Preparing Activity: USACE Superseding
UFGS-33 60 01 (April 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 33 61 13.19

VALVES, PIPING, AND EQUIPMENT IN VALVE MANHOLES

02/16

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SECTION 33 61 13.19

VALVES, PIPING, AND EQUIPMENT IN VALVE MANHOLES
02/16

****
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 item(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 3-430-01FA 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 13.13 PREFABRICATED UNDERGROUND HYDRONIC ENERGY DISTRIBUTION or 33 57 55 FUEL SYSTEM COMPONENTS (NON-HYDRANT); 33 61 13 PRE-ENGINEERED UNDERGROUND HEAT DISTRIBUTION SYSTEM or 33 63 16 EXTERIOR SHALLOW TRENCH STEAM DISTRIBUTION; 33 63 13.19 CONCRETE TRENCH HYDRONIC AND STEAM ENERGY DISTRIBUTION 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 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION; 03 30 00 CAST-IN-PLACE CONCRETE; 05 05 23.16 STRUCTURAL WELDING; 07 13 53 ELASTOMERIC SHEET WATERPROOFING; 08 31 00 ACCESS DOORS AND PANELS; 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 Reference Identifier (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.

****

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	(2017) American National Standard Alloy and Temper Designation Systems for Aluminum

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)
ASME B1.20.2M	(2006; R 2011) Pipe Threads, 60 Deg. General Purpose (Metric)
ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings
ASME B16.11	(2022) Forged Fittings, Socket-Welding and Threaded
ASME B16.20	(2017) Metallic Gaskets for Pipe Flanges
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.34	(2021) Valves - Flanged, Threaded and Welding End
ASME B31.1	(2022) Power Piping
ASME B40.100	(2022) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2022) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A106/A106M	(2019a) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A193/A193M	(2023) Standard Specification for Alloy-Steel and Stainless Steel Bolting

	Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2023) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A733	(2016; R 2022) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C449	(2007; R 2013) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C533	(2017; R 2023) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C547	(2022a) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C552	(2022) Standard Specification for Cellular Glass Thermal Insulation
ASTM C647	(2008; R 2013) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM D2822/D2822M	(2005; R 2011; E 2011) Standard Specification for Asphalt Roof Cement, Asbestos-Containing
ASTM D3278	(2021) Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D3359	(2017) Standard Test Methods for Rating Adhesion by Tape Test
ASTM E84	(2023) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2022a; E 2023) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM F1139	(1988; R 2019) Steam Traps and Drains

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

MSS SP-25	(2018) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-45	(2020) Bypass and Drain Connections
MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-72	(2010a) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-80	(2019) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(2014) Class 3000 Steel Pipe Unions Socket Welding and Threaded
MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code
NFPA 90A	(2024) Standard for the Installation of Air Conditioning and Ventilating Systems

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 16	(2006; R 2015; E 2015) 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	(2015) Near-White Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL 723	(2020) UL Standard for Safety 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, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification 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[, [_____]]

SD-03 Product Data

Support of the Equipment

Piping and Fittings

Valves

Insulating Flanges

Insulation

Sump Pumps and Drainers

Expansion Joints

SD-04 Samples

Insulated Sections; G[, [_____]]

SD-10 Operation and Maintenance Data

Valve Manholes and Accessories; G[, [_____]]

Data Package 2; G[, [_____]]

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, prepare a display of insulated sections showing compliance with specifications and showing fastening, sealing, jacketing, straps, waterproofing, supports, hangers, anchors, and saddles. Display approved display sample sections 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 items must be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations must be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

2.2 NAMEPLATES

Supply each major item of equipment such as sump pump, motor, steam trap, and pressure reducing valve with 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 are not allowed.

2.4 ELECTRICAL WORK

Provide motors, manual or automatic motor control equipment, and protective or signal devices required for the operation specified under this section in accordance with NFPA 70 and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.5 PIPING AND FITTINGS

2.5.1 General Requirements

Provide piping, fittings and piping accessories inside the valve manholes suitable for the working pressure and temperature requirements of the system conforming to ASME B31.1. To the greatest extent possible, match the piping and fittings inside the valve manholes to the piping and fittings located on the outside of the valve manhole. Provide steel piping in valve manholes 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, seal weld (continuous fillet weld) the interface area where the pipe threads meet the threaded fittings to preclude any water leakage. Do not attach supports, anchors, or stays 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

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

2.5.2.1 Nipples

Provide nipples that conform to ASTM A733 as required to match adjacent piping.

2.5.2.2 Pipe Threads

Provide pipe threads that conform to ASME B1.20.2MASME B1.20.1. Use pipe threads only on pipe 19 mm 3/4 inch or smaller.

2.5.3 Fittings

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

2.5.3.1 Welded Fittings

Provide welded fittings to match connecting pipes with butt welded fittings, conforming to ASME B16.9, and socket welded fittings, conforming to ASME B16.11.

2.5.3.2 Unions

Provide unions that conform to MSS SP-83 as required to match adjacent piping.

2.5.3.3 Ball Valves

Provide ball valves having flanged or buttwelded end connections conforming to MSS SP-72; provide ball valves having threaded end connections conforming to MSS SP-110.

2.5.4 Insulating Flanges and Dielectric Waterways

****

NOTE: Electrically insulating flanges or dielectric waterways must 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.

****

2.5.4.1 Insulating Flanges

For systems in which cathodic protection is used, provide insulating flanges or flange gasket kits in the valve manhole at the pipe connection to or from the heat distribution system, at the interface of 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. Provide a kit that consists of flanges, a flange gasket, nuts and bolts, bolt sleeves, and one insulating washer and one steel washer for both ends of each bolt. Provide manufacturer certified gasket kits 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. Submit evidence of satisfactory installations operating not less than 2 years, in accordance with paragraph SUBMITTALS, before materials are delivered. Ensure that these kits are provided and properly installed according to manufacturer's published instructions. Provide bolts torqued to the correct tightness and in the correct bolt pattern as recommended by the manufacturer's published instructions. Provide steel flanges that conform to ASME B16.5 Class [150] [and] [or] [300] and that match valves or flanged fittings on which used. Provide flat faced steel flanges. Provide non-asbestos compressed material gaskets in accordance with ASME B16.21. Provide bolts that conform to the requirements of ASTM A193/A193M, Grade B7. Provide bolt heads marked to identify the manufacturer and the standard to which the bolt complies. Extend bolt lengths to no less then 2 full threads beyond the nut at the required tension with the washer seated. Provide nuts that conform to the requirements of ASTM A194/A194M, Grade 7.

2.5.4.2 Dielectric Waterways

Provide dielectric waterways that have temperature and pressure rating

equal to or greater than that specified for the connecting piping and used for joining dissimilar metals on 19 mm 3/4 inch and smaller threaded pipe. Provide waterways that have metal connections on both ends suited to match connecting piping. Provide dielectric waterways that are internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Provide dielectric flanges that 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 that conform to 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 52 30.01 10 CENTRAL COAL-FIRED STEAM-GENERATING SYSTEM or Section 23 22 26.00 20 STEAM SYSTEM AND TERMINAL UNITS for Navy jobs.

****

Provide valves that conform to the material, fabrication, and operating requirements of ASME B31.1, unless otherwise specified. Provide valves suitable for the service temperatures and pressures utilized. Provide valves for [steam] [hot water] that conform to ASME B31.1 Class [150] [and] [or] [300], as suitable for service temperatures and pressures utilized. [Provide valves for condensate services that conform to ASME B31.1 Class 150.] Valves 19 mm 3/4 inch and smaller may be bronze where seal welding is not required. Provide valves 150 mm 6 inches and larger with a 25 mm 1 inch minimum gate or globe bypass valve sized in conformance with MSS SP-45.

2.6.1 Steel Valves

Provide steel globe, gate, angle, and check valves that conform to the requirements of ASME B16.34 and ASME B31.1 for the service temperatures and pressures utilized. Provide gate valves 65 mm 2-1/2 inches and smaller with a rising stem. Provide gate valves 80 mm 3 inches and larger with an outside screw and yoke.

2.6.2 Bronze Valves

2.6.2.1 Globe, Gate, and Angle Valves

Provide bronze globe, gate, and angle valves that conform to MSS SP-80, union bonnet type.

2.6.2.2 Check Valves

Provide bronze check valves that conform to MSS SP-80.

2.6.3 Packing

Provide asbestos free valve packing. Provide die-formed, ring type specifically designated valve stem packing suitable for service temperatures and pressures utilized. Provide polytetrafluoroethylene packing that has a with minimum 50 percent graphite filament. Provide valves 40 mm 1-1/2 inches and smaller with four or five packing rings and provide valves 50 mm 2 inches and larger with at least six packing rings. Spiral or continuous packing will not be acceptable. Provide a metal insert having proper clearance around the valve stem at the bottom of the stuffing box and acting as a base for the packing material. Provide one piece construction with provisions for not less than two bolts for packing adjustment, with a liner of noncorrosive material for packing glands.

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 must be provided for system warm-up.

****

Provide fail open traps with trap bodies suitable for a working pressure of not less than 1.5 times the steam supply pressure, but not less than 1379 kPa 200 psi.

2.7.1 Bucket Traps

Provide inverted-bucket type bucket traps with automatic air discharge conforming to ASTM F1139.

2.7.2 Thermostatic Traps

****

NOTE: Specify thermostatic traps where the trap location is subject to freezing.

****

Provide thermostatic traps that have a bimetallic element with automatic air discharge conforming to ASTM F1139.

[2.8 STRAINERS

****
NOTE: Delete this paragraph for high temperature water systems.
****

Provide basket or y-type strainers with connections the same size as the pipe lines in which the connections are installed. Provide heavy and durable strainer bodies, of cast steel, with bottoms drilled and plugged suitable for service temperatures and pressures utilized. Provide each strainer body with arrows clearly cast on the sides to indicate the direction of flow. Provide each strainer with an easily removable cover and sediment basket. Provide each strainer body or bottom opening with a nipple and gate valve for blowdown. Provide 0.6350 mm 0.025 inch thick stainless steel, monel or sheet brass strainer basket with small perforations of sufficient number to provide a net free area at least 2.5 times that of the entering pipe. Provide cast steel bodies and stainless or Monel baskets for high temperature hot water systems.

]2.9 PRESSURE GAUGES

Provide pressure gauges that conform to ASME B40.100 with a minimum dial size of 110 mm 4-1/4 inches. Provide each gauge with a throttling type needle valve or a pulsation dampener and shut-off valve.

2.10 DIAL THERMOMETERS

Provide dial type thermometers 90 mm 3-1/2 inches in diameter with stainless steel case, remote-type bulb or direct-type bulb as required. Provide thermometers that have an accuracy of plus or minus 1 degree C 2 degrees F. Provide thermometer wells of the separable socket type for each thermometer with a direct-type bulb. Provide thermometer with 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. Provide the undercoat and thermal barrier coating with a continuous use service temperature rating that exceeds 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.

****

2.12.1 General Provisions

Insulate piping, fittings, valves, etc., in the valve manholes. Provide insulation premolded, precut or job fabricated to fit and be removable and reusable. Provide thickness of insulation in accordance with Tables 1 and 2. Provide insulation jackets for all pipe and fitting insulation. Provide insulation that conforms to EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

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.

****

Provide piping, fittings, and valves with molded calcium silicate insulation 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. Do not use laminated construction unless the thickness exceeds 100 mm 4 inches. Insulation 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

****

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

****

Provide aluminum jackets of smooth sheet, 0.4064 mm 0.016 inch nominal thickness, that conform to the requirements of ASTM B209M ASTM B209, Type 3003, 3105, or 5005.[Supply aluminum jackets that have a factory installed moisture barrier that consists of at least 18.1 kg 40 pound kraft paper coated on one side with a 0.025 mm 1 mil thick polyethylene film. ProviDe a jacket with the moisture barrier adhered to the jacket over the entire area of the insulation-side surface.]

2.12.4 Bands

Provide bands for aluminum jacket 10 mm 3/8 inch wide and 32 gauge thickness made of aluminum or annealed stainless steel. Provide bands for insulation 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

Insulate flanges, unions, valves, and fittings with premolded, prefabricated, or field fabricated segments of insulation of the same material and thickness as the manhole pipe insulation. Provide insulation with essentially the same thermal characteristics and thickness as the adjoining piping.

2.12.6 Vapor Barrier Coating

Provide insulation with a vapor barrier coating that is water resistant, appropriately selected for either outdoor or indoor service, colored white, and has a water vapor permeance of the compound not exceeding 0.05 perm as determined according to Procedure B of ASTM E96/E96M. Provide a coating that is the nonflammable, fire resistant type conforming to ASTM E84, NFPA 90A and UL 723 and has a flash point not less than 26.7 degrees C 80 degrees F as determined in accordance with ASTM D3278. Provide a coating that conforms to ASTM C647; excluding the previous fire resistant requirements.

2.12.7 Finishing Cement

Provide mineral fiber hydraulic-setting thermal insulating cement that conforms with ASTM C449.

2.12.8 Glass Tape

Provide tape that conforms to the requirements of UL 723 and ASTM E84.

2.12.9 Plain Weave, Untreated

Provide with the ends interlocked with the picks to ensure no raveling of the tape edges. Provide tape that is 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, and average thickness of 0.1778 plus or minus 0.0254 mm 0.007 plus or minus 0.001 inches. Provide with warp ends or wales of 17 plus or minus 1 per centimeter 42 plus or minus 2 per inch or filling picks or 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

Provide with the wales interlocked with the courses to ensure no raveling of the tape edges. Provide tape that is 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; average thickness of 0.1778 plus or minus 0.0254 mm 0.007 plus or minus 0.001 inches; and warp ends/wales of 6 plus or minus per 1 centimeter 16 plus or minus 2 per inch. Use material with 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, minimum breaking strength of 375 grams per mm 21 pounds per inch of width.

2.12.11 Distortion Requirements

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) is not acceptable. The width tolerance is plus or minus 3 mm 1/8 inch.

2.12.12 Open-Weave Tape

Provide open-weave type tape, used for embedding between coats of adhesive or coating materials, that has an average weight of [_____] kg per square meter ounce per square yard.

2.13 SUMP PUMPS AND DRAINERS

****

NOTE: The application would be for a submersible sump pump in a manhole serving an underground heat distribution system. Flow range 1.6 L/s 25 to 50 gpm, head of 4.5 to 9 TDH 15 to 30 TDH, fluid temp of 93 degrees C 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 must be on a corrosion resistant metal plate and must 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

Provide a manufacturer's standard commercial product that is electrically driven and submersible, capable of operating while completely submerged, and capable of running without damage when not submerged. The pumps and motors must be capable of continuously pumping liquids at a temperature of 93 degrees C 200 degrees F. Provide sump pumps with 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 must be capable of passing a 10 mm 3/8 inch sphere.

2.13.1.1 Motors

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

2.13.1.2 Controls

Provide controls, controllers, water level switches, and electrical connections 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 must have demonstrated 200,000 cycles at 93 degrees C 200 degrees F and 100 percent relative humidity while totally submersed in water at 93 degrees C 200 degrees F.

2.13.2 High Level Alarm Indicator

Provide another switch to indicate high water level, connected to an emergency warning light mounted on or adjacent to the valve manhole. Set this high water level alarm 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 pressure and actuating when the water level rises sufficiently in the sump, raising the float opening the steam control valve to admit steam to the drainer, resulting in pumping the water from the sump. When the float is lowered by the pumping action, it closes the steam valve, stopping the pumping action until the rising water causes the to float rise again and open the steam valve, starting the cycle over again. Provide each drainer with controls to accomplish the above sequence of operation. Design the automatic float-operated steam valve to prevent dead centering under field conditions and to lengthen the life of the valve seat. Provide the valve with a high grade, renewable composition disc and a stainless steel or hard, noncorrosive bronze renewable seat inserted in the valve body with the drainer constructed of

corrosion-resistant copper and bronze. Provide piping from manhole drainers that conforms to 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

****

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 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION, or applicable portions of the above specifications, must be included as part of the project specifications. For Navy jobs, 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 71 02 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 must 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 must be required.

Edit Section 03 42 13.00 10 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION to require manholes be constructed of 27 MPa 4000 psi minimum compressive strength concrete.

****

2.14.1 Wall and Floor Construction

Provide manhole in accordance with Section 03 42 13.00 10 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION. Construct walls and

floors of reinforced concrete not less than 200 mm 8 inches thick. Construct walls using one monolithic pour. Extend walls [not less than 150 mm 6 inches above grade][flush with finished grade][flush with trench top] [_____]. Provide floor with an internal sump; slope the floor in all directions to the sump to allow water collection. Provide construction joints with water stops. Waterproof manhole exterior in accordance with Section 07 13 53 ELASTOMERIC SHEET WATERPROOFING.

2.14.2 Manhole Supported Cover(s)

****

NOTE: Indicate in the design the sectional requirements of the cover. When used in conjunction with concrete shallow trenches, set the top of cover flush with the concrete trench top. When used in conjunction with direct buried conduit systems, set the top of the cover a minimum of 150 mm 6 inches above grade.

Include the checkered plate cover over the top of open grates in cold climates and where trash accumulation is a concern.

****

Provide [a hot-dipped galvanized steel open grate] [an 8 mm 5/16 inch thick checker pattern, aluminum solid plate cover that conforms to AA H35.1/35.1M] [_____] cover that is supported by and is flush with the top of the manhole walls. Construct cover(s) to be removable and sectionalized as indicated. Provide hot-dipped galvanized structural steel supports, anchor bolts, nuts, and washers. Provide a cover and support system that can support a load up to[7.2 kPa 150 psf] [_____]. [Install an 8 mm 5/16 inch thick checker pattern, aluminum solid plate cover that conforms to AA H35.1/35.1M on top of the open grating. Attach the checkered plate to the grating with removable, galvanized steel fasteners.]

2.14.3 Raised Frame Cover(s)

****

NOTE: Do not use a raised frame and cover when connected to a shallow concrete trench system due to interference issues. A raised frame and cover is best suited for direct buried conduit type systems.

Indicate in the design the sectional requirements of the cover as well as the ventilation opening sizing.

****

Provide a raised support structure constructed out of hot-dipped galvanized steel that is designed to sit on top of the manhole walls. Provide an 8 mm 5/16 inch thick checker pattern, aluminum solid plate cover that conforms to AA H35.1/35.1M. Construct cover(s) to be removable and sectionalized as indicated. Provide ventilation openings as indicated around the entire perimeter below the raised top. Provide hot-dipped galvanized steel lifting lugs on the cover.

2.14.4 Concrete Cover

****

NOTE: The use of concrete covers is discouraged unless specifically requested by the user or if specific design conditions exist that require them.

For ventilation choose the brackets for the dual goosenecks if a direct buried system is used. Choose the brackets for the single gooseneck if a concrete shallow trench system is used.

****

Provide a[150 mm 6 inches] [_____] thick cast concrete cover designed to support loads up to[7.2 kPa 150 psf] [_____]. Provide a[1220 by 1220 mm 4 by 4 foot aluminum access door] [762 mm 30 inch diameter standard cast iron manhole frame and removable cover] [900 by 900 mm 36 by 36 inch watertight, hinged steel cover not less than 13 mm 1/2 inch thick] in the concrete top. [Provide two 150 mm 6 inch goosenecks; terminate one gooseneck inside the manhole within 600 mm 2 feet of the manhole's floor; terminate the other gooseneck inside the manhole just below the manhole top.] [Provide a single 150 mm 6 inch gooseneck pipe to allow heat/steam to exit the valve manhole; install the gooseneck off to one side of the valve manhole concrete top to minimize pedestrian traffic interference. Terminate gooseneck within 600 mm 2 feet above finished grade.]

2.14.5 Ladders

Provide steel valve manhole ladders, with nonslip surfaces, and consisting of uprights with steps or rungs. fabricate ladders with two stringers a minimum 9.5 mm 3/8 inch thick and 64 mm 2-1/2 inches wide, and rungs not be less than 406.4 mm 16 inches in width, 19.1 mm 3/4 inch diameter, spaced 304.8 mm 12 inches apart. Anchor the ladders to the wall by means of steel inserts spaced not more than 2 m 6 feet apart vertically, and install to provide at least 150 mm 6 inches of space between the wall and rungs. Galvanize ladders and inserts after fabrication in conformance with ASTM A123/A123M.

2.14.6 Pipe Sleeves

Provide zinc-coated steel pipe, conforming to ASTM A53/A53M, Schedule 40 or standard weight. Install so there is no electrical continuity between the pipe sleeve and the pipe casing.

2.14.6.1 Pipe Sleeves Through Valve Manhole Cover

Provide insulation continuously through sleeves and provide aluminum jacket over the insulation. Provide smooth sheet 0.4064 mm 0.016 inch nominal thickness aluminum jacket conforming to ASTM B209M ASTM B209. Where penetrations in valve manhole tops are required, insulate piping and seal with waterproof coating up to a point flush with the top of the flashing and the end of the insulation. Butt insulation exposed to the weather tightly against the flashing and valve manhole insulation, and extend the aluminum jacket required for piping exposed to the weather 50 mm 2 inches beyond the insulation to form a counterflashing. Flash and counterflash valve manhole penetrations and apply waterproof coating conforming to ASTM D2822/D2822M, Type I.

2.14.6.2 Pipe Sleeves for Conduit Penetrations

Provide a modular mechanical type sealing assembly between the valve manhole pipe sleeve and the [conduit casing] [or] [uninsulated chilled

water pipe]. The mechanical seal consists of interlocking elastomeric links shaped to continuously fill the annular space between the [casing] [or] [uninsulated chilled water pipe] and sleeve. The link material is a synthetic elastomeric capable of withstanding long term exposure at 205 degrees C 400 degrees F without deterioration. Attach the links to each other with corrosion resistant steel bolts, nuts and pressure plates. The link, bolts, nuts and pressure plates must be the product of single manufacturer and furnished as the product of single manufacturer as a package or kit.

2.14.7 Pipe Supports

Provide pipe supports in accordance with MSS SP-58. Galvanize all pipe supports, including structural cross support members, in accordance with Section 08 31 00 ACCESS DOORS AND PANELS. Chains, straps, or single point supports are not allowed.

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

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NOTE: Expansion joints must 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 must 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. Construct joints 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. Construct joints 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, designed to withstand 10,000 cycles over a 20 year period and a minimum working pressure of ASME Class 150. Provide limit stops to limit total movement in both directions. Cold set the joints to compensate for temperature at time of installation. 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

****
NOTE: Include miscellaneous metals located in trenches or valve manholes in Section 08 31 00 ACCESS DOORS AND PANELS.
****

Conform miscellaneous metal, not otherwise specified, to Section 08 31 00 ACCESS DOORS AND PANELS. Hot-dip galvanize miscellaneous metal bolted together, shop welded, or assembled in the field, and pipe supports, including structural cross support members and anchors, in accordance with Section 08 31 00 ACCESS DOORS AND PANELS.

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

Excavate, trench, and backfill the valve manholes as indicated and in accordance with Section 31 00 00 EARTHWORK.

3.2.2 Electric Work

Provide any wiring required for the operation of the equipment specified, but not indicated on the electrical drawings or under this section, in accordance with Sections 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.3 Painting

Clean the heat affected zone of field welded galvanized surfaces and other galvanized surfaces damaged during installation in compliance with SSPC SP 10/NACE No. 2, and paint in accordance with Section 09 90 00 PAINTS AND COATINGS. Clean steel and iron appurtenances, piping, and supports in compliance with SSPC SP 10/NACE No. 2, and paint in accordance with SSPC Paint 16.

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 must be provided with an anchor base where required or indicated. Where adjoining pipe is carbon steel, the sliding slip must be seamless steel plated with a minimum of 0.051 mm 2 mils of hard chrome in accordance with ASTM B650. All joint components must be fabricated from material equal to that of the pipeline. Initial setting must be made in accordance with the manufacturer's recommendations to compensate for ambient temperature at time of installation. Pipe alignment guides must be installed as recommended by the joint manufacturer, but in any case must 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 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.

****

Use steel piping and insulate in valve manholes. Protect insulation with [an aluminum] [a galvanized steel] jacket [, except for chilled water lines where indicated not to be insulated.] Cut pipe to measurements established at the site and work into place without springing or forcing. Clear all openings and equipment, and avoid cutting or other weakening of structural members to facilitate piping installation. Remove burrs from ends of pipe by reaming. Install to permit free expansion and contraction without damage to joints or hangers and in accordance with ASME B31.1. Do not attach supports, anchors, or stays where either expansion or the weight of the pipe could cause damage to permanent construction. The method of attaching supports must not interfere with the operation of the cathodic protection system.

3.3.2 Welded Joints

Weld all pipe joints for piping in valve manholes[, except joints at traps, strainers, and at valves and piping 19 mm 3/4 inch and smaller which may be threaded]. Conform welding to the requirements specified in paragraph WELDING.

3.3.3 Flanged and Threaded Joints

3.3.3.1 Flanged Joints

[Flanged joints are permitted for dielectric isolation only.]Construct flanged joints to be faced true, provided with gaskets, and made perfectly

square and tight. Use flanged joints only for electrical isolation and in other special cases where connected equipment is available with only flanged joints, or when specifically indicated. Provide electrically isolated flange joints at all connections to or from the heat distribution system and between dissimilar metals.

3.3.3.2 Threaded Joints

Apply graphite or inert filler and oil, graphite compound, or polytetrafluoroethylene tape to the male threads only. Provide unions at all screwed valves, strainers and connections to equipment 19 mm 3/4 inch and smaller. Use dielectric unions at connections of dissimilar metals in 19 mm 3/4 inch and smaller piping. When used on High Temperature Water Systems, seal weld threaded joints.

3.3.4 Reducing Fittings

3.3.4.1 Horizontal Water Heating Lines

Provide eccentric reducers for all pipe size changes. Provide eccentric type reducing fittings to maintain the tops of adjoining pipes at the same level.

3.3.4.2 Horizontal Steam Lines

Provide eccentric reducers for all pipe size changes. Provide eccentric type reducing fittings to maintain the bottoms of adjoining pipes at the same level.

3.3.5 Branch Connections

Branch off top of mains as indicated providing unrestricted circulation, elimination of air pockets, and permitting the complete drainage of the system. Branch connections may be made with either welding tees or forged branch outlet fittings. If branch outlet fittings are used, provide forged fittings no larger than two nominal pipe sizes smaller than the main run. Reinforce branch outlet fittings to withstand external strains and designed to withstand full pipe bursting strength.

3.3.6 Pipe Supports in Valve Manholes

Securely support horizontal and vertical runs of pipe in valve manholes.

3.4 WELDING

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

****

[Weld pipe in accordance with qualified procedures, using performance qualified welders and welding operators. Procedures and welders must 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. Notify the Contracting Officer 24 hours in advance of tests and perform the tests at the work site. The welder or welding operator must apply his assigned symbol near each weld he makes as a permanent record.] [Perform welding

and nondestructive testing procedures for piping as specified in Section [40 05 13.96] [40 17 26.00 20] WELDING PROCESS PIPING.] Weld structural members in accordance with Section 05 05 23.16 STRUCTURAL WELDING.

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 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. Provide thermal barrier coating having 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

Install insulation so that it is not damaged by pipe expansion or contraction. Keep insulation drybefore, during, and after installation. Groove insulation installed over welds to assure a snug fit. Hold insulation in place with stainless steel straps. Install a minimum of 2 bands on each individual length of insulation, with maximum spacing not exceeding 450 mm 18 inch centers.

3.6.1 Installation

Install material in accordance with published installation instructions of the manufacturer. Do not apply insulation materials until piping tests are complete. Prior to application, thoroughly clean surfaces of moisture, grease, dirt, rust, and scale; paint where required.

3.6.2 Insulation on Pipes Passing Through Sleeves

Provide continuous insulation, as required by paragraph PIPE SLEEVES THROUGH VALVE MANHOLE COVER. Provide aluminum jackets over the insulation. When penetrating valve manhole walls, extend aluminum jacket not less than 50 mm 2 inches beyond the sleeve on each side of the wall and secure with an aluminum band on each side of the wall. Where flashing is provided, secure the jacket 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, insulate pipe as required for valve manhole service.

3.6.3 Covering of Insulation in Valve Manholes

Cover insulation for pipe, flanges, valves, and fittings with [aluminum] [galvanized steel] jackets.

3.6.4 Insulation of Piping Accessories in Valve Manholes

Insulate flanges, couplings, unions, valves, fittings, and other pipe accessories, unless otherwise indicated, with removable and reusable factory premolded, prefabricated, or field fabricated insulation. Provide [aluminum] [galvanized steel] sheet over insulation manholes and neatly terminate for accessories that are not to be insulated.

3.6.5 Insulation Sealing for Chilled Water Systems

Seal the ends of insulation with vapor barrier, caulk penetrations and apply caulking to parting line between equipment and removable section insulation. Upon completion of installation of the insulation, including removable sections, apply two coats of vapor barrier coating with a layer of glass cloth embedded between the coats, providing a total dry thickness of the finish of 1.6 mm 1/16 inch while maintaining removability of the sections as designed. Apply coating to flanges, unions, valves, anchors, fittings and accessories, all terminations, and all insulation not protected by factory vapor barrier jackets or PVC fitting covers. Overlap tape seams 25 mm 1 inch. Extend the coating out onto the adjoining pipe insulation 50 mm 2 inches. Taper insulation terminations to unions at a 45-degree angle.

3.6.6 Insulation Thickness

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

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

TABLE 1 Minimum Pipe Insulation Thickness (In mm) (In inches)				
For steam (110 to 2,800 kPa (gage)) (16 to 408 psig) and High Temperature Hot Water Supply and Return (120 to 230 degrees C) (250 to 450 degrees F)				
Nominal Pipe Diameter (mm) (inches)	MPT-PC MPT-PF	Delta	Thermo-12 Super Caltemp	Foamglass
25 1.0	50 2.0	63 2.5	100 4.0	115 4.5
40 1.5	50 2.0	63 2.5	100 4.0	115 4.5
50 2.0	65 2.5	85 3.5	110 4.5	125 5.0
65 2.5	65 2.5	85 3.5	110 4.5	125 5.0
80 3.0	75 3.0	100 4.0	125 5.0	150 6.0
100 4.0	75 3.0	100 4.0	125 5.0	150 6.0
125 5.0	75 3.0	100 4.0	125 5.0	150 6.0
150 6.0	85 3.5	110 4.5	135 5.5	150 6.0
200 8.0	85 3.5	110 4.5	135 5.5	150 6.0
250 10.0	100 4.0	125 5.0	150 6.0	165 6.5
300 12.0	100 4.0	125 5.0	150 6.0	165 6.5

TABLE 1 Minimum Pipe Insulation Thickness (In mm) (In inches)				
For steam (110 to 2,800 kPa (gage)) (16 to 408 psig) and High Temperature Hot Water Supply and Return (120 to 230 degrees C) (250 to 450 degrees F)				
350 14.0	100 4.0	125 5.0	150 6.0	165 6.5
400 16.0	100 4.0	125 5.0	150 6.0	165 6.5
450 18.0	100 4.0	125 5.0	150 6.0	165 6.5

TABLE 2 Minimum Pipe Insulation Thickness (In mm) (In inches)				
For Low Pressure Steam (less than 110 kPa (gage) 16 psig), Condensate Return and Low Temperature Hot Water (less than 120 degrees C 250 degrees F)				
Nominal Pipe Diameter (mm) (inches)	MPT-PC MPT-PF	Delta	Thermo-12 Super Caltemp	Foamglass
25 1.0	40 1.5	50 2.0	80 3.0	80 3.0
40 1.5	40 1.5	50 2.0	80 3.0	80 3.0
50 2.0	40 1.5	50 2.0	80 3.0	80 3.0
65 2.5	40 1.5	50 2.0	80 3.0	80 3.0
80 3.0	50 2.0	65 2.5	85 3.5	85 3.5
100 4.0	50 2.0	65 2.5	85 3.5	85 3.5
125 5.0	50 2.0	65 2.5	85 3.5	85 3.5
150 6.0	65 2.5	80 3.0	110 4.5	110 4.5
200 8.0	65 2.5	80 3.0	110 4.5	110 4.5
250 10.0	80 3.0	100 4.0	125 5.0	125 5.0
300 12.0	80 3.0	100 4.0	125 5.0	125 5.0
350 14.0	80 3.0	100 4.0	125 5.0	125 5.0
400 16.0	80 3.0	100 4.0	125 5.0	125 5.0
450 18.0	80 3.0	100 4.0	125 5.0	125 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

Provide easy access in valve manholes without stepping on piping or equipment, and allow sufficient working area for maintenance work. Refer to drawings of piping and equipment in valve manholes for installation and support details. Install all globe, angle and gate valves 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. 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

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

Install sump pumps as indicated, with all electrical connections hard wired.[Connect monitoring of each pump motor and the high water alarm to the Energy Monitoring and Control System (EMCS). Coordinate electrical requirements of EMCS with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM]. Provide dedicated electrical circuits to the sump pumps. Provide all circuit breakers and switches in the electrical power distribution to the sump pumps with the capability of being locked in the "ON" position to be signed as follows. Stamp the words for the sign on a corrosion resistant metal plate with letters 10 mm 3/8 inch high, and affix the plate permanently near the switch or circuit breaker.

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.

3.8 TESTS

Perform tests of piping in the valve manholes as part of the testing of the direct buried conduit system. Iinclude the piping in the valve manhole in these tests and perform in accordance with the system supplier's Approved Brochure or the contract specifications.

-- End of Section --