SECTION 23 2113

HYDRONIC PIPING

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LANL MASTER SPECIFICATION SECTION

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| Rev. 7 Summary of ChangesDeleted Article *Summary*. Updated Articles *Related Sections* and *References*. Revamped *Submittals* to standardize across piping specification sections. Clarified when unlisted component evaluations are required in submittal space. Revised piping, fittings, and components throughout Part 2 to ensure template is ASME B31.9-compliant. Added article on *Seismic Performance Requirements* in Part 2. Clarified some items in Article *Installation*. Miscellaneous updates throughout to better align with ESM Ch. 6 and Ch. 17 requirements. Updated Part 3 to standardize across other piping sections and other minor editorial changes. |

Word file at <https://engstandards.lanl.gov>

This section is for water from vacuum to 350 psig and temperature from 0–250 degrees F (ASME B31.9-2020 scope). This template was developed to meet the requirements of ASME B31.9-2020. Note that some items listed in this section may have pressure or temperature ratings below that of the limits of the scope of the code. It is the designer’s responsibility to select components compatible with the design parameters of the piping system.

The designer is encouraged to review ESM Chapters 6, 13, and 17.

**This specification section does not meet the requirements for ASME B31.9 and ASME BPVC Section IV for boiler external piping. Changes to allowed materials is required when specifying boiler external piping. See ASME B31.9-2020 Figure 900.1.2 Code Jurisdictional Limits for Piping — Drum-Type Boilers, for locations to apply boiler external piping. Boiler External piping requires the use of ASME BPVC Section II, *Materials*.**

Any steam components that have an interface with hydronic piping such as heat exchanges shall be specified within Section 23 2215, *Steam* *and Condensate Heating Piping and Specialties*.

This template must be edited for each project. In doing so, Specifier must add job-specific requirements. Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets.  The section must also be edited to delete requirements for processes, items, or designs that are not included in the project -- and specifier’s notes such as these.  This template is written to meet requirements contained in the LANL Engineering Standards Manual (ESM).To seek a variance from or alternate method to requirements in the section that are applicable, contact the ESM Pressure Safety [POC](https://engstandards.lanl.gov/POCs.shtml#pressure) and/or Mechanical [POC](https://engstandards.lanl.gov/POCs.shtml#mech). Please contact POCs with suggestions for improvements as well.

When assembling a specification package, include applicable sections from all Divisions, especially Division 1, General Requirements.

This template was developed for ML-4 projects.  For ML-1, 2, and 3 applications, additional requirements might be necessary if increased confidence in procurement or execution is desired, and independent review is necessary. See ESM Chapter 1 Section Z10 Specifications and Quality sections.
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1. GENERAL

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For water treatment piping, see Section 23 2500, *HVAC Water Treatment.*

For potable water systems, see Section 22 1100, *Facility Water Distribution.*

For make-up water systems for cooling towers and process water loop, see Section 22 1100*, Facility Water Distribution*.

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* 1. SECTION INCLUDES
		1. Site and building pipe materials, fittings, valves, and accessories for:
			1. HVAC cooling water and heating water
			2. Chilled water
			3. Tower water
			4. Blow down piping
			5. Equipment gravity drains, and overflow piping.
			6. [includes above ground and buried piping for some applications.]
	2. RELATED SECTIONS
		1. Section 01 2500, *Substitution Procedures*
		2. Section 01 3300*, Submittal Procedures*
		3. Section 01 4000, *Quality Requirements – Non-nuclear*
		4. Section 01 4115, *Pressure Safety Submittals*
		5. Section 01 4216, *Definitions*
		6. Section 01 4444, *Offsite Welding, Brazing & Joining Requirements.*
		7. Section 01 4455, *Onsite Welding, Brazing & Joining Requirements.*
		8. Section 01 4525, *Nondestructive Examination* (*NDE) Requirements*
		9. Section 01 4631, *Welding, Brazing, and Soldering of ASME B31 Piping*
		10. Section 01 4731, *Flange Assembly for ASME B31 Systems*
		11. [Section 01 8113.13 Sustainable Design **[LEED v4 and]**Guiding Principles 2020: *Requirements for water efficiency, energy efficiency, material composition, and indoor air quality requirements*]
		12. Section 07 8400, *Firestopping*
		13. Section 22 0529, *Hangers and Supports for Plumbing Piping and Equipment*
		14. [Section 22 0548.23, *Vibration and Seismic Controls for Mechanical Systems]*
		15. Section 22 0554, *Identification for Plumbing, HVAC, and Fire Piping and Equipment.*
		16. Section 22 0713, *Plumbing and HVAC Insulation*
		17. Section 22 0813, *Testing Piping Systems*
		18. Section 23 2500, *HVAC Water Treatment*
		19. Section 25 5000, *Integrated Automated Facility Controls*
		20. Section 31 2000, *Earth Moving*

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In the listing below, designer shall eliminate code and standards that are not applicable to the project and add other code and standards that are. The referenced standards editions are based on the code of record ASME B31.9-2020 and ASME BPVC-2023. If the Code of Record for the project refers to a different version of ASME B31.9 & ASME BPVC, the designer is responsible to update the years/editions for the invoked standards. If the invoked standards editions do not comply with those referenced by the Code of Record, EOR needs to evaluate and verify those for equal or better. For the standards without an edition/year, the latest edition is to be used. In addition, the designer must ensure the code and standards editions align between sections in the project specification package and the project design drawings.

Note: ASCE 7 edition is based on Code of Record IBC 2021.

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* 1. REFERENCES
		1. ASCE 7-[16], Minimum Design Loads and Associated Criteria for Buildings and Other Structures
		2. ASME B1.20.1-[2013(R2018)], Pipe Threads, General Purpose (Inch)
		3. ASME B16.3-[2021], Malleable Iron Threaded Fittings Classes 150 and 300
		4. ASME B16.5-[2020], Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard
		5. ASME B16.9-[2018], Factory-Made Wrought Buttwelding Fittings
		6. ASME B16.18-[2021], Cast Copper Alloy Solder Joint Pressure Fittings
		7. ASME B16.22-[2021], Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
		8. ASME B16.24-[2022], Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500
		9. ASME B16.39-[2020], Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
		10. ASME B16.42-[2021], Ductile Iron Pipe Flanges and Flanged Fittings
		11. ASME B31.9-[2020], Building Services Piping
		12. ASME B40.100, Pressure Gauges and Gauge Attachments
		13. ASME B40.200, Thermometers, Direct Reading and Remote Reading
		14. ASME BPVC Section VIII, Division 1-[2023], Rules for Construction of Pressure Vessels
		15. ASME BPVC Section IX-[2023], Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators
		16. ASME BPVC Section XIII-[2023], Rules for Overpressure Protection
		17. ASTM A53/A53M-[2012], Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
		18. ASTM A105/A105M-[2014], Standard Specification for Carbon Steel Forgings for Piping Applications
		19. ASTM A126-[2004R2014], Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
		20. ASTM A197/A197M-[2000(R2015)], Standard Specification for Cupola Malleable Iron
		21. ASTM A234/A234M-[2015], Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
		22. ASTM A536-[1984(R2014)], Standard Specification for Ductile Iron Castings
		23. ASTM B62-[2015], Standard Specification for Composition Bronze or Ounce Metal Castings
		24. ASTM B68/B68M-[2011], Standard Specification for Seamless Copper Tube, Bright Annealed
		25. ASTM B75/B75M-[2011], Standard Specification for Seamless Copper Tube
		26. ASTM B88-[2014], Standard Specification for Seamless Copper Water Tube
		27. ASTM B280-[2016], Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
		28. ASTM G62, Standard Test Methods for Holiday Detection of Coatings to Protect Pipelines
		29. AWWA C110-[2012], *Ductile-Iron and Gray-Iron Fittings*
		30. AWWA C111-[2012], *Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings*
		31. AWWA C151-[2009], *Ductile-Iron Pipe, Centrifugally Cast*
		32. AWWA C153-[2019], *Ductile-Iron Compact Fittings*
		33. AWWA C606-[2015], *Grooved and Shouldered Joints*
		34. MSS SP-25-[2013], Standard Marking System for Valves, Fittings, Flanges, and Unions
		35. MSS SP-67-[2011], *Butterfly Valves*
		36. MSS SP-70-[2011], *Gray Iron Gate Valves, Flanged and Threaded Ends*
		37. MSS SP-71-[2011], *Gray Iron Swing Check Valves, Flanged and Threaded Ends*
		38. MSS SP-72-[2010a], *Ball Valves with Flanged or Butt-Welding Ends for General Service*
		39. MSS SP-80-[2013], *Bronze Gate, Globe, Angle, and Check Valves*
		40. MSS SP-85-[2011], *Gray Iron Globe and Angle Valves, Flanged and Threaded Ends*
		41. MSS SP-110-[2010], *Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends*
		42. NMAC, *New Mexico Administrative Code*
	2. SUBMITTALS
		1. Submit the following in accordance with Section 01 3300, *Submittal Procedures*
		2. Action Submittals:
			1. Catalog data on pipe materials, fittings, valves, and accessories. Include the manufacturer’s name, model number, parts list, and brief description of equipment and its basic operational features, i.e., data sheet, spec sheet, etc.

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When offsite only, delete submittals below regarding onsite welding. When onsite only, delete submittals below for offsite welding. For high-risk applications such as ML-1 or ML-2, add submittals for “Weld Filler Material Control Procedures” and “Filler Material Certified Material Test Reports CMTRs” when required. Add “Post-Weld Heat Treatment Procedures” when required.

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* + - 1. Per the requirements of Section 01 4444, *Offsite Welding, Brazing And Joining Requirements* and/or Section 01 4455, *Onsite Welding, Brazing And Joining Requirements*, submit:
				1. Welding procedure specification (WPS) and supporting procedure qualification record (PQR). [note: for onsite welding use of LANL WPS/PQR is the default; coordinate usage with the LANL CWI; no submittal required]
				2. Welder performance qualification records (WPQR) including continuity [note: for Onsite, welders are tested by LANL who will produce WPQR and track continuity; this includes brazing, bonding and fusing; no submittal required]
			2. [Per the requirements of Section 01 4525, *Nondestructive Examination* (*NDE) Requirements*, submit:
				1. Written Practice or Procedure for Qualification and Certification of NDE personnel.
				2. NDE Personnel Qualification Records
				3. NDE Procedures
				4. [NDE Procedure Qualification Records (Note: this is not required per ASME B31.9 unless requested by EOR)]
				5. NDE Report(s)
				6. NTIP submitted under Section 01 4525.]
			3. Before fabrication, submit:
				1. Proof of journeyman certificate of competence in accordance with NMAC 14.6.6.11
				2. Leak test plan submitted under Section 22 0813
				3. Cleaning procedures for joint assembly preparation
			4. After fabrication, submit examination records per ASME B31.9 para. 936.3.
		1. Informational Submittals.
			1. Spare Parts and Maintenance Materials list
			2. Installation, Operation, & Maintenance Manual
			3. Warranties
			4. Manufacturer’s data report form for ASME boilers and/or pressure vessels (e.g., ASME Form H-3 and U-1) showing National Board registration
	1. QUALITY ASSURANCE
		1. Material and Installation: Conform to ASME B31.9 for systems operating at pressure of 350 psig or less and at temperature of 250 degrees F or less.
		2. Welders Certification and Qualified Procedure Standards shall be in accordance with Section IX of ASME Boiler and Pressure Vessel Code. Welding per Sections [01 4444, *Offsite Welding, Brazing and Joining Requirements,* and/or 01 4455, *Onsite Welding, Brazing and Joining Requirements*].
		3. [NDE Personnel Certification and NDE Procedures shall be per Section 01 4525, *Nondestructive Examination (NDE) Requirements*.]
		4. Valve Identification: Each valve shall bear markings in accordance with MSS SP-25, including manufacturer’s name or trademark, the material of construction, and symbols to indicate the service conditions for which the manufacturer rates the valve.
		5. Component identification shall follow [ESM Chapter 1, Section 200, Item Numbering and Labelling](https://engstandards.lanl.gov/ESM_Chapters.shtml#esm1)*.* At existing facilities, component labeling conventions are to be continued to be used to avoid confusion.
		6. Design pressure and temperature of piping systems within this Section is provided in the Pressure Safety Implementation Plan, contained in [drawing or document number].
1. PRODUCTS
	1. PRODUCT OPTIONS AND SUBSTITUTIONS
		1. Alternate products may be accepted; follow Section 01 2500, *Substitution Procedures* and 01 4115, *Pressure Safety Submittals.*
		2. Proposal of unlisted components as substituted products is strongly discouraged and shall be evaluated per Section 01 2500, *Substitution Procedures*. Substitutions will be allowed only if the Subcontractor can demonstrate that the product can meet the same code requirements of the item specified in the design. Costs associated with evaluation of substituted unlisted components shall be the responsibility of the Subcontractor.
	2. SEISMIC PERFORMANCE REQUIREMENTS

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The seismic exemptions noted below are based on ASCE 7-16. If the Code of Record for the project refers to a different version of ASCE 7, the Designer is responsible to check the seismic design requirements per that applicable edition.

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* 1. Piping systems with trapeze assemblies/rod hangers that meet the requirements per ASCE 7, Section 13.6.7.3 are seismically exempt.
	2. For piping systems not meeting the above exemption, Structural EOR shall design seismic supports per [ESM Chapter 5, Structural, Section II](https://engstandards.lanl.gov/ESM_Chapters.shtml#esm5); ASCE 7, Chapter 13; and ASME B31.9.

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On Welding, brazing, soldering: When specifying joints, consider that welding, brazing, or soldering reduces the tube rating to the fully annealed condition. Welding, brazing, soldering shall meet Section 01 4631, *Welding, Brazing, and Soldering of ASME B31 Piping.*

On flanges: Use Section 01 4731, *Flange Assembly for ASME B31 Systems*. Use ASME PCC-1, *Pressure Boundary Bolted Flange Joint Assembly*, for ASME B16.5 flanges.

On copper tubing: Designer shall match ASTM spec and the tempers available within that spec to the allowable Conditions listed in ASME B31.9 Table I-1. For example, note that O50 (light annealed) and O60 (soft annealed) may not meet the ASME B31.9 callout for “Annealed” (O61).

Designation of Schedule and Standard pipe deviate in thickness after 12 inch size.

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* 1. [[HEATING] [COOLING] [CHILLED] [TOWER] WATER PIPING, BURIED OR ABOVE GRADE
		1. Copper tubing ASTM [B68] [B75] [B88] [B280], Alloy [102] [122], Temper [O50] [O60] [O61] [O62] [H55] [H58] [H80].
			1. Braze Joints
				1. Fittings: ASME B16.22, wrought copper and copper alloy solder joint pressure fittings [and/or] ASME B16.18 cast-copper-alloy solder joint pressure fittings
				2. Comply with Section [01 4444, *Offsite Welding, Brazing and Joining Requirements*, 01 4455, *Onsite Welding, Brazing and Joining Requirements,* 01 4631*, Welding, Brazing, and Soldering of ASME B31 Piping*].

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Do not specify solder joints for buried piping.

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* + - 1. Solder joints
				1. Fittings: ASME B16.22, wrought copper and copper alloy, solder joint pressure fittings [and/or] ASME B16.18 cast copper alloy solder joint pressure fittings

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Do not specify press joints for buried piping.

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* + - 1. Press joints
				1. Application is restricted to 50 percent glycol solution up to [200] [250] [284] degrees F
				2. Tubing standard: ASTM B88 hard drawn tubing (Types K and L) between ½ and 4 inches nominal.
				3. Fittings: [Viega ProPress with [FKM][HNBR] sealing elements][Nibco Press].
		1. Steel Pipe and Fittings up to 2 Inches:
			1. Pipe: Black Steel, ASTM A53, Type [E, F, S], Grade [A or B], Schedule [40] [80].
			2. Threaded joints: ASTM A197 malleable iron, ASME B16.3 threaded type ASME B1.20.1, Class [150] [300]
			3. Unions: ASME B16.39 malleable iron, threaded type ASME B1.20.1, Class [150] [200] [300]
		2. Steel Pipe and Fittings greater than 2 Inches:
			1. Pipe: Black Steel, ASTM A53, Type [E, F, S], Grade [A or B], Schedule [40] [80].
			2. [Bolted Joints: ASME B16.5 forged carbon steel, ASTM A105, Class 150.] Flange hardware per Section 01 4731*, Flange Assembly for ASME B31 Systems*.
			3. [Welded Joints: Carbon steel, ASTM A234 Grade WPB, butt welding type per ASME B16.9. Wall thickness to match pipe schedule.]
			4. [Mechanical Joints: Pipe ends prepared per AWWA C606. Fittings to be Victaulic grooved fittings and couplings.]

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Ductile iron pipe shall not be specified for above-grade piping.

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* + 1. Ductile Iron Pipe:
			1. AWWA C151 for [3 inch, \_\_\_ inch, 48 inch] inch pipe size, Rated Water Working Pressure Class [150] [200] [250] [300] [350], suitable for trench Type [1] [2] [3] [4] [5].
			2. Fittings:
				1. AWWA C110 Fittings:
				2. [350 psig pressure rating for [3 inch, \_\_\_\_ inch, 24 inch], ductile-iron push-on-joint fittings or flange-joint fittings]
				3. [250 psig pressure rating for [24 inch, \_\_\_\_ inch, 48 inch], [ductile-iron, grey-iron] ]
				4. [150 psig pressure rating for [24 inch, \_\_\_\_ inch, 48 inch], [grey-iron]
				5. AWWA C153 Ductile-Iron Compact Fittings, Class 350.
				6. [350 psig pressure rating for [3 inch, \_\_\_\_ inch, 24 inch], ductile-iron mechanical or push-on-joint fittings]
				7. [250 psig pressure rating for [30 inch, \_\_\_\_ inch, 48 inch], [ductile-iron mechanical or push-on-joint fittings]
				8. Joints: Synthetic rubber gaskets meeting AWWA C111 [ring and/or full-face] conforming to AWWA C110 Table A.1.
			3. Bolted Joints:
				1. Fittings: ASME B16.42 Ductile Iron Pipe Flanges and Flanged Fittings, Class [150, 300].
				2. Flange hardware per Section 01 4731*, Flange Assembly for ASME B31 Systems*.
			4. Mechanical Joints:
				1. Mechanical joint bell, socket, plain ends, and accessories: AWWA C111 using [ductile-iron, grey-iron]
				2. [Manufacturers and model numbers]
	1. PRESSURIZED BLOW DOWN PIPING, BURIED OR ABOVE GRADE
		1. Copper tubing ASTM [B68] [B75] [B88] [B280], Alloy [102] [122], Temper [O50] [O60] [O61] [O62] [H55] [H58] [H80].
			1. Braze Joints
				1. Fittings: ASME B16.22, wrought copper and copper alloy, solder joint pressure fittings [and/or] ASME B16.18 cast copper alloy
				2. Comply with Section [01 4444, *Offsite Welding, Brazing and Joining Requirements*, 01 4455, *Onsite Welding, Brazing and Joining Requirements,* 01 4631*, Welding, Brazing, and Soldering of ASME B31 Piping*].

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Do not specify solder joints for buried piping.

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* + - 1. Solder joints
				1. application is restricted to less than 4.125 inch OD.
				2. Fittings: ASME B16.22, wrought copper and copper alloy, solder joint pressure fittings [and/or] ASME B16.18 cast copper alloy solder joint pressure fittings

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Do not specify press joints for buried piping.

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* + - 1. Press joints
				1. Application is restricted to 50 percent glycol solution up to [200] [250] [284] degrees F
				2. Tubing standard: ASTM B88 hard drawn tubing (Types K and L) between ½ and 4 inches nominal.
				3. Fittings: [Viega ProPress with [FKM][HNBR] sealing elements][Nibco Press].
		1. Steel Pipe and Fittings up to 2 Inches:
			1. Pipe: Black Steel, ASTM A53, Type [E, F, S], Grade [A or B], Schedule [40] [80].
			2. Threaded joints: ASTM A197 malleable iron, ASME B16.3 threaded type ASME B1.20.1, Class [150] [300]
			3. Unions: ASME B16.39 malleable iron, threaded type ASME B1.20.1, Class [150] [200] [300]
		2. Steel Pipe and Fittings greater than 2 Inches:
			1. Pipe: Black Steel, ASTM A53, Type [E, F, S], Grade [A or B], Schedule [40] [80].
			2. [Bolted Joints: ASME B16.5 forged carbon steel, ASTM A105, Class 150.] Flange hardware per Section 01 4731*, Flange Assembly for ASME B31 Systems*.
			3. [Welded Joints: Carbon steel, ASTM A234 Grade WPB, butt welding type per ASME B16.9. Wall thickness to match pipe schedule.]
			4. [Mechanical Joints: Pipe ends prepared per AWWA C606. Fittings to be Victaulic grooved fittings and couplings.]
	1. EQUIPMENT GRAVITY DRAINS AND OVERFLOWS (ALL EQUIPMENT)
		1. Steel Pipe and Fittings up to 2 Inches:
			1. Pipe: Galvanized Steel, ASTM A53, Type [E, F, S], Grade [A or B], Schedule [40] [80].
			2. Threaded joints: [Galvanized grey iron per ASME B16.12] [ASTM A197 malleable iron, ASME B16.3] threaded type ASME B1.20.1, Class [150] [300]
			3. Unions: ASME B16.39 malleable iron, threaded type ASME B1.20.1, Class [150] [200] [300]
		2. Steel Pipe and Fittings greater than 2 Inches:
			1. Pipe: Galvanized Steel, ASTM A53, Type [E, F, S], Grade [A or B], Schedule [40] [80].
			2. [Bolted Joints: ASME B16.5 forged carbon steel, ASTM A105, Class 150.] Flange hardware per Section 01 4731*, Flange Assembly for B31 Systems*.
			3. [Welded Joints: Carbon steel, ASTM A234 Grade WPB, butt welding type per ASME B16.9. Wall thickness to match pipe schedule.]
			4. [Mechanical Joints: Pipe ends prepared per AWWA C606. Fittings to be Victaulic grooved fittings and couplings.]

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All the following components (disregarding ASME BPVC items) are either standard piping components (listed items) per ASME B31.9 para. 926 or have previously LANL approved unlisted component evaluations in accordance with ASME B31.9 para. 904.7.

The types of components shown may be a non-exhaustive list. Any substitutions or additions shall be ASME B31.9 compliant. All previously LANL approved ASME B31.9 components are available in the [LANL ESM Ch. 17](https://engstandards.lanl.gov/ESM_Chapters.shtml#esm17) Approved ASME Unlisted Material/Component List and Approval Process under Chapter References and Resources.

Provide globe valves for throttling, bypass, or manual flow control services. Any valves used for pressure reducing valve bypass shall have a flow capacity (Cv) no greater than that of the reducing valve per ASME B31.9 para. 922.1.3. Bypass valves shall be capable of administrative control.

Provide gate valves inside building to isolate equipment or part of piping system.

Provide safe access or remote operators where valves and fittings are not exposed or installed over 7 feet in height above finished floor.

Provide ball valves at low points of piping system. Provide ball valves on strainer drain ports.

**Information on valves below are provided for soldered/brazed/threaded/flanged connections. If using press joints, replace applicable entries with information on press joint valves.**

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* 1. VALVES
		1. Gates Valves up to 2 inches.
			1. Manufacturer: Nibco, Series 111.
			2. MSS SP-80 Class [125, 150 for threaded, or solder] ends, valve type [1A, 1B, 2, 3, or 4] bronze body, bronze trim.
		2. Gate Valves above 2 inches to 12 inches.
			1. Manufacturer: Nibco, Series F-617-0
			2. MSS SP-70, Class [125, 250], valve type [I, II, III, IV], construction [NF: non-rising stem, OF: outside screw and yolk], iron body, bronze trim flanged ends.
		3. Globe Valves up to 2 inches.
			1. Manufacturer: Nibco, Series 211.
			2. MSS SP-80, Class [125, 150 for threaded, or solder] ends, valve type [1, 2, or 3] bronze body, bronze trim, rising stem, hand wheel, inside screw.
			3. Flow coefficient Cv: [ ]
		4. Globe Valves above 2 inches to 10 inches.
			1. Manufacturer: Nibco F-718-B.
			2. MSS SP-85, Class 150 flanged ends, iron body, bronze trim, hand wheel, type [1, 2, or 3] removable bronze disc.
			3. Flow coefficient Cv: [ ]
		5. Ball Valves up to 2 inches.
			1. Manufacturer: Nibco, Series 585-70.
			2. MSS SP-110, 150 psi non-shock cold working pressure (CWP) minimum pressure rating
			3. Bronze, two-piece body, chrome-plated brass ball, full port, Teflon seats and stuffing box ring, blowout proof stem, lever handle, solder or threaded ends.
		6. Ball Valves above 2 inches to 12 inches.
			1. Manufacturer: Nibco, Series F-510-CS-R-66-FS
			2. MSS SP-72, one piece carbon steel body, full port ball, ASME B16.5 flange class 150, 150 psig non-shock cold working pressure (CWP) minimum.
		7. Butterfly Valves 2 inches to 12 inches
			1. Manufacturer: Nibco, Series GD-4775
			2. Standard: Design to comply with MSS SP-67, Type I (tight shut-off), AWWA C606 end connections, non-shock cold working pressure (CWP) minimum pressure rating.
		8. Butterfly Flanged Valves 2 inches to 12 inches
			1. Manufacturer: Nibco, Series FD-57[6=EPDM, 7=BUNA]
			2. Standard: Design to comply with MSS SP-67, Type I (tight shut-off), flanged end connections class 150, minimum, non-shock cold working pressure (CWP) minimum pressure rating.
		9. Butterfly Wafer or Lug Valves above 2 inches to 12 inches
			1. Manufacturer: Nibco, Series WD 2000/ LD 2000
			2. Design to comply with MSS SP-67, Type I (tight shut-off). Bolting compatible with class 150 flange, 150 psig non-shock cold working pressure (CWP) minimum pressure rating.
		10. Lift Check Valves sizes up to 2 inches.
			1. Manufacturer: Nibco 473 Series.
			2. MSS SP-80, Type [1, 2] bronze, horizontal swing, Y-pattern, renewable seat and disc, non-shock cold working pressure (CWP) minimum pressure rating. Solder or threaded ends.
		11. Lift Check Valves sizes above 2 inches to 12 inches.
			1. Manufacturer: Nibco F-918-B.
			2. MSS SP-71, grey iron, type I [II, III, IV] class 125, flanged end connections, 150 psig minimum pressure rating.
		12. Spring Check Valves up to 2 inches.
			1. Manufacturer: Nibco 480 Series.
			2. MSS SP-80, Type [1, 2] bronze, horizontal swing, Y-pattern, renewable seat and disc, non-shock cold working pressure (CWP) minimum pressure rating. [Solder] [Threaded] ends.
		13. Balancing Valves
			1. Size above 3 inches to 12 inches:
				1. Manufacturer: Bell and Gossett
				2. Model Number: Circuit Setter cb-[3, \_\_\_,12]F
				3. End Connections: Flanged
			2. Size up to 3 inches:
				1. Manufacturer: Bell and Gossett
				2. Model Number: Circuit Setter cb-[½, \_\_\_, 3][S]
				3. End Connections: [Solder] [NPT]

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Pressure and Vacuum Gauges: Overpressure relief protection must be provided on Bourdon-tube, dial-indicating pressure gauges that operate at pressures greater than 15 psig by one of the following means:

1. Pressure gauges approved by Underwriters Laboratories (UL) in accordance with UL-404.
2. Tempered safety glass or plastic face or shield and a blowout back or plug for pressure relief.

Pressure gauges that serve primarily a pressure indication for overpressure protection (i.e., not used for process data collection) must have a range of at least 1.25 times, but no more than twice the set pressure of the relief device as recommended in ASME Section VIII, Div. 1, Appendix M, Para. M-14.

Refer to manufacturer’s recommendation for gauge pressure range. Generally, a pressure range of twice the expected normal pressure is recommended with maximum working pressure not exceeding 75 percent of the range. If pulsation occurs, working pressure should not exceed 65 percent of the pressure range. Pressure gauges in the suction side of the pump will be vacuum pressure gauges.
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* 1. PRESSURE GAUGES
		1. Manufacturer: Ashcroft, Type 1009
		2. Gauge: ASME B40.100, Accuracy Grade 1A, minimum 2-1/2 inch dial, 1/4 inch NPT brass bottom connection, phosphor bronze bourdon tube, maximum plus or minus 1 percent accuracy full scale, stainless steel case, process temperature limit of -40 degrees F to 250 degrees F, and with stainless steel tube.
			1. Range: [ psi] [per drawings].
			2. Required options: Dry gauge, pressure relief blowout plug, acrylic or shatter-proof glass
			3. [Isolation Valve: ¼ inch brass plug, minimum 250 psi working pressure valve. Manufacturer: \_\_\_\_\_\_\_Part No.\_\_\_\_\_\_\_\_]
	2. THERMOMETER
		1. Manufacturer: Reotemp
		2. Model: [MM]
		3. ASME B40.200, Grade A, maximum plus or minus 1 percent full scale accuracy, bimetal thermometer, mercury free, minimum 4 inches dial, stainless steel case, all angle direct mount, with connection to match thermowell size.
			1. Range: [ ] degrees F.
			2. Stem Length: [ ] inch.
	3. THERMOWELL
		1. Thermowell design meeting ASME PTC 19.3 TW
		2. Manufacturer: Daily Thermetrics, [½] [¾] [1] inch NPT
		3. Material: [316 stainless steel rated at 7000 psig at 70 degrees F] [Brass rated at 5000 psig at 70 degrees F]
	4. DIELECTRIC CONNECTIONS
		1. Unions
			1. Union with galvanized or plated-steel threaded-end, copper solder-end, and water-impervious isolation barrier. Rated to 250 psig and conform to ASME B16.39.
			2. Size: [1/2, \_\_\_, 2] inch
			3. Make/Model: Watts 3001A
		2. Flanges
			1. Dielectric flanged fittings, rated to 175 psig and conforming to ASME B16.42 (ductile iron), ASME B16.24 (copper alloy). [Iron pipe thread to copper solder joint end connections.]
			2. Size: [2, \_\_\_, 4] inch
			3. Gasket: [Buna-N (180 degrees F at 250 psi)] [EPDM (300 degrees F at 50 psi)]
			4. Bolt insulators: Watts Insulator Kit
			5. Make/Model: [Watts 3100]
	5. PRESSURE TEMPERATURE TEST PORT
		1. Manufacturer: Pete’s Plug
			1. 316 stainless steel, ¼ inch, suitable for use in 150 psig systems. Provide extra-long (XL) plug when pipe insulation exceeds 1 in. thickness.

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Provide automatic air vents at high points of system. Provide isolation ball valve at inlet connection.

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* 1. AUTOMATIC AIR VENTS
		1. Manufacturer: Spirax Sarco Automatic Air Vents, Model [13WS][13WHS]
			1. Body: [ASTM A126 Class B cast iron body] [ASTM B62 brass body]
			2. Pressure and Temperature Rating: [150 psig] [300 psig] @ minimum 317 degrees F
			3. Size/end connections: 3/4 inch x 3/8 inch
		2. Manufacturer: Bell & Gossett Automatic Air Vents, Model No. 87
			1. Body: Brass with non-ferrous internals
			2. Pressure and Temperature Rating: Rated for 150 psi @ 240 degrees F
			3. Size/end connection: Combination ½ inch female NPT and ¾ inch male NPT
	2. BASKET STRAINERS
		1. Size 8 inch to 24 inch
			1. Manufacturer/Model: Eaton Model 510
			2. Body: Carbon steel, 150 psi pressure rating
			3. End connection: Class 150 flanges
			4. Basket type: [\_\_\_\_\_ mesh] [\_\_\_\_\_ inch perforations]
			5. Additional options: [\_\_\_\_\_]
		2. Size 2 inch to 6 inch
			1. Manufacturer/Model: Eaton Model 72
			2. Body: [Iron] [Bronze] [Carbon Steel], 200 psi pressure rating
			3. Seals: [Buna-N] [Viton]
			4. End connection: [Threaded] [Class 125 flange] [Class 150 flange]
			5. Basket type: [\_\_\_\_\_ mesh] [\_\_\_\_\_ inch perforations]
			6. Additional options: [\_\_\_\_\_]

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ASME BPVC Section IV hot water boilers use relief devices rated as BTU per hour (BTU/Hr). These valves are stamped HV for saturated hot water service. The use of an ASME Stamped HV **temperature and pressure relief valve** are restricted to hot water heating or supply boilers in accordance with ASME BPVC Section VI HG 402A.2.

If the designer opts to include relief device information other than below, including complete part number (e.g., drawing bill of materials), the relief valve section below shall be deleted.

ASME BPVC Section XIII Table 2.1-1 provides pressure relief devices and methods permitted by ASME BPVC Sections. [ESM Ch. 17](https://engstandards.lanl.gov/ESM_Chapters.shtml#esm17) Section PS-REQUIREMENTS 8.5 *Overpressure Protection Requirements* provides LANL-specific information on relief device requirements for most common Design Basis piping systems.

Pipe relief device to nearest floor drain. For threaded relief valves, install a union in the piping to allow the valve to be replaced for preventive maintenance.

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* 1. RELIEF VALVE
		1. Manufacturer/model number: [Aquatrol Series 740][Watts Series 174A]
		2. [Bronze/brass body, stainless steel trim, ASME Section XIII (UV) rated for liquid service, maximum pressure and temperature rating 300 psig and 406 degrees F.] [Iron body, ASME Section XIII (HV) rated for saturated water service, maximum temperature 250 degrees F.]
			1. Connection Sizes and type: [1/2 inch inlet, ¾ inch outlet, NPT] [as shown on drawings].
			2. Set Pressure: [ ] psi.
			3. Capacity: [ gpm] [ BTU/hr].
	2. VIBRATION ELIMINATION
		1. Manufacturer: Universal Hose & Braid
		2. Model: Anaconda [model number]
		3. Material: [Bronze] [Stainless Steel] braided hose
		4. End connections: Copper ends conforming to ASME B16.18 and B16.22
		5. Diameter [ ] inch
		6. Length [ ] inch
		7. Pressure rating [ ] psig
	3. EXPANSION TANK
		1. An expansion tank is required on hot water heating and chilled water closed piping systems. An ASME coded tank is required.
		2. Size: [ ] gal
		3. Manufacturer: [ ]
		4. Model Number: [ ]
		5. ASME code stamp for ASME Boiler and Pressure Vessel Code Section VIII, Division 1. Provide NBIC numbering and registration.
	4. CHEMICAL POT FEEDER WITH FILTER
		1. Manufacturer: [Griswold Water Systems]
		2. Series: [Professional DB-GE]
		3. Model: [DB-12-GE-CS-A.]
		4. ASME code stamp for ASME Boiler and Pressure Vessel Code Section VIII, Division 1. Provide NBIC numbering and registration.
		5. Accessories:
			1. Capacity [12] gallon
			2. Connections [3/4 inch FPT] inlet and outlet
			3. Full Bottom Drain
			4. Carbon steel construction
			5. Bolt on holes with anchor bolt holes.
			6. Stainless Steel basket
			7. [Filter bag kit with (4) 25 Micron Filter bags rated for 170 degrees F]
			8. [Funnel kit]
			9. [Victaulic Cap Enclosure rated at 600 psi at 230 degrees F]
	5. PUMP EXPANSION FITTING
		1. Manufacturer: Hyspan
		2. Model: 5501R
		3. Type: Laminated bellows with tie rods.
		4. End connections: ASME B16.5 flange, Class 150
	6. CONTROL VALVES
		1. See Section 25 5000, *Integrated Automated Facility Controls*

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See designer note for Article *Valves* regarding the B31.9-required relationship between bypass and pressure reducing valve flow coefficient Cv.

Typically, this pressure reducing valve is in the scope of UPC (Section 22 1100), not within ASME B31.9 Boiler External Piping.

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* 1. PRESSURE REDUCING VALVE
		1. Manufacturer: Bell and Gossett
		2. Model: [FB-38TU] [B7-12]
		3. End Connections: [½ inch Union NPT/Solder] [3/4 inch NPT]
		4. Brass body, factory setting 12 psig, adjustable range 10-25 psig, removable strainer, low inlet pressure check valve. Rated to 125 psig and 225 degrees F.
		5. Flow Coefficient Cv: [ ]
	2. TRIPLE DUTY VALVE
		1. Supplier: [Aurora] [Bell & Gossett]
		2. Model Number: [3DVG-S] [3DS] [3DV]
		3. Body: [Ductile Iron ASTM A536 GR 65-45-12] [Cast Iron with Bronze Seat]
		4. Size: [2 inch] [3 inch] [4 inch]
		5. End Connections: [ ]
		6. Pressure Rating: [ ] psig
		7. Temperature Rating: [ ] degrees F
1. EXECUTION
	1. PREPARATION
		1. Square, ream pipe and tube ends. Remove burrs.

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Consult manufacturer’s recommendation for the use of acids and cleaning agents to prevent damage.

Ensure safeguards are taken to protect personnel from hazards of cleaning, which may include but not be limited to flying particulates, corrosive chemicals, and harmful vapors.

A suitable chemical and/or mechanical cleaning method shall be used, if necessary, to clean all surfaces to be fabricated.

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* + 1. Cleaning:
1. Remove scale and dirt on inside and outside before assembly.
2. Cleaning will consist of removing all non-adhering material such as loose scale, sand, weld spatter particles, rust, cutting chips, grinding residue, etc. from the inside of the piping assembly by suitable means. This level of cleaning will allow the presence of mill scale and surface rust.
3. [specify any special cleaning requirement]
	* 1. Prepare piping connections to equipment with flanges or unions.
		2. Fastener materials shall be free of nicks, burrs, chips, dirt, and damage (inspect threads, shank, and nuts). All damaged fasteners must be replaced.
	1. BURIED PIPING

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Tracer wire and test station(s): are required when specifying cast iron, ductile iron, and non-metallic piping.

Comply with [Civil Standard Drawings](https://engstandards.lanl.gov/Dwgs_Details.shtml#civil) ST-G30GEN-3 for tracer wire/test station details and ST-G30GEN-4 for trenching detail.

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* + 1. Tracer wire and test station(s).
			1. Provide earth cover, bedding, warning tape, tracing wire and test stations. Refer to Section 31 2000, *Earth Moving*.
		2. Verify that excavation meets the requirements specified in the design drawings.
		3. Do not install underground piping when bedding is wet or frozen.
	1. INSTALLATION
		1. General:
			1. Install piping in conformance with ASME B31.9.
			2. Welding, brazing, or soldering shall be in accordance with Section 01 4631, *Welding, Brazing and Soldering of ASME B31 Piping.*
			3. Assemble flange joints per Section 01 4731, *Flange Assembly for ASME B31 Piping.*
			4. [Prior to operation: fill, clean, and chemically treat piping system. Refer to Section 23 2500, *HVAC Water Treatment*.]
			5. Label piping system in accordance with Section 22 0554, *Identification for Plumbing, HVAC, and Fire Piping and Equipment*.
			6. Insulate piping system in accordance with Section 22 0713, *Piping and HVAC Insulation*. Provide clearance for installation of insulation and access to valves and fittings.
			7. Support piping system in accordance with Section 22 0529, *Hangers and Supports for Plumbing Piping and Equipment*. Do not anchor the pipe. Allow piping to slide and expand or contract with temperature.
			8. [Sleeve and caulk pipes penetrating exterior walls or interior bearing walls. Provide waterproof installation for exterior walls. Provide UL/FM approved through-penetration firestop system when penetrating fire rated barriers (e.g., walls, floors, etc.). See Section 07 8400, *Firestopping*.]
			9. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
			10. For multiple openings in piping mains, the distance between their centers shall be at least the sum of their inside diameters.
			11. Branch connections shall utilize fittings (tee, lateral, or cross) in accordance with listed codes.
			12. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Matching of bronze with steel or copper does not require dielectrics.
			13. Install piping to maintain headroom and neither interfere with use of space nor take more space than necessary.
			14. Group piping whenever practical at common elevations.
			15. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
			16. All valves shall be installed in accordance with the manufacturer's instructions and with sufficient clearance and access for ease of operation and maintenance. Install valves with stems upright or horizontal, not inverted.
			17. Slope water piping at least 1 inch per 40 feet (0.25 percent) in direction of flow and provide drain valves at low points.
			18. Install pressure gauges vertically.
			19. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction, protect open ends with temporary plugs, caps, or residue-free tape.
			20. Install vibration eliminator for [\_\_\_\_\_\_\_\_\_] where shown on drawings.
		2. Welding, brazed, or soldered joints:
			1. Welded, brazed, or soldered joining of piping/tubing and components shall be per Section 01 4631, *Welding, Brazing and Soldering of ASME B31 Piping*.
			2. When brazing/welding or soldering piping/tubing to a valve, follow manufacturer’s instructions to prevent heat damage to valve internals.
		3. Press joints:
			1. Assemble press joints per manufacturer installation instructions using the tooling required by the manufacturer.
				1. [Installation Manual Viega ProPress®, www.viega.us, latest edition]
				2. [NIBCO® Press System ® — Installation Instructions, www.nibco.com, latest edition]
		4. Threaded joints:
			1. Assemble ASME B1.20.1 threaded pipe joints as follows:
				1. No more than six and no less than two threads visible after makeup of the joint.
				2. No severe chipping or tearing of visible threads.
		5. Bolted joints:
			1. Assemble flanges per Section 01 4731, *Flange Assembly for ASME B31 Systems.*
		6. Mechanical coupling joints:
			1. Installation instructions: [Victaulic, I-300 Field Installation Handbook latest edition, www.victaulic.com]
			2. [Tighten the nuts evenly by alternating sides until metal-to-metal contact occurs at the bolt pads. Make sure the housing keys engage the grooves completely during tightening.]
			3. [Visually inspect the bolt pads at each joint to ensure metal-to-metal contact is achieved across the entire bolt pad section.]
	2. EXAMINATION, INSPECTION, AND TESTING
		1. All welding, brazing, and soldering: Inspected, examined, and tested in accordance with Section 01 4631 *Welding, Brazing, and Soldering of ASME B31 Piping* [and Section 01 4525 *Nondestructive Examination* (*NDE) Requirements*].
		2. Externally the pressure system will be free of weld slag, flux, and weld spatter.
		3. Contact LANL Owner’s Inspector to determine the initial inspection points (minimum hold points).
		4. LANL Owner’s Inspector shall have access to any and all design, fabrication, manufacture, fabrication, heat treatment, assembly, erection, examination, testing, records, documentation and other project information or activities to verify that all required examinations and testing have been completed and to inspect the piping to the extent necessary to be satisfied that it conforms to all applicable examination requirements of the Code and of the engineering design and to perform the role defined in ASME B31.3.
		5. LANL Owner’s Inspector is the final authority on acceptance of the project examination or test.
		6. Examination activities to verify the quality of the work must be performed by persons other than those who performed the activity being examined. Such persons must not report directly to the immediate supervisors responsible for work being examined.
		7. The fabrication documentation must have evidence of the examination, the evidence must be maintained in the pressure system documentation package submitted to the pressure safety officer.

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For systems designed to operate above 100 psig, test hydronic piping to 1.5 times design pressure (ASME B31.9 para. 937.3). For systems designed to operate at or below 100 psig, test hydronic piping to either operating pressure (ASME B31.9 para. 937.5) or 1.5 times design pressure (ASME B31.9 para 937.3).

Leak testing of the connections between existing piping and new piping defined below are based in [ESM Ch. 17](https://engstandards.lanl.gov/ESM_Chapters.shtml#esm17) Section PS-REQUIREMENTS 10.3, Pressure and Leak Testing.

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* + 1. Pressure test piping system per Section 22 0813, *Testing Piping Systems,* at the test pressures and durations indicated.
			1. Test with water per ASME B31.9 paragraph [937.3] [937.5] at [ ] psig, holding test pressure for at least [10] minutes. After [10] minutes, reduce to design pressure before checking for leaks.
			2. For modifications to existing piping test the connection between new and existing at normal operating pressure. Bring system up to operating pressure gradually. Visually examine the piping for leaks at one-half the system operating pressure. Perform a final examination at the system operating pressure. No leaking from the piping indicates that the system meets the requirement of the project.
		2. Holiday test buried piping with coating per ASTM G62.
	1. CORROSION CONTROL FOR BURIED PIPING

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Contact LANL ESM Ch. 7 *Electrical* [POC](https://engstandards.lanl.gov/POCs.shtml#elec) for cathodic protection requirements when using buried piping. See also Section 13 4713, *Cathodic Protection*.

Factory pre-insulated piping systems (e.g., Perma Pipe, Multi Therm 500, (303) 751- 4100 or Rovanco Corp, (505) 344-7100), or solid pour-in-place insulation may be used as a replacement for corrosion control and/or field insulation.

Specify a field wrap pipe coating such as polyken or a factory coating suitable for the operating temperature of the piping system.

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* + 1. Pipe Coating. Field-wrap pipe coating such as Polyken or a factory coating suitable for the operating temperature of the piping system. Field-wrap joints and fittings.
			1. Piping Corrosion Tape for Joints and Fittings: Polyken #934-35 35-mil polyethylene tape or LANL-approved equal. Provide manufacturer-recommended primer (Polyken 1027). Maximum Operating Temperature [\_\_\_\_]. Pre-clean pipe per tape manufacturer’s requirements. All joints and fittings field-wrapped with a minimum of two layers of 30-mil corrosion tape.
			2. Field-Applied Corrosion Coating: Polyken #1600-30HT or LANL-approved equal. Provide manufacturer-recommended primer (Polyken 955 or 954). Total thickness 30 mils. Maximum Operating Temperature 180 degrees F. All joints and fittings field-wrapped with a minimum of two layers of 35-mil corrosion tape. Pre-clean pipe per tape manufacturer’s requirements. Field Applied Corrosion Coating System shall be a two-layer system:
				1. Layer One: A liquid adhesive (primer) layer consisting of thermally-activated material formulated for elevated temperature stability.
				2. Layer Two: A coating layer consisting of a cross-linked polyethylene backing and a cross-linked elastomeric adhesive capable of maintaining long-term protection at the temperature up to 180 degrees F.
			3. Factory Applied Corrosion Control Coating: Factory applied fused system consisting of: an adhesive primer layer, with minimum 10-mil thermoplastic elastomer layer and minimum 40-mil polyolefin top layer containing UV protection; or alternate of an epoxy primer layer with minimum 50-mil high-density polyethylene top layer or an approved equal. Product marking shall be transferred to and stenciled to the outside of the pipe coating. Minimum transferred information shall include: pipe specifications, grade, size, type, and heat number in accordance with the certified material test report and the product marking. All joints and fittings shall be field wrapped with a minimum of two layers of 35-mil corrosion tape.
			4. Factory Applied Corrosion Control manufacturers:
				1. Tyco Adhesives, Synergy Plant Coating System.
				2. Tyco Adhesives, VANGUARD Plant Coating System.
				3. LANL-approved equal.
		2. Field-wrap joints and fittings.
			1. Outside Coating: [cement mortar-lined with seal coated with asphaltic materials outside coating.] [asphaltic outside coating] [fusion bonded epoxy spray coating] [corrosion control thin-film coatings from 0.0254 to 0.254 mm (1 to 10 mils)]
				1. [Manufacturer and model numbers]
			2. Inside Lining: [cement mortar-lined] [asphaltic lining] [corrosion control thin-film coatings from 0.0254 to 0.254 mm (1 to 10 mils)]
				1. [Manufacturer and model numbers]
		3. Solid Pour-in-Place Insulation
			1. [Gilsulate, model number]
				1. [Manufacturer and model numbers]

END OF SECTION

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Do not delete the following reference information:

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THE FOLLOWING REFERENCE is FOR LANL USE ONLY

This project specification section is based on LANL Master Specification Section 23 2113, Rev. 7, dated January 8, 2025.