: According to the following:
1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.
    - a. Gaskets: ASTM F 477, elastomeric seals.
  - B. PVC Sewer Pipe and Fittings, NPS 18 (DN 450) and Larger: ASTM F 679, T-1 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

### 2.3 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
1. Light Duty: In earth or grass foot-traffic areas.
  2. Medium Duty: In paved foot-traffic areas.
  3. Heavy Duty: In vehicle-traffic service areas.
  4. Extra-Heavy Duty: In roads.
  5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

### 3.2 IDENTIFICATION

- A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.
1. Use warning tape or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

### 3.3 PIPING APPLICATIONS

- A. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.
- B. Gravity-Flow Piping: Use the following:
  1. NPS 4 and NPS 6: PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.
  2. NPS 8 to NPS 15: PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.
  3. NPS 18 to NPS 36 (DN 450 to DN 900): PVC sewer pipe and fittings, gaskets, and gasketed joints.

### 3.4 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.
- C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.
  1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
  2. Install piping with 36-inch minimum cover.
- F. Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

### 3.5 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to installations indicated.
- B. PVC Sewer Pipe and Fittings: As follows:

1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
2. Install according to ASTM D 2321.

- C. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.
- D. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

### 3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
  2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
  3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic areas.
  4. Use extra-heavy-duty, top-loading classification cleanouts in road areas.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement/gravel parking area surface.

### 3.7 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
1. In large, accessible piping, brushes and brooms may be used for cleaning.
  2. Place plug in end of incomplete piping at end of day and when work stops.
  3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.



4. Reinspect and repeat procedure until results are satisfactory.
- C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate reports for each test.
  5. Leaks and loss in test pressure constitute defects that must be repaired.
  6. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

**END OF SECTION**

## SECTION 02741 - HOT-MIX ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Hot-mix asphalt patching.
  - 2. Pavement-marking paint.
- B. Related Sections include the following:
  - 1. Section 02300 – Earthwork for aggregate base.

#### 1.2 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the standard specifications of the state or of authorities having jurisdiction and the West Virginia Division of Highways, Standard Specifications, most current edition.

#### 1.3 SUBMITTALS

- A. Product Data: For each product specified. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate dedicated handicapped spaces with international graphics symbol.
- D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Material Test Reports: Indicate and interpret test results for compliance with testing requirements for thickness and density as specified in Part 3.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

- B. **Manufacturer Qualifications:** Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.
  - 1. Firm shall be a registered and approved paving mix manufacturer with authorities having jurisdiction or with the West Virginia Division of Highways.
- C. **Testing Agency Qualifications:** Demonstrate to Architect's satisfaction, based on Architect's evaluation of criteria conforming to ASTM D 3666, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- D. **Asphalt-Paving Publication:** Comply with AI's "The Asphalt Handbook," except where more stringent requirements are indicated.
- E. **Preinstallation Conference:** Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" Review methods and procedures related to asphalt paving including, but not limited to, the following:
  - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
  - 2. Review condition of substrate and preparatory work performed by other trades.
  - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
  - 4. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving Installer's personnel, and equipment required to execute the Work without delays.
  - 5. Review inspection and testing requirements, governing regulations, and proposed installation procedures.
  - 6. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

## 1.5 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:
  - 1. **Asphalt Base Course:** Minimum surface temperature of 40 deg F and rising at time of placement.
  - 2. **Asphalt Surface Course:** Minimum surface temperature of 60 deg F at time of placement.
- B. **Pavement-Marking Paint:** Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. **General:** Use materials and gradations that have performed satisfactorily in previous installations.

- B. Coarse Aggregate: Sound; angular crushed stone; crushed gravel; or properly cured, crushed blast-furnace slag; complying with ASTM D 692 and Section 703 of the West Virginia Division of Highways, Standard Specifications.
- C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag, or combinations thereof; complying with ASTM D 1073 and Section 702 of the West Virginia Division of Highways, Standard Specifications.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

## 2.2 ASPHALT MATERIALS

- A. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.

## 2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: Alkyd-resin type, ready-mixed, complying with FS TT-P-115, Type I, or AASHTO M-248, Type N.
  - 1. Color: Yellow or white.

## 2.4 MIXES

- A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
  - 1. Provide mixes specified below from Table 401.4.2 of the West Virginia Division of Highways Standard Specifications:
    - a. Base Course: Base 1.
    - b. Base Course: Base 2.
    - c. Wearing Course: Wearing 1.
    - d. Wearing Course: Wearing 2.
  - 2. Provide mixes complying with the composition, grading, and tolerance requirements of ASTM D 3515 for the following nominal, maximum aggregate sizes:
    - a. Base Course: 1 inch.
    - b. Surface Course: 1/2 inch.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

### 3.2 PATCHING AND REPAIRS

- A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.
  - 1. Tack coat faces of excavation and allow to cure before paving.
  - 2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
- B. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of 1/4 inch. Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.

### 3.3 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to cure for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint to produce pavement markings matching original site conditions with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements. Testing agency shall perform tests as follows:
  - 1. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.
    - a. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
    - b. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
- B. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

- C. For corrected Work, additional testing, at Contractor's expense, will be performed to determine compliance with specified requirements.

**END OF SECTION**

## SECTION 07412 - METAL WALL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 07920 – Joint Sealants

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Honey Comb Core Composite Metal Wall Panels.
  - 2. Support Furring Channels.

#### 1.3 DEFINITION

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 1.57 lbf/sq. ft..
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
- D. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft..
  - 1. Water Leakage: As defined according to AAMA 501.1.
  - 2. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
- E. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:
    - a. Uniform pressure of 30 lbf/sq. ft., acting inward or outward.
    - b. Uniform pressure as indicated on Drawings.
  2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/240 of the span.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
  1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
    - a. Flashing and trim.
    - b. Anchorage systems.
- C. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
  1. Include similar Samples of trim and accessories involving color selection.
  2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- E. Maintenance Data: For metal wall panels to include in maintenance manuals.
- F. Warranties: Sample of special warranties.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Source Limitations: Obtain each type of metal wall panel from single source from single manufacturer.
- D. Preinstallation Conference: Conduct conference at Project site.



1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels, including installers of doors, windows, and louvers.
2. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
4. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
5. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
6. Review temporary protection requirements for metal wall panel assembly during and after installation.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

#### **1.8 PROJECT CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

#### **1.9 COORDINATION**

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### **1.10 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.

- b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Ten years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
- 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 HONEY COMB CORE COMPOSITE METAL WALL PANELS**

- A. General: Provide factory-formed metal wall 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. Metal Wall Panels: Sandwich panel with aluminum skins laminated with a structural adhesive to an aluminum honeycomb core.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. UNA-CORE Series 10 by Firestone Metal Products/UNACLAD (Basis of Design).
    - b. CENTRIA Architectural Systems.
    - c. Petersen Aluminum Corporation.
  - 2. Material: Aluminum sheet, 0.040 inch thick.
    - a. Exterior Finish: 3-coat fluoropolymer Metallic fluoropolymer.
    - b. Color: As selected by Architect from manufacturer's full range.

### **2.2 MISCELLANEOUS METAL FRAMING**

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Hat-Shaped, Rigid Furring Channels:
  - 1. Nominal Thickness: 0.040 inch.
  - 2. Depth: As indicated.
- C. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

## 2.3 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

## 2.4 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
  2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.018-inch minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim 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 wall panels.

## 2.5 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, 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. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the 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. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
  - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## 2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
  1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
  2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
  3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
  4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

### 3.3 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Deviation from vertical and horizontal alignment of installed panels shall be a maximum of ¼ inch in 20 feet.
4. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
11. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

**B. Fasteners:**

1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.

**C. Metal Protection:** Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

**D. Joint Sealers:** Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 07920 "Joint Sealants."

**E. Metal Wall Panels:** Fasten metal wall 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 corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. 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.
3. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
4. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.

### **3.4 ACCESSORY INSTALLATION**

**A. General:** Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

### **3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft..
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### **3.6 CLEANING AND PROTECTION**

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION**

## SECTION 15060 - HANGERS AND SUPPORTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
  - 1. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.
  - 2. Division 15 Section "Basic Mechanical Materials and Methods" for Welding.

#### 1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Pipe Hangers:
    - a. B-Line Systems, Inc.

- b. Grinnell Corp.
  - c. PHD Manufacturing, Inc.
2. Channel Support Systems:
- a. B-Line Systems, Inc.
  - b. Grinnell Corp.; Power-Strut Unit.
  - c. Thomas & Betts Corp.
  - d. Unistrut Corp.
3. Thermal-Hanger Shield Inserts:
- a. Michigan Hanger Co., Inc.
  - b. Pipe Shields, Inc.
  - c. Rilco Manufacturing Co., Inc.
4. Powder-Actuated Fastener Systems:
- a. Hilti, Inc.
  - b. ITW Ramset/Red Head.
  - c. Masterset Fastening Systems, Inc.

## 2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
- 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
  - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
- 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
  - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.
- 1. Material for Cold Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
  - 2. Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate.
  - 3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
  - 4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
  - 5. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.



## 2.3 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
  4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
  5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
  7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
  10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
  11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
- F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

- H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- K. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9.
  - 2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 5. Pipes NPS 8 and Larger: Include wood inserts.
  - 6. Insert Material: Length at least as long as protective shield.
  - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

### 3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

### **3.5 ADJUSTING**

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

**END OF SECTION**

## SECTION 15083 - PIPE INSULATION

### 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 preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
  1. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
  2. Division 15 Section "Hangers and Supports" for pipe insulation shields, inserts, and protection saddles.

#### 1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
  1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
  2. Attachment and covering of heat trace inside insulation.
  3. Insulation application at pipe expansion joints for each type of insulation.
  4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  5. Removable insulation at piping specialties and equipment connections.
  6. Application of field-applied jackets.

#### 1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
  1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

### 1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for insulation application.
- C. Coordinate installation and testing of steam or electric heat tracing.

### 1.7 SCHEDULING

- A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Mineral-Fiber Insulation:
    - a. CertainTeed Manson.
    - b. Knauf FiberGlass GmbH.
    - c. Owens-Corning Fiberglas Corp.
    - d. Schuller International, Inc.
  2. Flexible Elastomeric Thermal Insulation:
    - a. Armstrong World Industries, Inc.
    - b. Rubatex Corp.

### 2.2 INSULATION MATERIALS

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
  2. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
    - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
  3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
  4. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
  5. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
1. Adhesive: As recommended by insulation material manufacturer.
  2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
- C. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

### 2.3 FIELD-APPLIED JACKETS

- A. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
1. Adhesive: As recommended by insulation material manufacturer.
  2. PVC Jacket Color: White or gray.
- B. Heavy PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 30-mil- thick, high-impact, ultraviolet-resistant PVC.
1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
  2. Adhesive: As recommended by insulation material manufacturer.
- C. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.
- D. Stainless-Steel Jacket: ASTM A 666, Type 304 or 316; 0.10 inch thick; and factory cut and rolled to indicated sizes.

### 2.4 ACCESSORIES AND ATTACHMENTS



- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..
  - 1. Tape Width: 4 inches.
- B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
  - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
  - 2. Galvanized Steel: 0.005 inch thick.
  - 3. Aluminum: 0.007 inch thick.
  - 4. Brass: 0.010 inch thick.
  - 5. Nickel-Copper Alloy: 0.005 inch thick.
- C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

## 2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
  - 1. Apply insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
  - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
  - 1. Pull jacket tight and smooth.
  - 2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
  - 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

- a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
  - 4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
  - 5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
- 1. Seal penetrations with vapor-retarder mastic.
  - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
  - 3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal metal jacket to roof flashing with vapor-retarder mastic.
- Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
- 1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."
- T. Floor Penetrations: Apply insulation continuously through floor assembly.
- 1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

### 3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
- 1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
  - 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
  - 3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
  - 4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
- 1. Apply preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
1. Apply premolded insulation sections of the same material and thickness as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
  2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
  3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- D. Apply insulation to valves and specialties as follows:
1. Apply premolded insulation sections of the same material and thickness as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
  3. Apply insulation to flanges as specified for flange insulation application.
  4. Use preformed heavy PVC fitting covers for valves. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
  5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

### 3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
1. Follow manufacturer's written instructions for applying insulation.
  2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- B. Apply insulation to flanges as follows:
1. Apply pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- D. Apply insulation to valves and specialties as follows:
1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
  2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.
  3. Apply insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

### 3.6 FIELD-APPLIED JACKET APPLICATION

- A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch-thick coats of jacket manufacturer's recommended adhesive.
  3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.
- B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.
1. Draw jacket material smooth and tight.
  2. Apply lap or joint strips with the same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Apply jackets with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.
- C. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
- D. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.7 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."

- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

### **3.8 PIPING SYSTEM APPLICATIONS**

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
  1. Flexible connectors.
  2. Vibration-control devices.
  3. Fire-suppression piping.
  4. Drainage piping located in crawl spaces, unless otherwise indicated.
  5. Below-grade piping, unless otherwise indicated.
  6. Chrome-plated pipes and fittings, unless potential for personnel injury.
  7. Unions.

### **3.9 FIELD QUALITY CONTROL**

- A. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
  1. Inspect fittings and valves randomly selected by Architect.
  2. Remove fitting covers from 20 elbows or 1 percent of elbows, whichever is less, for various pipe sizes.
  3. Remove fitting covers from 20 valves or 1 percent of valves, whichever is less, for various pipe sizes.
- B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

### **3.10 INSULATION APPLICATION SCHEDULE, GENERAL**

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

### **3.11 INTERIOR INSULATION APPLICATION SCHEDULE**

- A. Service: Rainwater conductors.
1. Operating Temperature: 32 to 100 deg F.
  2. Insulation Material: Mineral fiber.
  3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. Cast Iron Pipe, up to 8" – 1" thick.
  4. Field-Applied Jacket: None.
  5. Vapor Retarder Required: Yes.
  6. Finish: None.
- B. Service: Roof drain bodies.
1. Operating Temperature: 32 to 100 deg F.
  2. Insulation Material: Mineral fiber.
  3. Insulation Thickness: 1" thick.
  4. Field-Applied Jacket: Foil and paper.
  5. Vapor Retarder Required: Yes.
  6. Finish: None.

**END OF SECTION**

## SECTION 15160 - STORM DRAINAGE PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes storm-drainage piping inside the building and to locations indicated.
- B. Related Sections include the following:
  - 1. Division 15 Section "Plumbing Specialties" for storm drainage piping system specialties.

#### 1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
  - 1. PVC: Polyvinyl chloride plastic.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water.

#### 1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

#### 1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.



## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

### 2.2 CAST-IRON SOIL PIPING

- A. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.
  - 1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center pipe stop.
    - a. Standard, Shielded Stainless-Steel Couplings: CISPI 310, stainless-steel shield; stainless-steel bands; and sleeve.

### 2.3 PVC PIPING

- A. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

### 3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Aboveground Storm Drainage Piping: Use the following piping materials for each size range:
  - 1. NPS 2 to NPS 15: Hubless, cast-iron soil piping and one of the following:
    - a. Couplings: Standard, shielded stainless steel.

- C. Underground Storm Drainage Piping: Use the following piping materials for each size range:
1. NPS 3 to NPS 12: PVC pipe, PVC socket fittings, and solvent cemented joints.

### 3.3 PIPING INSTALLATION

- A. Refer to Division 2 Section "Storm Drainage" for Project site storm sewer and drainage piping.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Install underground PVC storm drainage piping according to ASTM D 2321.
- K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.4 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
  - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.

### 3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
    1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
    2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
    4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
    5. Prepare reports for tests and required corrective action.

### 3.8 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.

**END OF SECTION**

## SECTION 15430 - PLUMBING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following plumbing specialties:
  - 1. Roof drains.

#### 1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. PE: Polyethylene plastic.
  - 3. PUR: Polyurethane plastic.
  - 4. PVC: Polyvinyl chloride plastic.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water.

#### 1.5 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
  - 1. Cleanouts, floor drains, open receptors, interceptors, and roof drains.
- B. Field test reports.

#### 1.6 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
- B. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Size based on ASSE 1010 or PDI-WH 201, Sizes A through F.

### **2.2 CLEANOUTS**

- A. Products:
  - 1. Josam Co.
  - 2. Smith, Jay R. Mfg. Co.
  - 3. Tyler Pipe, Wade Div..
  - 4. Watts Industries, Inc., Drainage Products Div.
  - 5. Zurn Industries, Inc., Jonespec Div.
- B. Floor Cleanouts: Zurn AN1400 Level-trol
  - 1. Dura-Coated cast iron body.
  - 2. Bronze plug and round scoriated vandal-proof top.
  - 3. Provide square top in areas with finished floor coverings.
  - 4. Provide carpet marker for ceiling installation above cleanouts in carpeted areas.
- C. Equipment Room Cleanouts: Zurn Z1402 Tuf-Top.
  - 1. Non adjustable floor cleanout.
  - 2. Dura-Coated cast iron body.
  - 3. Gas and water-tight bronze plug.
  - 4. Round scoriated vandal-proof secured cover and frame.
- D. Wall Cleanouts: Zurn Z1441
  - 1. Dura-Coated cast iron body.
  - 2. Gas and water-tight bronze plug.
  - 3. Round smooth stainless steel access cover.
- E. Cleanout Plugs: Zurn Z1470

1. Countersunk bronze cleanout plug.
- F. Yard Cleanouts-Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Install cleanout as per detail on dwg. P3-1. Use units with top-loading classifications according to the following applications:
1. Light Duty: In earth or grass foot-traffic areas.
  2. Medium Duty: In paved foot-traffic areas.
  3. Heavy Duty: In vehicle-traffic service areas.
  4. Extra-Heavy Duty: In roads.
  5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
  6. Use detectable warning tape over nonferrous piping and over edges of underground structures.

### 2.3 ROOF DRAINS

- A. Products:
- a. Josam Co.
  - b. Smith, Jay R. Mfg. Co.
  - c. Tyler Pipe, Wade Div.
  - d. Watts Industries, Inc., Drainage Products Div.
  - e. Zurn Industries, Inc., Jonespec Div.
- B. Roof Drains: Zurn Z100.
1. 15" diameter roof drain.
  2. Dura-Coated cast iron body.
  3. Cast iron combination membrane flashing clamp/gravel guard.
  4. Low silhouette vandal-proof cast iron dome.
  5. Furnish with sump receiver and under deck clamp.
  6. Roof deck plate may be used in lieu of receiver and under deck clamp.
  7. Gravel guard for gravel ballasted roofs.
  8. Furnish with side flashing flange for elastomeric roofing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each storm water riser.
- D. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- E. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- F. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
1. Install roof drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  2. Position roof drains for easy access and maintenance.
- G. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- H. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- I. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- J. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### **3.2 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect plumbing specialties to piping specified in other Division 15 Sections.

### **3.3 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION**



## SECTION 16430 - SWITCHGEAR

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the replacement of the existing buildings 5, 6 and 7 General Electric metal-enclosed, low-voltage power circuit-breaker switchgear rated 480/277 V AC.
- B. The Contractor shall remove and legally dispose of the existing outdoor 480 Volt switchgear as part of this contract.
- C. This specification and associated drawings describe Square-D **Power-Zone® 4** Low Voltage Draw-out Switchgear assembly constructed to ANSI C37.20.1 standards.
- D. Circuit breakers shall be drawout type **MASTERPACT®** with **MICROLOGIC™** electronic trip units as specified on the associated drawings. Circuit breakers shall have interrupting, close and latch, and 30-cycle withstand ratings that meet the application requirements. Interrupting rating shall be available up to 200 kA RMS amperes without fuses. Close and latch ratings to 65 kA available on all frame sizes. Thirty-cycle withstand rating available up to 100 kA to provide maximum coordination with downstream circuit breakers.  
Circuit breakers shall be available in 800, 1600, 2000, 3200, 4000 and 5000 A frame sizes. An adjustable rating plug (range of 0.4 to 1 times the sensor plug value) and a field-replaceable sensor plug (available in standard amperage steps from 50% to 100% of the frame size) shall determine the ampere rating of the circuit breaker.
- E. Two (2) buss tie breakers shall be provided to connect the secondary buss, Unit 1, Unit 2 and Unit 3. Tie breakers shall be 4000 amp and key interlocked to main secondary breaker Unit 1, Unit 2 and Unit 3. (Interlock main secondary breaker, Unit 1, Unit 2 with the tie breaker between Unit 1 and Unit 2; interlock main secondary breaker Unit 2, and Unit 3 with the tie breaker between Unit 2 and Unit 3). One main secondary breaker shall be open when a tie breaker is closed. Tie breakers shall be electrically operated.
- F. Related Sections include the following:
  - 1. Division 16 Section "Electrical System Protective Device Study" for coordination and determination of circuit breaker ratings and trip settings.

#### 1.3 DEFINITIONS

- A. ATS: Acceptance Testing Service.
- B. GFCI: Ground-fault circuit interrupter.

#### 1.4 SUBMITTALS

- A. **Product Data:** For each type of switchgear, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. **Shop Drawings:** For each type of switchgear and related equipment.
  - 1. **Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:**
    - a. Tabulation of installed devices with features and ratings.
    - b. Enclosure types and details.
    - c. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
    - d. Bus configuration with size and number of conductors in each bus run, including phase, neutral, and ground conductors of main and branch buses.
    - e. Current rating of buses.
    - f. Short-time and short-circuit current rating of switchgear assembly.
    - g. Nameplate legends.
    - h. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. **Wiring Diagrams:** Power, signal, and control wiring.
- C. **Coordination Drawings:** Floor plans showing dimensioned layout, required working clearances, and required area above and around switchgear where pipe and ducts are prohibited. Show switchgear layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- D. **Manufacturer Seismic Qualification Certification:** Submit certification that switchgear, overcurrent protective devices, accessories, and components will withstand seismic forces for the locality in which installed. Include the following:
  - 1. **Basis of Certification:** Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. **Dimensioned Outline Drawings of Equipment Unit:** Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. **Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.**
- E. **Qualification Data:** For testing agency.
- F. **Field quality-control test reports.**
- G. **Updated mimic-bus diagram reflecting field changes after final switchgear load connections have been made, for record.**

H. Operation and Maintenance Data: For switchgear and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," 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.

#### 1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain switchgear through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of switchgear and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

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. Equipment shall be designed, tested and manufactured according to the following:

1. ANSI C37.20.1 – Metal Enclosed Low Voltage Power Circuit Breaker Switchgear
2. ANSI C37.51 – Testing of Metal-Enclosed Low Voltage AC Power Circuit Breaker Switchgear.
3. NEMA SG-5 – Power Switchgear Assemblies
4. UL 1558 – Switchgear Assemblies

G. Main and Feeder Circuit Breakers shall be designed, tested and manufactured to the following:

1. ANSI C37.13- Low Voltage AC Power Circuit Breakers Used In Equipment
2. ANSI C37.16- Preferred Rating, Related Requirement And Application Recommendations For Low Voltage Power Circuit Breakers and AC Power Circuit Protectors.
3. ANSI C37.50- Testing of Low Voltage AC Power Circuit Breakers
4. NEMA SG-3 - Low Voltage Power Circuit Breakers
5. UL1066- Low Voltage Power Circuit Breakers

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchgear in sections of lengths that can be moved past obstructions in delivery path and that provide for the safest and most efficient installation possible with the least amount of electrical outage time..
- B. If stored in areas subjected to weather, cover switchgear to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchgear; install electric heating (250 W per section) to prevent condensation.

#### 1.7 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace building components and structures to provide pathway for moving switchgear into place.
- B. 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 Owner, in writing, no fewer than 7 days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Owner's written permission.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchgear, including clearances between switchgear, and adjacent surfaces and other items. Comply with indicated maximum dimensions and code require working space about electrical equipment.
- D. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not exceeding 40 deg C.
  - 2. Altitude: Not exceeding 6600 feet (2010 m).

#### 1.8 COORDINATION

- A. Coordinate layout and installation of switchgear and components with other construction that penetrates ceilings and floors or is supported by them, including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

#### 1.9 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. Fuses: Six of each type and rating used. Include spares for potential transformer fuses, control power fuses, and fuses and fusible devices for fused circuit breakers.

2. Indicating Lights: Six of each type installed.
3. Touchup Paint: 3 containers of paint matching enclosure finish, each 0.5 pint (250 mL).

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear shall be Square D; Schneider Electric Power-Zone 4 using Masterpact type Low Voltage Power Circuit Breakers, or approved equal.

### 2.2 RATINGS

- A. Nominal System Voltage: 480/277 V, 4 wire, 60 Hz.
- B. Main-Bus Continuous: 4000 A. with 100% Neutral
- C. Short-Time and Short-Circuit Current: Match rating of highest-rated circuit breaker in switchgear assembly.
  1. The short circuit current rating of the system shall be determined by the available fault current at the Low Voltage Switchgear. The minimum short circuit rating of the switchgear shall be 100,000 amperes rms symmetrical. All circuit interruption shall be accomplished by the circuit breaker and without the aid of limiter fuses. The Short time rating shall also be a function on the desired selectivity of the electrical system.
- D. The assembly shall be designed for use on 60 Hz electrical systems up to 600 Vac. The assembly shall be properly braced to the ratings of the circuit breaker installed within the assembly.
- E. Any items not specifically mentioned but which are obviously necessary for proper operation are implied in this specification.

### 2.3 FABRICATION

- A. Factory assembled and tested and complying with IEEE C37.20.1.
- B. Indoor Enclosure Material: Steel.
- C. Provide necessary space heaters thermostatically controlled for breaker, bus and cable compartments of adequate wattage to prevent the accumulation of moisture within the compartments.
  1. Power for the space heaters, lights and receptacles shall be obtained from a control power transformer within the switchgear. Supply voltage shall be 120 volts AC.
- D. Finish: IEEE C37.20.1, manufacturer's standard ANSI #49 medium gray finish over a rust-inhibiting primer on phosphatizing-treated metal surfaces.

#### B.E. Dimensions

1. Section widths should be 22, 30, or 36" wide dependent on the size of the circuit breakers being installed.
2. The lineup shall provide adequate wire bending space for mains and feeders breakers using up to 750 kcmil wires.
3. Section depth shall be 72".

Formatted: Bullets and Numbering

#### C.F. Moving and Handling

1. The Lineup shall be divided into shipping splits not to exceed 88" wide and shall be capable of being lifted overhead or by a forklift.
2. Each shipping split shall be provided with removable lifting straps
3. Removable Base Channels shall be provided with prying slots for ease of final positioning at the job-site.
4. **For circuit breakers, an overhead lifter shall be provided to ease the installation or removal of circuit breakers. See Accessories section herein.**

Formatted: Bullets and Numbering

- G. Section barriers between main and tie circuit-breaker compartments shall be extended to rear of section. Provide additional sectional and shipping split barriers as required to provide a safe working environment while the switchgear is being assembled.
- H. Bus isolation barriers shall be arranged to isolate line bus from load bus at each main and tie circuit breaker.
- I. Circuit-breaker compartments shall be equipped to house drawout-type circuit breakers and shall be fitted with hinged outer doors.
- J. Fabricate enclosure with removable, hinged, rear cover panels to allow access to rear interior of switchgear.
- K. Auxiliary Compartments: Match and align with basic switchgear assembly. Include the following:
  1. Bus transition sections.
  2. Incoming-line pull sections.
  3. Hinged front panels for access to metering, accessory, and blank compartments.
- L. Support Base and Splice Box: Unit manufacturer shall provide a continuous 14 inch high structural steel splice box on the bottom of switchgear to support the switchgear and provide for extra room for pulling and splicing existing cable, with removable front, rear and side access covers and ventilation provisions adequate to maintain air temperature in splice box within same limits as switchgear.
  1. The splice box shall run the full length and width of the switchgear
  2. The splice box shall support the entire weight of the switchgear.
  3. Provide an access walkway platform with steps and fiberglass grating from the front edge of the switchgear to the opposite interior surface of the building wall as indicated on the drawings.
  4. Provide full width steps (1 step, 2 risers) at each end of the switchgear line up as indicated on the drawings.
  5. The splice box shall be constructed in sections to accept shipping splits and accommodate staged sections of installation.
  6. All steel sections shall be painted to match the switchgear finish.

## 2.4 BREAKER COMPARTMENT

### A. Circuit Breakers

1. Each circuit breaker shall be mounted in its own barriered compartment.
2. Feeder circuit breakers rated 2000A or less shall be capable of being mounted in the uppermost compartment without derating.
3. Operational buttons on the circuit breaker as well as the trip unit and the display shall be accessible without opening the breaker compartment door.
4. Circuit breakers of like sizes and rated 1600A or less shall be interchangeable as standard. Circuit breakers of lower interruption ratings shall be mechanically prohibited from being placed in the cell.
5. Prepared spaces shall be totally complete, include the racking mechanism, bussing, and secondary contacts as necessary, so that a circuit breaker of the correct frame size can be installed with no modifications required.
6. Circuit Breaker and prepared space compartments shall be "keyed" such that a breaker cannot be incorrectly installed with respect to Interrupting Rating, Frame Size, or secondary connections

### B. Secondary Connections

1. All customer secondary control and communications connections shall be made from the front of the switchgear lineup.
2. A dedicated wiring area accessible from the front shall allow easy access to all control or communications terminations
3. Control Connections shall be cage clamp terminals. All control wire shall be 14 gage SIS.
4. Dedicated conduit entry for control wires shall be provided at the top and bottom of each section, capable of landing up to 3 each 1 1/2" conduits and accessible from the front.
5. All interconnections between sections at shipping splits shall use locking-pull apart terminal blocks.
6. All secondary and communication wiring shall be securely fastened to the switchgear without the use of adhesive backed wire anchors.

### C. Instrumentation

1. Where additional space is required for instrumentation, CPT's, metering, etc., a barriered instrumentation compartment shall be used.
2. The instrumentation compartment shall not inhibit the routing of control or communication wires.
3. Individual component mounting surfaces and pans in the instrument compartments shall be painted white as standard.

## 2.5 BUSING AND CABLE COMPARTMENT

### A. Busing

1. All vertical and horizontal distribution bussing shall be rated for the full ampacity of the lineup.
2. All bus joints shall consist of Grade 5 hardware and conical spring (e.g. Belleville) washers to withstand mechanical forces exerted during short circuits. All joints shall consist of a minimum of 2 bolts.
3. Busing shall be copper and plated along its entire length.
4. Busing shall be braced to withstand the instantaneous interrupting rating of the main breaker(s) or 65kA minimum.
5. Barriers shall be available to separate the bussing and cable compartment.

### B. Cable Compartment

1. All incoming or outgoing power conductors shall be routed through this area.

2. Feeder Breakers shall have adequate wire bending space regardless of the interrupting rating. See table below for additional information.
3. Conduit area for each section shall be a minimum of 17" wide and provide adequate depth for all section conduits. Select depth based on the tables below:
4. Barriers to separate the busing and cable compartments shall be provided. Barriers to separate the cable compartment from and adjacent cable compartment shall be provided.

## 2.6 DIFFERENTIAL GROUND FAULT PROTECTION

- A. 480Y/277V or 600Y/347V, 4-wire, connected equipment having multiple sources shall have a modified differential ground fault system (MDGF). The manufacturer shall complete the MDGF design prior to building equipment to insure that the proper main or tie breaker (s) operate properly during the following occurrences on the main bus.
  1. Insure the system will trip with the occurrence of a ground fault at any location in the switchgear.
  2. Insure system will not trip without ground fault and with normal current flow.
  3. Insure system will not trip due to large single-phase currents.
  4. Insure system will trip with combination of normal current flow and ground fault current flowing together.
  5. Insure system will not trip with circulating currents through the neutral due to multiple grounds and sources external to the immediate low voltage power sources.
- B. The manufacturer shall be required to include additional CT's, ground fault relays, interlocks, wiring, components etc. to insure the ground fault systems operates without nuisance tripping on the main bus of the switchgear.
- C. The manufacturer shall include a wiring diagram of the MDGF system along with a test procedure using high current injection equipment.

## 2.7 Power Circuit Breakers

- A. Circuit Breakers
  1. The circuit breaker shall be Square D **Masterpact NW** and/or **NT** Low Voltage Power Circuit Breaker and listed to UL 1066.
  2. Circuit breakers shall be suitable for the required instantaneous rating without the use of current limiting fuses.
  3. All circuit breakers shall have field interchangeable electrical accessories including shunt trip, spring release, electrical operator, auxiliary contacts, and Trip Unit.
  4. All secondary connections shall be made directly to the front of the circuit breaker cradle.
  5. Each Circuit breaker shall have built in contact temperature and contact wear sensors.
- B. Padlocking provisions shall be furnished to receive up to three padlocks when circuit breaker is in the disconnected position, positively preventing unauthorized closing of the circuit breaker contacts.
- C. Provisions for up to two key locks shall be furnished allowing locking in the disconnected position. Provisions for locking in the connected, test and disconnected positions by padlock or key lock shall be available as an option.
- D. Located on the face of the circuit breaker shall be buttons, with optional lockable clear cover, to open and close the circuit breaker and indicators to show the position of the circuit breaker contacts, status of the closing springs, and circuit breaker position in the cell. An indicator shall show "charged-not OK to close" if closing springs are charged but circuit breaker is not ready to



close. Circuit breaker racking system must have positive stops at the connected, test, disconnected and withdrawn positions.

- E. Circuit breaker must be equipped with an interlock to discharge the stored energy spring before the circuit breaker can be withdrawn from its cell. Circuit breaker must provide a positive ground contact check between the circuit breaker and cell when the accessory cover is removed while the circuit breaker is in the connected, test or disconnected positions.
- F. Circuit breaker shall provide long service life. The 3200 A circuit breaker frame and those of lower ratings must be certified to perform a minimum of 10,000 operations without maintenance. The 4000 A and 5000 A frames must be certified to 5,000 operations without maintenance.
- G. Trip Units
1. Circuit breaker trip system shall be a **MICROLOGIC** electronic trip unit.
  2. All trip units shall be removable to allow for field upgrades.
  3. Trip Units shall incorporate "True RMS Sensing", and have LED long-time pickup indications.
  4. **MICROLOGIC** trip unit functions shall consist of adjustable long-time pickup and delay, short-time pickup and delay, instantaneous, ground-fault pickup and delay.
  5. Adjustable long-time pickup ( $I_r$ ) and delay shall be available in an adjustable rating plug that is UL Listed as field-replaceable. Adjustable rating plug shall allow for nine long-time pickup settings from 0.4 to 1 times the sensor plug ( $I_n$ ). Other adjustable rating plugs shall be available for more precise settings to match the application. Long-time delay settings shall be in nine bands from 0.5–24 seconds at six times  $I_r$ .
  6. [Short-time pickup shall allow for nine settings from 1.5 to 10 times  $I_r$ . Short-time delay shall be in nine bands from 0.1–0.4  $I^2 t$  ON and 0–0.4  $I^2 t$  OFF.
  7. Instantaneous settings on the trip units with LSI protection shall be available in nine bands from 2 to 15 times  $I_n$ . The Instantaneous setting shall also have an OFF setting when short-time pick-up is provided.
  8. All trip units shall have the capability for the adjustments to be set and read locally by rotating a switch.
  9. Trip unit shall provide local trip indication
  10. Ground-fault protection shall be available for solidly grounded three-phase, three-wire or three-phase, four-wire systems. Trip unit shall be capable of the following types of ground-fault protection: residual, source ground return, and modified differential. Ground-fault sensing systems may be changed in the field.
  11. Ground-fault settings for circuit breaker sensor sizes 1200 A or below shall be in nine bands from 0.2 to 1.0 times  $I_n$ . The ground-fault settings for circuit breakers above 1200 A shall be nine bands from 500 to 1200 A.
  12. Trip Units shall be Micrologic Series A with the following features:
    - a. True RMS Sensing
    - b. LI
    - c. LSI
    - d. LSIG/Ground-Fault Trip
    - e. Adjustable Rating Plugs
    - f. LED-Long-time Pickup
    - g. LED-Trip Indication
    - h. Digital Ammeter
    - i. Phase Loading Bar Graph
    - j. Zone Selective Interlocking
    - k. Communications
- H. A test set shall be available to provide automatic function testing of the circuit breaker. No disassembly of circuit breaker shall be required. See Accessories section herein.

- I. Key Interlocks: Arranged so keys are attached at devices indicated. Mountings and hardware are included where future installation of key-interlock devices is indicated.

## 2.8 COMPONENTS

- A. Instrument Transformers: Comply with IEEE C57.13.
  - 1. Potential Transformers: Secondary-voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
  - 2. Current Transformers: Ratios as required; burden and accuracy class suitable for connected relays, meters, and instruments.
  - 3. Control Transformers: Two (2) 2 KVA Minimum or as required.
- B. Multifunction Digital-Metering Monitor: UL-listed or -recognized, microprocessor-based unit suitable for three- or four-wire systems and with the following features:
  - 1. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
  - 2. Switch-selectable digital display of the following:
    - 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. Three-Phase Real Power: Plus or minus 2 percent.
    - e. Three-Phase Reactive Power: Plus or minus 2 percent.
    - f. Power Factor: Plus or minus 2 percent.
    - g. Frequency: Plus or minus 0.5 percent.
    - h. Integrated Demand, with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
    - i. Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.
  - 3. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
  - 4. Provide one Digital-Metering Monitor in each Main Breaker Section.
- C. Relays: Comply with IEEE C37.90, types and settings as indicated; with test blocks and plugs.
- D. Surge Arresters: Distribution class, metal-oxide-varistor type in each Main Breaker Section.. Comply with IEEE C62.11 and NEMA LA 1.
  - 1. Install in cable termination compartments and connect in each phase of circuit.
  - 2. Coordinate rating with circuit voltage.
- E. Provision for Future Devices: Equip compartments with rails, mounting brackets, supports, necessary appurtenances, and bus connections.
- F. Fungus Proofing: Permanent fungicidal treatment for switchgear interior, including instruments and instrument transformers.

## 2.9 ACCESSORIES

- A. Accessory Set: Furnish tools and miscellaneous items required for circuit-breaker and switchgear test, inspection, maintenance, and operation.
  - 1. Racking handle to manually move circuit breaker between connected and disconnected positions.
  - 2. Portable test set for testing all functions of circuit-breaker, solid-state trip devices without removal from switchgear.
  - 3. Relay and meter test plugs suitable for testing switchgear meters and switchgear class relays.
- B. Circuit-Breaker Removal Apparatus: Overhead-circuit-breaker lifting device, track mounted at top front of switchgear and complete with hoist and lifting yokes matching each size of drawout circuit breaker installed.
- C. Spare-Fuse Cabinet: Identified and compartmented steel box or cabinet with lockable door. Locate cabinet on the wall near the switchgear.
- D. Storage for Manual: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

## 2.10 IDENTIFICATION

- A. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads. Include as-built data for low-voltage power switchgear and connections as follows:
  - 1. Frame size of each circuit breaker.
  - 2. Trip rating for each circuit breaker.
  - 3. Conduit and wire size for each feeder.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces where switchgear will be installed for compliance with installation tolerances, required clearances, and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with applicable portions of NECA 400.
- B. Anchor switchgear assembly and support base/splice box to concrete floor and attach by bolting.
  - 1. Design each fastener and support to carry load indicated by seismic requirements for the local in which it is installed.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, brackets, and temporary blocking of moving parts from switchgear units and components.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Diagram and Instructions:
  - 1. Frame and mount under clear acrylic plastic on the front of switchgear.
    - a. Operating Instructions: Printed basic instructions for switchgear, including control and key-interlock sequences and emergency procedures.
    - b. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads.
  - 2. Storage for Maintenance: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

### 3.4 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."
- C. Bond Switchgear to the new ground bus in the courtyard enclosure.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
  - 1. Inspect switchgear installation, including wiring, components, connections, and equipment.[ Test and adjust components and equipment.]
  - 2. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 16 Sections.
  - 3. Complete installation and startup checks according to manufacturer's written instructions.
  - 4. Assist in field testing of equipment[ including pretesting and adjusting of equipment and components].
  - 5. Report results in writing.
- C. Perform the following field tests and inspections and prepare test reports:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:
    - a. Switchgear.

- b. Circuit breakers.
- c. Protective relays.
- d. Instrument transformers.
- e. Metering and instrumentation.
- f. Ground-fault systems.
- g. Surge arresters.

2. Remove and replace malfunctioning units and retest as specified above.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchgear. Remove front and rear panels so joints and connections are accessible to portable scanner.

- 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchgear 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 switchgear checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.6 ADJUSTING

- A. Set field-adjustable, protective-relay trip characteristics according to results in Division 16 Section "Electrical System Protective Device Study."

### 3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of switchgear. 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.

### 3.8 PROTECTION

- A. Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

### 3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchgear. Refer to Division 1 Section "Demonstration and Training."

**END OF SECTION 16430**

## SECTION 16440 - ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Scope: This Section covers the furnishing of an electrical short circuit and overcurrent protective device coordination study for the new medium-voltage switchgear substation and associated new low voltage (480Volt) switchgear. Include coordination with existing Square-D MCC#1 Building -5, Panel-G Building-7, MCC #3 Building-6 and Westinghouse SW'MD ISB Building-6.

#### 1.2 SUBMITTALS

- A. Division 1: Conform to the requirements of Division 1, Section 01300, "Submittals."
1. In addition to the requirements of Division 1, the short circuit and protection coordination studies shall be bound in 8-1/2-inch by 11-inch hard cover bound volumes with drawings and diagrams folded to fit the 8-1/2 by 11-inch format and securely retained in pockets or compartments of the rigid binder.
  2. Six (6) copies of the study shall be submitted.
  3. The study shall include low voltage distribution system as indicated.
- B. Industry Standards: Provide, for each section of the study, an identification and description of the industry testing standards on which the study is based.

#### 1.3 STUDY REQUIREMENTS

- A. Power Company: The study shall include the utility power company's system and relay characteristics.
- B. Preparer: The system studies shall be prepared by the manufacturer of the power circuit breaker, switchgear or equipment for the incoming service to the site.
- C. Contract Drawings: The drawings and specifications indicate the general requirements for the motors, motor starter equipment, and low voltage equipment. Determine additional specific characteristics of equipment furnished in accordance with the results of the short circuit and protective device coordination study.
1. Submit any equipment design discrepancies and the proposed corrective modifications, if required, with the short circuit and protective device coordination study. Identify any variations clearly on the subsequent shop drawings. Modifications shall be incorporated into equipment without additional expense.
  2. Provide the necessary field settings, adjustments and equipment modifications for conformance with the approved short circuit and protective device coordination study,

without additional expense.

3. Submit equipment shop drawings and the protective device coordination study at the same time for approval.

#### D. Short-Circuit Analysis

1. Calculation of the maximum rms symmetrical three-phase short-circuit current at each significant location in the electrical system shall be made using a digital computer.
2. Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the computer calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.
3. A tabular computer printout shall be included which lists the calculated short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment.
4. The study shall include a computer printout of input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
5. Include a computer printout identifying the maximum available short-circuit current in rms symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.
6. The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis.
7. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.
8. The contractor shall be responsible for supplying conductor information (lengths, types, number per phase, etc.) in a timely manner to allow the short-circuit analysis to be completed prior to submittal of equipment shop drawings.
9. Any inadequacies shall be called to the attention of the engineer (architect) and recommendations made for improvements as soon as they are identified.

#### E. Protective Device Time-Current Coordination Analysis

1. The time-current coordination analysis shall be performed with the aid of a digital computer and will include the determination of settings, ratings, or types for the overcurrent protective devices supplied.
2. Where necessary, an appropriate compromise shall be made between system protection and service continuity with system protection and service continuity considered to be of equal importance.
3. A sufficient number of computer generated log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
4. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, setting of the adjustable devices, the short-circuit current availability at the device location when known, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
5. The study shall include a separate, tabular computer printout containing the suggested

device setting of all adjustable overcurrent protective devices, the equipment where the device is located, and the device number corresponding to the device on the system one-line diagram.

6. A computer generated system one-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
7. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for increasing system protection or device coordination.
8. Significant deficiencies in protection and/or coordination shall be called to the attention of the engineer (architect) and recommendations made for improvements as soon as they are identified.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**