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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2012
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DIVISION 33 - UTILITIES

SECTION 33 60 01

VALVES, PIPING, AND EQUIPMENT IN VALVE MANHOLES

04/08

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SECTION 33 60 01

VALVES, PIPING, AND EQUIPMENT IN VALVE MANHOLES
04/08

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NOTE: This guide specification covers the requirements for valves, piping and equipment in valve manholes that form a part of an underground heat distribution system.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

PART 1 GENERAL

****
NOTE: Design manual UFC 3-430-1 HEATING AND COOLING DISTRIBUTION SYSTEMS contains information that will assist the designer. Do not allow chilled water lines or other plastic piping to be routed through manholes where high temperature piping systems (above 110 degrees C (230 degrees F)) are installed.

Provide the following information on the contract drawings: (1) valve manhole dimensions, (2) location of all valve manholes, (3) sizes of the pipe in the valve manholes, (4) location of all valves in the valve manholes, (5) thickness of the insulation on the pipe, (6) valve manhole details, (7) final elevations of the valve manholes, (8)

valve manhole cover details including manway access details, (9) how valve manholes are drained and vented, (10) sump pump piping details, (11) valve manhole equipment dimensions and details, (12) sump pump capacity, (13) electrical wiring details for the equipment (dedicated service for sump pump), (14) steam drip trap locations with access and capacities, (15) steam main drip leg sizes.

This guide specification is to be included as a part of a contract which includes Sections 33 61 00 PREFABRICATED UNDERGROUND HEATING/COOLING DISTRIBUTION SYSTEM or 33 57 00 BULK FUEL RECEIVING/DISPENSING EQUIPMENT; 33 61 13 PRE-ENGINEERED UNDERGROUND HEAT DISTRIBUTION SYSTEM or 33 63 16 EXTERIOR SHALLOW TRENCH STEAM DISTRIBUTION; 33 61 15 HEAT DISTRIBUTION SYSTEMS IN CONCRETE TRENCHES or 33 63 13EXTERIOR UNDERGROUND STEAM DISTRIBUTION SYSTEM. Include the following Sections as part of this contract: 31 00 00 EARTHWORK; 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION; 33 70 02.00 10 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND or 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION; 03 15 00.00 10 CONCRETE ACCESSORIES
; Section [03 30 00.00 10 CAST-IN-PLACE CONCRETE][03 30 00 CAST-IN-PLACE CONCRETE]; 05 05 23 WELDING, STRUCTURAL; 05 50 13 MISCELLANEOUS METAL FABRICATIONS; 07 13 53 ELASTOMERIC SHEET WATERPROOFING; 09 90 00 PAINTS AND COATINGS; 40 05 13.96 or 40 17 26.00 20 WELDING PROCESS PIPING; 26 20 00 INTERIOR DISTRIBUTION SYSTEM or 26 51 00 INTERIOR LIGHTING; and others as applicable to the project.
****

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.
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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA H35.1/35.1M	(2009) ANS Alloy & Temper Designation Systems for Aluminum

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B1.20.2M	(2006; R 2011) Pipe Threads, 60 Deg. General Purpose (Metric)
ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.20	(2007) Metallic Gaskets for Pipe Flanges - Ring-Joint, Spiral Wound, and Jacketed
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2009; Supp 2010) Valves - Flanged, Threaded and Welding End
ASME B16.5	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.1	(2010) Power Piping
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A106/A106M	(2011) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A193/A193M	(2012) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and

	Other Special Purpose Applications
ASTM A194/A194M	(2011) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A234/A234M	(2011a) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A733	(2003; R 2009e1) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C449	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C533	(2011) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C547	(2012) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C647	(2008) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM D2822/D2822M	(2005e1; R 2011) Asphalt Roof Cement
ASTM D3278	(1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D3359	(2009e2) Measuring Adhesion by Tape Test
ASTM E84	(2012) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2010) Standard Test Methods for Water Vapor Transmission of Materials
ASTM F1139	(1988; R 2010) Steam Traps and Drains

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(2008) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-45	(2003; R 2008) Bypass and Drain Connections
MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-69	(2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
MSS SP-72	(2010a) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(2006) Class 3000 Steel Pipe Unions Socket Welding and Threaded

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 16	(2006) Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint
SSPC Paint 29	(2002; E 2004) Zinc Dust Sacrificial Primer, Performance-Based
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

****
NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals

required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.][information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings[; G][; G, [_____]]

SD-03 Product Data

Piping and Fittings
Valves
Insulation
Sump Pumps and Drainers
Expansion Joints

SD-04 Samples

Insulated Sections[; G][; G, [_____]].

SD-10 Operation and Maintenance Data

Valve Manholes and Accessories
Data Package 2

1.3 QUALITY ASSURANCE

1.3.1 Detail Drawings

Submit detail drawings [_____] days after notice to proceed.for valve manholes and the piping and equipment in the valve manholes, such as steam traps, valves, sump pumps, pressure gauges, thermometers and insulation, including a complete list of equipment and materials, manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, installation instructions, and complete wiring and schematic diagrams. Show on the drawings pipe anchors and guides, and layout and anchorage of equipment and appurtenances in valve manholes, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.3.2 Insulated Sections

Submit sample sections, [_____] days after notice to proceed, for insulation of pipe, elbow, tee, valve, support point, and terminating points. After approval of materials and prior to insulation of piping, a display shall be prepared of insulated sections showing compliance with specifications and showing fastening, sealing, jacketing, straps, waterproofing, supports, hangers, anchors, and saddles. Approved display sample sections shall remain on display at the jobsite during the construction period until no longer needed by Contracting Officer, then removed.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect all materials and equipment delivered and placed in storage from the weather, excessive humidity, and excessive temperature variation; dirt, dust, or other contaminants.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.2 NAMEPLATES

Each major item of equipment such as sump pump, motor, steam trap, and pressure reducing valve shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.3 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products will not be allowed.

2.4 ELECTRICAL WORK

Motors, manual or automatic motor control equipment, and protective or signal devices required for the operation specified shall be provided under

this section in accordance with NFPA 70 and Section [33 70 02.00 10 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND] [33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION].

2.5 PIPING AND FITTINGS

2.5.1 General Requirements

Piping, fittings and piping accessories inside the valve manholes shall conform to the requirements of ASME B31.1 and shall be suitable for the working pressure and temperature requirements of the system. To the greatest extent possible, the piping and fittings inside the valve manholes shall match the piping and fittings located on the outside of the valve manhole. All piping in valve manholes shall be steel with joints welded except that joints 19 mm 3/4 inch and smaller may be threaded. When threaded joints are used on High Temperature Water Systems, the interface area where the pipe threads meet the threaded fittings shall be seal welded (continuous fillet weld) to preclude any water leakage. No supports, anchors, or stays shall be attached to any piping system in places where either the installation of or the movement of the pipe and its contents will cause damage to the construction.

2.5.2 Steel Pipe

Pipe shall be black steel, seamless or electric-resistance welded, conforming to the requirements of ASTM A53/A53M, Grade B or ASTM A106/A106M, Grade B. Pipe up to and including 250 mm 10 inches in diameter shall be schedule 40. Pipe 300 mm 12 inches in diameter and greater shall be 10 mm 0.375 inch nominal wall thickness. Gauge piping [, condensate piping,] [drip piping,] [sump pump dicharge] and piping 19 mm 3/4 inch in diameter and smaller shall be schedule 80.

2.5.2.1 Nipples

Nipples shall conform to ASTM A733 as required to match adjacent piping.

2.5.2.2 Pipe Threads

Pipe threads shall conform to ASME B1.20.2MASME B1.20.1. Pipe threads may be used only on pipe 19 mm 3/4 inch or smaller. All pipe which is to be threaded shall be schedule 80.

2.5.3 Fittings

All fittings, valves, flanges and unions shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.5.3.1 Welded Fittings

Welded fittings shall conform to ASTM A234/A234M, buttwelded or socket welded, as required to match connecting piping. Buttwelded fittings shall conform to ASME B16.9, and socket welded fittings shall conform to ASME B16.11.

2.5.3.2 Unions

Unions shall conform to MSS SP-83 as required to match adjacent piping.

2.5.3.3 Ball Valves

Ball valves shall conform to MSS SP-72 for flanged or buttwelded valves or MSS SP-110 for threaded ball valves.

2.5.4 Insulating Flanges and Dielectric Waterways

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NOTE: Electrically insulating flanges or dielectric waterways shall be shown in manholes where piping is connected to a system that is not cathodically protected. Insulating flanges and dielectric waterways must be in accessible locations, such as valve manholes or buildings.

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2.5.4.1 Insulating Flanges

For systems in which cathodic protection is provided, insulating flanges or flange gasket kits shall be installed in the valve manhole at the pipe connection to or from the heat distribution system and at dissimilar metals and when the carrier pipe and appurtenances are supported in such a way as to electrically ground or alter the cathodic protection system voltages or currents. The kit shall consist of flanges, a flange gasket, nuts and bolts, bolt sleeves, and one insulating washer and one steel washer for both ends of each bolt. The manufacturer shall certify that the gasket kits are capable of electrically isolating the pipe at the [_____] kPa psig pressure and [_____] degrees C F temperature of the heating medium at the point of application. Evidence of satisfactory installations operating not less than 2 years shall be submitted in accordance with paragraph SUBMITTALS before materials are delivered. Ensure that these kits are provided and properly installed according to manufacturer's published instructions. Bolts shall be torqued to the correct tightness and in the correct bolt pattern as recommended by the manufacturer's published instructions. Steel flanges shall conform to ASME B16.5 Class [150] [and] [or] [300] and shall match valves or flanged fittings on which used. Steel flanges shall be flat faced. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 2 mm 1/16 inch thickness, full face or self centering flat ring type. Bolts shall conform to the requirements of ASTM A193/A193M, Grade B7. The bolt head shall be marked to identify the manufacturer and the standard to which the bolt complies. Lengths of bolts shall be such that not less than two full threads extend beyond the nut with the bolt tightened to the required tension and the washer seated. Nuts shall conform to the requirements of ASTM A194/A194M, Grade 7.

2.5.4.2 Dielectric Waterways

Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping and shall be used for joining dissimilar metals on 19 mm 3/4 inch and smaller threaded pipe. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

2.5.4.3 Gaskets Non-Insulating

Provide spiral wound, non-asbestos gasket with centering ring in accordance with ASME B16.20.

2.6 VALVES

****
NOTE: Select the appropriate valves for the operating temperatures and pressures of all systems in the project. Delete valve types not included in project.

Use not less than Class 150 for up to 862 kPa (125 psig) steam, and not less than Class 300 for 863 kPa to 1724 kPa (126 to 250 psig) steam and high temperature water. For isolation and shutoff, use gate valves only. Steam pressure reducing valves are not normally part of the system. If needed, designer should refer to Section 23 70 01.00 10 CENTRAL STEAM-GENERATING SYSTEM, COAL-FIRED or Section 23 22 26.00 20 STEAM SYSTEM AND TERMINAL UNITS for Navy jobs.
****

Unless otherwise specified, valves shall comply with the material, fabrication, and operating requirements of ASME B31.1. Valves shall be suitable for the temperature and pressure requirements of the system on which used. Valves for [steam] [hot water] shall conform to ASME B31.1 Class [150] [and] [or] [300], as suitable for the application. [Valves for condensate services shall conform to ASME B31.1 Class 150.] Valves 19 mm 3/4 inch and smaller may be bronze where seal welding is not required. Valves 150 mm 6 inches and larger shall have a 25 mm 1 inch minimum gate or globe bypass valve sized in conformance with MSS SP-45.

2.6.1 Steel Valves

Steel globe, gate, angle, and check valves shall conform to the requirements of ASME B16.34 and ASME B31.1 for the temperature and pressure requirements of the system. Gate valves 65 mm 2-1/2 inches and smaller shall be rising stem. Gate valves 80 mm 3 inches and larger shall be outside screw and yoke.

2.6.2 Bronze Valves

2.6.2.1 Globe, Gate, and Angle Valves

Bronze globe, gate, and angle valves shall conform to requirements of MSS SP-80, union bonnet type.

2.6.2.2 Check Valves

Bronze check valves shall conform to the requirements of MSS SP-80.

2.6.3 Packing

Packing used with valves shall not contain asbestos. Valve stem packing shall be die-formed, ring type specifically designated as suitable for the temperature and pressure of the service and compatible with the fluid in

the system. Packing shall be polytetrafluoroethylene with minimum 50 percent graphite filament. Valves 40 mm 1-1/2 inches and smaller shall have four or five packing rings and valves 50 mm 2 inches and larger shall have at least six packing rings. Spiral or continuous packing will not be acceptable. A metal insert shall be provided having proper clearance around the valve stem at the bottom of the stuffing box and acting as a base for the packing material. Packing glands shall be furnished with a liner of noncorrosive material and shall be of one piece construction with provisions for not less than two bolts for packing adjustment.

2.7 STEAM TRAPS

****
NOTE: The following paragraphs are applicable to steam systems only. Only these two types will be used. Delete these paragraphs when the distribution system is not a steam system.

A schedule of steam trap selection will be shown on the drawings. Trap capacity (kg per second (pounds per hour)) during normal operation, pressure drop (kPa (psi)), and pressure rating (kPa (psi)) of each trap will be included in this schedule. Also, show on the drawings a vent valve or test valve connection downstream of traps for test of trap operation, a strainer ahead of traps, a union, a check valve in the outlet piping, and shut-off valves on both sides of trap for trap changeout. A means of bypassing the trap shall be provided for system warm-up.
****

Class of trap bodies shall be suitable for a working pressure of not less than 1.5 times the steam supply pressure, but not less than 1379 kPa 200 psi, and traps shall be capable of operation under a steam-supply pressure as indicated. Traps shall have capacities as shown when operating under the specified working conditions. Traps shall fail open.

2.7.1 Bucket Traps

Bucket traps shall be inverted-bucket type with automatic air discharge and conform to ASTM F1139.

2.7.2 Thermostatic Traps

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NOTE: Specify thermostatic traps where the trap location is subject to freezing.
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Traps shall be thermostatic type; bimetallic element with automatic air discharge and conform to ASTM F1139.

2.8 STRAINERS

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NOTE: Delete this paragraph for high temperature water systems.
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Strainers shall be basket or y-type with connections the same size as the pipe lines in which the connections are installed. The strainer bodies for steam systems shall be heavy and durable, of cast steel, with bottoms drilled and plugged. The strainers shall be suitable for the temperature and pressure requirements of the system on which they are installed. The bodies shall have arrows clearly cast on the sides to indicate the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment basket. The body or bottom opening shall be equipped with nipple and gate valve for blowdown. The basket for steam systems shall be not less than 0.6350 mm 0.025 inch thick stainless steel, Monel or sheet brass, with small perforations of sufficient number to provide a net free area through the basket of at least 2.5 times that of the entering pipe. The flow shall be into the basket and out through the perforations. For high temperature hot water systems, only cast steel bodies and stainless or Monel baskets shall be used.

2.9 PRESSURE GAUGES

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NOTE: Delete if not required.
****

Gauges shall conform to ASME B40.100, and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Minimum dial size shall be 110 mm 4-1/4 inches.

2.10 DIAL THERMOMETERS

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NOTE: Delete if not required.
****

Dial type thermometer shall be 90 mm 3-1/2 inches in diameter with stainless steel case, remote-type bulb or direct-type bulb as required. The thermometer shall have an accuracy of plus or minus 1 degree C 2 degrees F. Thermometer wells of the separable socket type shall be provided for each thermometer with direct-type bulb. The thermometer shall have a white face with black digits graduated in 1 degree C 2 degrees F increments.

2.11 COATINGS

Coat steel manhole piping with an organic zinc undercoat that conforms to SSPC Paint 29 Type II followed by a thermal barrier coating having a manufacturer's documented minimum thermal conductivity of 0.100 W/m•K 0.058 Btu/hr•ft•°F. The undercoat and thermal barrier coating shall have continuous use service temperature ratings that exceed the nominal system operating temperature by a minimum of 28 degrees C 50 degrees F.

2.12 INSULATION AND JACKETING

****
NOTE: All piping, valves and fittings for steam, hot water and dual temperature heat distribution systems in valve manholes require insulation for the protection of operating and maintenance personnel as well as for the conservation of energy; whether or not to insulate chilled water lines, valves, and

fittings in the manholes can be determined by the necessity to prevent condensation on the piping and energy conservation.

The energy savings will vary with the ambient temperature but will be a factor in warm climates. There may be some isolated cases where the chilled water distribution pipes entering the manhole are not insulated; therefore, the piping in the manhole would not normally be insulated unless condensation from the air forming on the chilled water pipes causes a problem.

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2.12.1 General Provisions

All piping, fittings, valves, etc., in the valve manholes shall be insulated. Insulation shall be premolded, precut or job fabricated to fit and shall be removable and reusable. Thickness of insulation shall be in accordance with Tables 1 and 2. Insulation jackets shall be provided for all pipe and fitting insulation. Insulation shall conform to EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS.

2.12.2 Insulation

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NOTE: The insulations allowed in this paragraph have passed a 96 hour boiling test which indicates that satisfactory performance is expected.

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Insulation for all piping, fittings, and valves shall be molded calcium silicate conforming to ASTM C533, Type I, or molded mineral fiber insulation conforming to ASTM C547, Class 2, or cellular glass insulation conforming to ASTM C552. All insulation shall be asbestos free. Laminated construction shall not be used unless the thickness exceeds 100 mm 4 inches. Insulations and the manufacturers approved for use are:

a. Delta, available from Rockwool in Leeds, Alabama.

b. MPT-PC and MPT-PF, available from Mineral Products of Texas in Houston, TX.

c. Thermo-12, Super Caltemp, available from Johns Manville in Denver, Colorado.

d. Foamglass (cellular glass), available from Pittsburgh Corning Corporation.

2.12.3 Aluminum Jackets

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NOTE: Vapor barrier requirements are only to be included for chilled water systems.

****

Aluminum jackets shall be smooth sheet, 0.4064 mm 0.016 inch nominal thickness and conform to the requirements of ASTM B209M ASTM B209, Type

3003, 3105, or 5005.[Aluminum jackets shall be supplied with a factory installed moisture barrier. This moisture barrier shall consist of at least 18.1 kg 40 pound kraft paper coated on one side with a 0.025 mm 1 mil thick polyethylene film. The moisture barrier shall be adhered to the aluminum jacket over the entire area of the aluminum jacket insulation-side surface.]

2.12.4 Bands

Bands for aluminum jacket shall be 10 mm 3/8 inch wide and 32 gauge thickness made of aluminum or annealed stainless steel. Bands for insulation shall be 13 mm 1/2 inch wide and 32 gauge thickness made of annealed stainless steel.

2.12.5 Insulation for Flanges, Unions, Valves, and Fittings

Flanges, unions, valves, and fittings shall be insulated with premolded prefabricated, or field fabricated segments of insulation of the same material and thickness as the manhole pipe insulation. Insulation shall be removable and reusable and shall have essentially the same thermal characteristics and thickness as the adjoining piping.

2.12.6 Vapor Barrier Coating

The vapor barrier coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall not exceed 0.05 perm and shall be determined according to Procedure B of ASTM E96/E96M. The coating shall be a nonflammable, fire resistant type conforming to ASTM E84, NFPA 90A and UL 723. The flash point of the compound shall not be less than 26.7 degrees C 80 degrees F and shall be determined in accordance with ASTM D3278. All other application and service properties shall be in accordance with ASTM C647.

2.12.7 Finishing Cement

Mineral fiber hydraulic-setting thermal insulating cement in accordance with ASTM C449.

2.12.8 Glass Tape

Glass tape shall meet the requirements of UL 723 and ASTM E84.

2.12.9 Plain Weave, Untreated

The ends shall be properly interlocked with the picks to ensure that there shall be no raveling of the tape edges. The tape shall have an average weight of 196.7 plus or minus 10 percent grams per square meter 5.8 plus or minus 10 percent ounces per square yard. An average thickness of 0.1778 plus or minus 0.0254 mm 0.007 plus or minus 0.001 inches. Warp ends/wales of 17 plus or minus 1 per centimeter 42 plus or minus 2 per inch or filling picks/courses of 13 plus or minus 1 per centimeter 32 plus or minus 2 per inch, a minimum breaking strength of 2679 grams per mm 150 pounds per inch of width, and after heating to 482 degrees C 900 degrees F for 2 hours. A minimum breaking strength of 714 grams per mm 40 pounds per inch of width.

2.12.10 Knitted, Untreated

The wales shall be properly interlocked with the courses to ensure that

there shall be no raveling of the tape edges. The tape shall have an average weight of 153 plus or minus 10 percent grams per square meter 4.5 plus or minus 10 percent ounces per square yard. An average thickness of 0.1778 plus or minus 0.0254 mm 0.007 plus or minus 0.001 inches, warp ends/wales of 6 plus or minus per 1 centimeter 16 plus or minus 2 per inch. A minimum breaking strength of 714 grams per mm 40 pounds per inch of width and, after heating to 482 degrees C 900 degrees F for 2 hours. A minimum breaking strength of 375 grams per mm 21 pounds per inch of width.

2.12.11 Distortion Requirements

There shall be no distortion of the tape when a sample 610 mm 24 inches in length is spread across a flat horizontal surface and observed for evidence of distortion (such as tendency to curl rather than lie flat). The width tolerance is plus or minus 3.175 mm 1/8 inch.

2.12.12 Open-Weave Tape

Tape shall be open-weave type and shall have an average weight of [_____] kg per square meter ounce per square yard and shall be used for embedding between coats of adhesive or coating materials.

2.13 SUMP PUMPS AND DRAINERS

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NOTE: The application would be for a submersible sump pump in a manhole serving an underground heat distribution system. Flow range 25 to 50 gpm, head of 15 to 30 TDH, fluid temp of 200 deg F. When pump performance is outside the flow, head or temperature range identified herein, materials of construction need to be validated with a pump supplier and specification written whereby multiple vendors can meet both performance and material construction as specified. Delete this paragraph when positive drainage of the valve manhole is provided and sump pumps are not needed. Use of duplex sump pumps is encouraged. Delete text in brackets if a single sump pump is specified.

Provide one or two sump pumps in valve manholes. Units should discharge by buried piping to the nearest storm sewer if possible. Where not economical to discharge to a storm sewer, pumps are to discharge above grade. Plan discharge locations carefully so water will not be discharged over valve manhole tops, sidewalks, etc. Check available NPSH versus required NPSH for pump selected. Coordinate power requirements with electrical designer and provide tell-tale light above ground to indicate sump pump failure. Drawings will show the following: (a) a dedicated circuit; (b) lockable switches and circuit breakers that can both be locked ON; (c) permanent labels at key positions indicated on the drawings so that personnel can understand that the circuit should be left ON. The label shall be on a corrosion resistant metal plate and shall read as follows:

THIS CIRCUIT SUPPLIES POWER TO THE ELECTRIC SUMP PUMPS IN THE UNDERGROUND HEAT DISTRIBUTION SYSTEM. THIS CIRCUIT MUST BE ON AT ALL TIMES; OTHERWISE EXTENSIVE DAMAGE WILL OCCUR TO THE UNDERGROUND HEAT DISTRIBUTION SYSTEM AND PREMATURE FAILURE WILL OCCUR.

****

2.13.1 Sump Pumps

The sump pumps furnished shall be a manufacturer's standard commercial product. Sump pumps shall be electrically driven and submersible, capable of operating while completely submerged. The pumps and motors shall be capable of continuously pumping liquids at a temperature of 93 degrees C 200 degrees F. The pumps and motors shall be capable of running without damage when not submerged. Sump pumps shall have permanently lubricated bearings, [monel] [stainless steel] shafts, [bronze] [stainless steel] [cast iron] impellers, screened inlets and housings of [bronze] [stainless steel] [cast iron]. Each sump pump shall be capable of passing a 10 mm 3/8 inch sphere.

2.13.1.1 Motors

The motors shall have overload protection. The pump[s] shall be automatically controlled by a submersible switch assembly with pump wiring and switch suitable for submersion in 93 degrees C 200 degrees F liquids. Control components shall be provided by the pump manufacturer.[Provide duplex (one on - one standby) arrangement with automatic alternating lead-lag controller.] Motor electrical connections shall be [cord and plug.][hardwired.]

2.13.1.2 Controls

All controllers, water level switches, and electrical connections shall be suitable for service at 100 percent humidity, at 93 degrees C 200 degrees F temperature, and occasional water submersion. The sump pumps automatic control switches shall have demonstrated 200,000 cycles at 93 degrees C 200 degrees F and 100 percent relative humidity and shall withstand total submersion in water at 93 degrees C 200 degrees F.

2.13.2 High Level Alarm Indicator

Provide another switch to indicate high water level, and connect to an emergency warning light mounted on or adjacent to the valve manhole as indicated. This high water level alarm shall be set at a level which is below the bottom of any pipe in the valve manhole. provide auxiliary contacts in a separate junction box to permit connection to a [future] Energy Monitoring and Control System (EMCS) for monitoring the operation of each pump motor and the high water level alarm system.

2.13.3 Drainers

Provide automatic type drainers to operate on 862 kPa (gage) 125 psig steam supply. The drainer shall operate when the water level rises sufficiently in the sump, the float shall rise and open the steam control valve to admit steam to the drainer, which in turn shall pump the water from the sump. When the water level is lowered by the pumping action, the float shall lower and close the steam valve to stop the pumping action until water again gathers in the sump. Provide each drainer with controls to

accomplish the above sequence of operation. The automatic float-operated steam valve shall be designed to prevent dead centering under field conditions and to lengthen the life of the valve seat. The valve shall have a high grade, renewable composition disc and a stainless steel or hard, noncorrosive bronze renewable seat inserted in the valve body. The drainer shall be constructed of corrosion-resistant copper and bronze. Piping from manhole drainers shall be ASTM A53/A53M, Weight Class XS (Extra Strong), hot-dip galvanized steel pipe with ASME B16.11 or ASME B16.3, Class 300, hot-dip galvanized threaded fittings. Provide a steam pressure regulating valve assembly for manhole drainers for operation on steam system above 862 kPa (gage) 125 psig.

2.14 CONCRETE VALVE MANHOLES AND ACCESSORIES

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NOTE: If the referenced sections are not to be included in the project specifications, applicable paragraphs from the referenced sections must be incorporated into this specification. The designer is also advised that, for Army projects, Section 31 00 00 EARTHWORK, and if electrically operated sump pumps are installed, either Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION or Section 33 70 02.00 10 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND, or applicable portions of the above specifications, must be included as part of the project specifications. For Navy jobs, Section 31 23 00.00 20 EXCAVATION AND FILL, and if electrically operated sump pumps are installed, either Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION or Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION, or applicable portions of the above specifications must be included as part of the project specifications.

The design of manholes including size, reinforcing, arrangement, penetrations, equipment and piping within the valve manholes is the responsibility of the designer. Valve manholes shall be designed to provide proper venting and drainage and adequate room for maintenance without stepping on or over any equipment. When electric sump pumps are used, the electrical distribution and tie in points must be designed and shown on the drawings.

In most cases, valve manhole covers will consist of open grates. If manhole top is to be used as part of a sidewalk and valve manhole is not deep, a solid plate cover may be used without special provisions for manhole ventilation. These tops must be designed to be removed or opened completely during maintenance operations. For larger and deeper valve manholes, raised frame solid plate cover shall be required.

****

2.14.1 Valve Manhole Construction

Valve manhole dimensions shall be as indicated. [The valve manholes shall

be constructed of reinforced concrete as indicated and in accordance with Section 03 40 00.00 10 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION.][Valve manholes shall be provided with a 762 mm 30 inch standard cast iron frame and removable cover as a minimum, or a 900 by 900 mm 36 by 36 inch watertight, hinged steel cover not less than 13 mm 1/2 inch thick.] Valve manholes shall be drained as shown. Concrete sections shall not be less than 150 mm 6 inches thick. [The top shall be a cast concrete slab of the same strength and thickness as the valve manhole or fabricated from stainless steel, hot dipped galvanized steel or aluminum.] [The top shall be [open grate cover] [or] [raised frame] [solid plate cover (8 mm 5/16 inch thick checker pattern) conforming to AA H35.1/35.1M].] [When open grate covers are used for direct buried conduit systems, the top of the grate will be at least 150 mm 6 inches above the surrounding grade. When used for concrete shallow trenches, the top of the grate will be flush with the concrete trench top. Open grates will be constructed of galvanized steel. A checkered plate cover (also referred to as diamond plate or embossed plate), shall be installed over the grating in colder climates and where accumulation of trash is a problem. This checkered plate shall be attached to the grating and shall be removable.] [Solid plate covers shall be used for HTHW and steam/condensate direct buried conduit systems only. Solid plate covers shall not be used for shallow trench systems which are often used as sidewalks, or when substantial loadings are expected. Ventilation openings shall be provided around the entire perimeter below the raised top. The solid plate cover assembly shall be removable. The cover, constructed of aluminum, shall also provide sectionalized access for inspection and maintenance.] [When concrete covers are used for direct buried conduit systems, the top of the concrete cover shall be designed to be a minimum of 150 mm 6 inches above the surrounding grade. When used for concrete shallow trenches, the cover shall be designed to be flush with the trench top. Concrete requirements for this cover shall be similar to those required for valve manhole construction. Concrete cover shall be designed to support anticipated loadings. A 1220 by 1220 mm 4 by 4 foot aluminum access door (Bilco model JD-2AL or equal with slip resistant finish) shall be provided in the concrete top. For concrete shallow trench systems, a single 150 mm 6 inch gooseneck pipe shall be used to allow steam to exit the valve manhole if a leak or excessive heat loss is present; the gooseneck shall be installed off to one side of the valve manhole concrete top to minimize pedestrian traffic interference. For direct buried systems, two 150 mm 6 inch goosenecks shall be used. One shall extend below the top; the other shall be similar but shall extend to within 600 mm 2 feet of the manhole floor to provide natural air movement.] Valve manhole sides shall be constructed by one monolithic pour and shall extend not less than 150 mm 6 inches above grade unless otherwise stated. Valve manholes shall be waterproofed in accordance with Section 07 13 53 ELASTOMERIC SHEET WATERPROOFING. All steel components shall be protected from corrosion.

2.14.2 Ladders

Valve manhole ladders shall be steel, shall have nonslip surfaces, and shall consist of uprights with steps or rungs. Ladders shall not be less than 406.4 mm 16 inches in width, with 19.1 mm 3/4 inch diameter rungs, spaced 304.8 mm 12 inches apart. The two stringers shall be a minimum 9.5 mm 3/8 inch thick and 63.5 mm 2-1/2 inches wide. Ladders shall be adequately anchored to the wall by means of steel inserts spaced not more than 2 m 6 feet apart vertically, and installed to provide at least 150 mm 6 inches of space between the wall and rungs. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A123/A123M.

2.14.3 Pipe Sleeves

Pipe sleeves of sufficient length to pass through valve manhole or building walls shall be provided. Pipe sleeves shall be zinc-coated steel pipe, conforming to the requirement of ASTM A53/A53M, Schedule 40 or standard weight. The pipe sleeves shall be secured in the proper position and location during construction of the valve manhole or building wall. For manhole top penetrations, the diameter of the pipe sleeve will be large enough to allow at least 6 mm 1/4 inch of clearance between the pipe insulation and the sleeve, and, the sleeve will be sized to accommodate the specific mechanical seal size used for the [conduit] [or] [uninsulated chilled water pipe] penetration. The space between the sleeve and the pipe casing, and the caulking and sealing materials shall be selected so there shall be NO electrical continuity between the pipe sleeve and the pipe casing when finished.

2.14.3.1 Pipe Sleeves Through Valve Manhole Cover

Insulation shall be continuous through sleeves as shown on the drawings. Aluminum jacket shall be provided over the insulation. Aluminum jacket shall be smooth sheet 0.4064 mm 0.016 inch nominal thickness, ASTM B209M ASTM B209. Where penetrating valve manhole top, pipe shall be insulated as required for valve manhole service up to a point flush with the top of the flashing and the end of the insulation shall be sealed with waterproof coating. Insulation exposed to the weather shall butt tightly against the flashing and valve manhole insulation, and the aluminum jacket required for piping exposed to the weather shall extend 50 mm 2 inches beyond the insulation to form a counterflashing. The entire valve manhole top penetration shall be flashed and counterflashed as shown on the drawings. Waterproof coating shall conform to ASTM D2822/D2822M, Type I.

2.14.3.2 Pipe Sleeves for Conduit Penetrations

A modular mechanical type sealing assembly will be used between the valve manhole pipe sleeve and the [conduit casing] [or] [uninsulated chilled water pipe]. The mechanical seal shall consist of interlocking elastomeric links shaped to continuously fill the annular space between the [casing] [or] [uninsulated chilled water pipe] and sleeve. The link material shall be a synthetic elastomeric capable of withstanding long term exposure at 205 degrees C 400 degrees F without deterioration. The links shall be attached to each other with corrosion resistant steel bolts, nuts and pressure plates. The link, bolts, nuts and pressure plates shall be the product of single manufacturer and shall be furnished as the product of single manufacturer and shall be furnished as a package or kit. The links shall be loosely assembled with bolts to form a continuous rubber belt around the [casing] [or] [uninsulated chilled water pipe] with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the [casing] [or] [the uninsulated chilled water pipe] and the sleeve. The pipe sleeve diameter shall be sized so that no more than one half of the seal assembly's expansion capability is used to achieve a water seal.

2.14.4 Pipe Supports

Pipe Supports shall be in accordance with MSS SP-58 and MSS SP-69, type as shown. All pipe supports, including structural cross support members, shall be galvanized in accordance with Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS. Chains, straps, or single point supports shall not be used.

2.15 EXPANSION JOINTS

****
NOTE: Expansion joints generally will not be used in the design of the piping layout. If no other method is available to handle the expansion problem in a specific location, the design layout using an expansion joint at a specific location must be justified by a design analysis and approved in the planning phase of the piping layout, prior to including expansion joints in the specifications. Cold spring (pipe expansion) will be shown on the drawings. Sizing of expansion loops and bends will not be based on cold spring.

If expansion joints or ball joints are required, the locations will be indicated on the drawings. Since expansion joints are high maintenance items, they must be located in a readily accessible location. Type I and III slip joint, packed expansion joints are adjustable gland type and require continuing maintenance to contain leakage and are now manufactured by only one company making them proprietary. For these reasons, these types are not specified.

Coordinate this paragraph with paragraph PIPING in PART 3; remove this whole paragraph or subparagraphs not required in the project.
****

Submit manufacturer's descriptive data and technical literature, performance charts, catalog cuts and installation instructions.

[2.15.1 Guided Slip Tube

****
NOTE: Expansion joints shall provide for either single or double slip of the connected pipes, as required or indicated, and for not less than the traverse indicated. The joints shall be designed for hot water working pressure in accordance with applicable requirements of EJMA-01 and ASME B31.1. This joint is designed for packing injection under full line pressure.
****

Internally-externally guided type, injected semiplastic type packing, with service outlets. Joints shall be for minimum working pressure of ASME Class 150. Provide single or double slip tube type as indicated. Provide flanged or buttwelding end connections as indicated.

][2.15.2 Flexible Ball

****
NOTE: The ball joint will be designed for packing injection under full line pressure to contain leakage. Balls and sockets will be of equivalent

material as the adjoining pipeline. The exterior spherical surface of carbon steel balls will be plated with 0.051 mm (2 mils) of hard chrome in accordance with ASTM B650. The ball type joints will be designed and constructed in accordance with ASME B31.1 and Section VIII, Boiler and Pressure Vessel Code, where applicable. Flanges where required will conform to ASME B16.5. Gaskets and compression seals will be compatible with the service intended.

****

Provide chromium plated steel balls capable of 360-degree rotation plus 15-degree angular flex movement. Provide pressure molded composition gaskets designed for continuous operation temperature of 274 degrees C 525 degrees F. Joints shall be for minimum working pressure of ASME Class 150. Provide flanged or buttwelding end connections as indicated.

][2.15.3 Bellows-Type

****

NOTE: Bellows type joints must be flexible, guided expansion joints. The expansion element will be stabilized corrosion resistant steel. Bellows type expansion joints will conform to the applicable requirements of EJMA-01 and ASME B31.1 with internal liners. The joints will be designed for the working temperature and pressure suitable for the application but will not be less than 1034 kPa (150 psig).

****

Type 304 stainless steel corrugated bellows, reinforced with rings, internal sleeves, and external protective covers. Provide limit stops to limit total movement in both directions. Cold set the joints to compensate for temperature at time of installation. Joints shall withstand 10,000 cycles over a 20 year period. Joints shall be for minimum working pressure of ASME Class 150. Provide single or double bellows expansion joint as indicated. Provide first pipe alignment guide no more than four pipe diameters from the expansion joint; provide second pipe alignment guide no more than 14 pipe diameters from the first guide. Provide flanged or buttwelding end connections as indicated.

]2.16 MISCELLANEOUS METAL

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NOTE: Include miscellaneous metals located in trenches or valve manholes in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

****

Miscellaneous metal not otherwise specified, shall conform to Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS. Miscellaneous metal bolted together, shop welded, or assembled in the field, and pipe supports, including structural cross support members and anchors, shall be hot-dip galvanized in accordance with Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 SITE WORK

3.2.1 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling of the valve manholes shall be as shown and in accordance with Section 31 00 00 EARTHWORK.

3.2.2 Electric Work

Any wiring required for the operation of the equipment specified, but not shown on the electrical drawings, shall be provided under this section in accordance with Sections [33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION, and Section 33 70 02.00 10 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND] [33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION and Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION].

3.2.3 Painting

The heat affected zone of field welded galvanized surfaces and other galvanized surfaces damaged during installation shall be cleaned in compliance with SSPC SP 10/NACE No. 2, and painted in accordance with Section 09 90 00 PAINTS AND COATINGS. Steel and iron appurtenances, piping, and supports shall be cleaned in compliance with SSPC SP 10/NACE No. 2, and painted in accordance with SSPC Paint 16, coal-tar epoxy-polyamide.

3.3 PIPING

3.3.1 General

****

NOTE: Delete provisions in brackets and all other references to threaded connections for high temperature water systems.

If expansion joints are required, coordinate this paragraph with paragraph EXPANSION JOINTS in PART 2.

For Guided Slip Tube expansion joints the end connections will be flanged or beveled for welding as indicated. Joint shall be provided with an anchor base where required or indicated. Where adjoining pipe is carbon steel, the sliding slip shall be seamless steel plated with a minimum of 0.051 mm (2 mils) of hard chrome in accordance with ASTM B650. All joint components shall be fabricated from material equal to that of the pipeline. Initial setting shall be made in accordance with the manufacturer's recommendations to compensate for ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended

by the joint manufacturer, but in any case shall not be more than 1.5 m (5 feet) from expansion joint except that in lines 100 mm (4 inches) or smaller, guides will be installed not more than 600 mm (2 feet) from the joint. Service outlets will be provided where indicated.

Flexible ball joints will be constructed of alloys as appropriate for the service intended. Joint ends will be threaded (to 50.8 mm (2 inches) only), grooved, flanged or beveled for welding as indicated or required, and must be capable of absorbing a minimum of 15-degree angular flex and 360-degree rotation.

For Bellows-Type joints, guiding of piping on both sides of expansion joint will be in accordance with the published recommendations of the manufacturer of the expansion joint. When a joint is installed within four pipe diameters of an anchor, only one side needs guiding.

****

All piping in valve manholes shall be steel and insulated. Insulation shall be protected with [an aluminum] [galvanized steel] jacket [, except for chilled water lines where indicated not to be insulated.] Pipe shall be accurately cut to measurements established at the site and shall be worked into place without springing or forcing. Pipe and insulation shall clear all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation will not be permitted. Burrs shall be removed from ends of pipe by reaming. Installation shall permit free expansion and contraction without damage to joints or hangers. Piping shall be installed in accordance with ASME B31.1. Joints for piping in valve manholes shall be welded [, except joints at traps, strainers, and at valves and piping 19 mm 3/4 inch and smaller which may be threaded]. [Flanged joints will be permitted for dielectric isolation only.] Supports, anchors, or stays shall not be attached where either expansion or the weight of the pipe will cause damage to permanent construction. The method of attaching supports shall not interfere with the operation of the cathodic protection system.

3.3.2 Welded Joints

Joints between sections of pipe, between sections of pipe and valves, and between sections of pipe and fittings shall be welded [except where joints are allowed to be screwed for pipe sizes 19 mm 3/4 inch and smaller]. The welding shall conform to the requirements specified in paragraph WELDING.

3.3.3 Flanged and Threaded Joints

3.3.3.1 Flanged Joints

Flanged joints shall be faced true, provided with gaskets, and made perfectly square and tight. Flanged joints shall be used only for electrical isolation and in other special cases where connected equipment is available with only flanged joints, or when specifically shown on the drawings. Electrically isolated flange joints shall be provided at all connections to or from the heat distribution system and between dissimilar metals.

3.3.3.2 Threaded Joints

Threaded joints shall have graphite or inert filler and oil, graphite compound, or polytetrafluoroethylene tape applied to the male threads only. Unions shall be provided at all screwed valves, strainers and connections to equipment 19 mm 3/4 inch and smaller. Dielectric unions shall be used at connections of dissimilar metals in 19 mm 3/4 inch and smaller piping. When used on High Temperature Water Systems, threaded joints shall be seal welded.

3.3.4 Reducing Fittings

Eccentric reducers in horizontal runs shall be installed with the straight side down. Changes in horizontal piping sizes shall be made through eccentric reducing fittings.

3.3.5 Branch Connections

Branches from mains shall branch off top of mains as indicated or as approved. Connections shall ensure unrestricted circulation, elimination of air pockets, and shall permit the complete drainage of the system. Branch connections may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings where used shall be forged and shall be no larger than two nominal pipe sizes smaller than the main run. Branch outlet fittings shall be reinforced to withstand external strains and designed to withstand full pipe bursting strength.

3.3.6 Pipe Supports in Valve Manholes

Horizontal and vertical runs of pipe in valve manholes shall be securely supported.

3.4 WELDING

****
NOTE: If the need exists for more stringent pipe welding requirements, delete the sentences in the first set of brackets.
****

[Piping shall be welded in accordance with qualified procedures, using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.] [Welding and nondestructive testing procedures for piping shall be as specified in Section [40 05 13.96] [40 17 26.00 20] WELDING PROCESS PIPING.] Structural members shall be welded in accordance with Section 05 05 23 WELDING, STRUCTURAL.

3.5 COATINGS

Prepare the steel piping surface by abrasive blasting to the near-white metal grade in conformance with SSPC SP 10/NACE No. 2. Within eight hours of blasting, or prior to any condensation of moisture or other surface

deterioration whichever occurs first, coat all surfaces with an organic zinc primer conforming to the requirements of SSPC Paint 29 Type II. Spray apply the primer to a minimum thickness at any point of 0.10 mm 4 mils. Allow the primer to cure according to the manufacturer's recommendations prior to overcoating with the thermal barrier coating. The thermal barrier coating shall have film forming properties, an adhesion value of 5 when tested according to ASTM D3359 and a minimum thermal conductivity of 0.100 W/m•K 0.058 Btu/hr•ft•°F. Spray apply the thermal barrier coating in accordance with manufacturers recommendations to a minimum thickness at any point of 1.3 mm 50 mils.

3.6 INSULATION

The insulation shall be installed so that it will not be damaged by pipe expansion or contraction. Insulation shall not become wet before, during, or after installation. Insulation installed over welds shall be grooved to assure a snug fit. Insulation shall be held in place with stainless steel straps. A minimum of 2 bands shall be installed on each individual length of insulation and maximum spacing shall not exceed 450 mm 18 inch centers.

3.6.1 Installation

Material shall be installed in accordance with published installation instructions of the manufacturer. Insulation materials shall not be applied until piping tests are completed. Prior to application, surfaces shall be thoroughly cleaned of moisture, grease, dirt, rust, and scale, and painted where required.

3.6.2 Insulation on Pipes Passing Through Sleeves

Insulation shall be continuous, as required by paragraph Pipe Sleeves Through Valve Manhole Cover. Aluminum jackets shall be provided over the insulation. When penetrating valve manhole walls, aluminum jacket shall extend not less than 50 mm 2 inches beyond the sleeve on each side of the wall and shall be secured with an aluminum band on each side of the wall. Where flashing is provided, the jacket shall be secured with not less than one band located not more than 25 mm 1 inch from the end of the jacket. When penetrating valve manhole tops, pipe shall be insulated as required for valve manhole service as indicated.

3.6.3 Covering of Insulation in Valve Manholes

The insulation for pipe, flanges, valves, and fittings shall be covered with [aluminum] [galvanized steel] jackets.

3.6.4 Insulation of Piping Accessories in Valve Manholes

Flanges, couplings, unions, valves, fittings, and other pipe accessories, unless otherwise shown or approved, shall be insulated with removable and reusable factory premolded, prefabricated, or field fabricated insulation. For accessories in valve manholes, [aluminum] [galvanized steel] sheet shall be applied over the insulation. Where accessories are designated not to be insulated, the adjoining insulation and jacket shall terminate neatly. The terminations for the chilled water systems shall provide a complete vapor seal.

3.6.5 Insulation Sealing for Chilled Water Systems

The ends of insulation shall be sealed with vapor barrier. Penetrations

shall be caulked. Caulking shall be applied to parting line between equipment and removable section insulation. Upon completion of installation of the insulation, including removable sections, two coats of vapor barrier coating shall be applied with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1.6 mm 1/16 inch. The coating shall be applied so that the removable sections are coated separate from the body of the equipment so these sections remain removable. Coating shall be applied to flanges, unions, valves, anchors, fittings and accessories, all terminations, and all insulation not protected by factory vapor barrier jackets or PVC fitting covers. Tape seams shall overlap 25 mm 1 inch. The coating shall extend out onto the adjoining pipe insulation 50 mm 2 inches. Insulation terminations shall be tapered to unions at a 45-degree angle.

3.6.6 Insulation Thickness

****
NOTE: Delete inapplicable columns in Tables 1 and 2.
****

The minimum thickness of insulation for [the heat distribution system] [and] [condensate return system] [each section of pipe] shall be in accordance with Tables 1 and 2.

TABLE 1
Minimum Pipe Insulation Thickness (In millimeters)

For steam (110 to 2,800 kPa (gage)) and High Temperature Hot Water Supply and Return (120 to 230 degrees C)

Nominal Pipe Diameter (mm)	MPT-PC MPT-PF	Delta	Thermo-12 Super Caltemp	Foamglass
25	50	63	100	115
40	50	63	100	115
50	65	85	110	125
65	65	85	110	125
80	75	100	125	150
100	75	100	125	150
125	75	100	125	150
150	85	110	135	150
200	85	110	135	150
250	100	125	150	165
300	100	125	150	165
350	100	125	150	165
400	100	125	150	165
450	100	125	150	165

TABLE 1
Minimum Pipe Insulation Thickness (In inches)

For steam (16 to 408 psig) and High Temperature Hot Water Supply and Return (250 to 450 degrees F)

Nominal Pipe Diameter (inches)	MPT-PC MPT-PF	Delta	Thermo-12 Super Caltemp	Foamglass
1.0	2.0	2.5	4.0	4.5
1.5	2.0	2.5	4.0	4.5
2.0	2.5	3.5	4.5	5.0
2.5	2.5	3.5	4.5	5.0
3.0	3.0	4.0	5.0	6.0
4.0	3.0	4.0	5.0	6.0
5.0	3.0	4.0	5.0	6.0
6.0	3.5	4.5	5.5	6.0
8.0	3.5	4.5	5.5	6.0
10.0	4.0	5.0	6.0	6.5
12.0	4.0	5.0	6.0	6.5
14.0	4.0	5.0	6.0	6.5
16.0	4.0	5.0	6.0	6.5
18.0	4.0	5.0	6.0	6.5

TABLE 2
Minimum Pipe Insulation Thickness (In millimeters)

For Low Pressure Steam (less than 110 kPa (gage)), Condensate Return and Low Temperature Hot Water (less than 120 degrees C) Supply and Return

Nominal Pipe Diameter (mm)	MPT-PC MPT-PF	Delta	Thermo-12 Super Caltemp	Foamglass
25	40	50	80	80
40	40	50	80	80
50	40	50	80	80
65	40	50	80	80
80	50	65	85	85
100	50	65	85	85
125	50	65	85	85
150	65	80	110	110
200	65	80	110	110
250	80	100	125	125
300	80	100	125	125
350	80	100	125	125
400	80	100	125	125
450	80	100	125	125

TABLE 2
Minimum Pipe Insulation Thickness (In inches)

For Low Pressure Steam (less than 16 psig), Condensate Return and Low Temperature Hot Water (less than 250 degrees F) Supply and Return

Nominal Pipe Diameter (inches)	MPT-PC MPT-PF	Delta	Thermo-12 Super Caltemp	Foamglass
1.0	1.5	2.0	3.0	3.0
1.5	1.5	2.0	3.0	3.0
2.0	1.5	2.0	3.0	3.0
2.5	1.5	2.0	3.0	3.0
3.0	2.0	2.5	3.5	3.5
4.0	2.0	2.5	3.5	3.5
5.0	2.0	2.5	3.5	3.5
6.0	2.5	3.0	4.5	4.5
8.0	2.5	3.0	4.5	4.5
10.0	3.0	4.0	5.0	5.0
12.0	3.0	4.0	5.0	5.0
14.0	3.0	4.0	5.0	5.0
16.0	3.0	4.0	5.0	5.0
18.0	3.0	4.0	5.0	5.0

3.7 VALVE MANHOLES AND ACCESSORIES

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NOTE: Provide design details on drawings of concrete reinforcing, size, dimensions of valve manhole, piping arrangements, type of removable cover, valve manhole penetrations, pipe and equipment supports, etc.
****

3.7.1 Piping and Equipment in Valve Manholes

Piping and equipment in valve manholes shall be installed to provide easy access without stepping on piping or equipment, and to provide sufficient working room. Piping and equipment in valve manholes shall be installed and supported as shown on the drawings. All globe, angle and gate valves shall be installed with the stems horizontal or above. Submit Data Package 2 as related to all equipment provided for the project in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Submit [6] [_____] copies of operation and [6] [_____] copies of maintenance manuals for the equipment furnished. Detail in the operation manuals the step-by-step procedures required for equipment startup, operation, and shutdown. Include in the operation manuals the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. List in the maintenance manuals routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Include in the maintenance manuals piping and equipment layout and simplified wiring and control diagrams indicating location of electrical components with terminals designated for wiring, as installed.

3.7.2 Sump Pumps Installation

****
NOTE: Coordinate this paragraph with the specified requirements in paragraph SUMP PUMPS.
****

Sump pumps shall be installed as indicated. All electrical connections

shall be hard wired.[Monitoring of each pump motor and the high water alarm shall be connected to the Energy Monitoring and Control System (EMCS). Coordinate electrical requirements of EMCS with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM]. Electrical circuits to the sump pumps shall be dedicated circuits. All circuit breakers and switches in the electrical power distribution to the sump pumps shall be capable of being locked in the "ON" position and will be signed as follows:

a. THIS CIRCUIT SUPPLIES POWER TO THE ELECTRIC SUMP PUMPS IN THE UNDERGROUND DISTRIBUTION SYSTEM. THIS CIRCUIT MUST BE "ON" AT ALL TIMES; OTHERWISE EXTENSIVE DAMAGE WILL OCCUR TO THE UNDERGROUND HEAT DISTRIBUTION SYSTEM AND PREMATURE FAILURE WILL OCCUR.

b. The words on the sign shall be stamped on a corrosion resistant metal plate with letters 10 mm 3/8 inch high, and the plate shall be affixed permanently near the switch or circuit breaker.

3.8 TESTS

Tests of piping in the valve manholes will be performed as part of the testing of the direct buried conduit system. These tests shall include the piping in the valve manhole and performed in accordance with the system supplier's Approved Brochure or the contract specifications.

-- End of Section --