SECTION 232213 - STEAM AND CONDENSATE PIPING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

1. GENERAL
   * + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
      1. SUMMARY
         1. Section Includes:

Steel pipe and fittings.

Stainless steel pipe and fittings.

Joining materials.

* + - * 1. Related Requirements:

Retain subparagraph below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 232216 "Steam and Condensate Heating Piping Specialties" for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

* + - 1. SUBMITTALS
         1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions
         2. Manufacturer’s installation instructions shall be provided along with product data.
         3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
         4. Product Data: For each type of the following:

Steel pipe and fittings.

Stainless steel pipe and fittings.

Joining materials.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel pipe within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

Retain "Delegated Design Submittal" paragraph below if design services have been delegated to Contractor. if design was finished during design phase, by Design Professionals, and incorporated in the contract documents, remove "calculation" requirements.

For acceptable reason, if full design can't be finished during design phase, delegated design submittal, including calculations, shall be prepared by the Professional Engineer, hired by the Contractor, and submitted for review and approval by the Contractor.

* + - * 1. Delegated Design Submittal:

Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.

Locations of pipe anchors and alignment guides and expansion joints and loops.

Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

* + - * 1. Qualification Data: For Installer.

Retain "Welding certificates" paragraph below if retaining "Steel Support Welding" or "Pipe Welding" paragraph in "Quality Assurance" Article.

* + - * 1. Welding certificates.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
      1. QUALITY ASSURANCE
         1. Installer Qualifications:

Retain "Steel Support Welding" and "Pipe Welding" paragraphs below for welded supports or piping. AWS states that welding qualifications remain in effect indefinitely unless welding personnel have not welded for more than six months or there is a specific reason to question their ability.

* + - * 1. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."
        2. Pipe Welding: Qualify procedures and operators according to the following:

Retain applicable options in "ASME Compliance" subparagraph below. Retain all three options if steam system includes high and low pressure.

ASME Compliance: Comply with [**ASME B31.1, "Power Piping,"] [and] [ASME B31.9, "Building Services Piping,"**] for materials, products, and installation.

Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. PERFORMANCE REQUIREMENTS

Performance requirements in this article are for the piping system. Individual components may have higher pressure or temperature ratings.

* + - * 1. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:

Pressures and temperatures below are provided for information only, and should be inserted for each Project as the working pressures and temperatures are unique to each system.

Insert minimum working pressure for systems in "HP Steam Piping," "LP Steam Piping," and "LP Clean Steam Piping" subparagraphs below.

HP Steam Piping: <**Insert psi**g>.

LP Steam Piping: <**Insert psig**>.

LP Clean Steam Piping: <**Insert psig**>.

Insert or retain minimum working pressure and temperature for systems in "Condensate Piping," "Clean Steam Condensate Piping," and "Makeup-Water Piping" subparagraphs below.

Condensate Piping: <**Insert psig> at [250 deg F ] <Insert temperature**>.

Clean Steam Condensate Piping: <**Insert psig> at [250 deg F ] <Insert temperature**>.

Makeup-Water Piping: [**80 psig**] [**150 psig] <Insert value> at [150 deg F] <Insert temperature**>.

Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.

Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.

Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

See "Writing Guide" Article in the Evaluations for discussion of this Section's organization and of the most efficient way to revise this Section.

* + - 1. STEEL PIPE AND FITTINGS
         1. Steel Pipe: ASTM A53, black steel, plain ends, welded and seamless, Grade B, and Schedule as indicated in piping applications articles.

Coordinate flange class in first four paragraphs below with products in other parts of this Section and in related Sections to match face size and bolt patterns.

* + - * 1. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in piping applications articles.
        2. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in piping applications articles.
        3. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in piping applications articles.
        4. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in piping applications articles; raised ground face, and bolt holes spot faced.
        5. Wrought-Steel Fittings: ASTM A234, wall thickness to match adjoining pipe.
        6. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

Material Group: 1.1.

End Connections: Butt welding.

Facings: Raised face.

* + - * 1. Steel Pipe Nipples: ASTM A733, made of ASTM A53, black steel of same Type, Grade, and Schedule as pipe in which installed.
      1. STAINLESS STEEL PIPE AND FITTINGS
         1. Stainless Steel Pipe: ASTM A312, plain ends, seamless; stainless steel of types and schedules as indicated in piping application articles.
         2. Stainless Steel Socket Weld Fittings: Stainless steel, wrought or forged, of types and classes as indicated in piping application articles.
         3. Stainless Steel Flanges and Flanged Fittings: ASME B16.5, Class 150, wrought, raised face weld neck, including gaskets, bolts, and nuts of material to match pipe.
      2. JOINING MATERIALS
         1. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.

Full-Face Type: For flat-face flanges.

Narrow-Face Type: For raised-face flanges.

* + - * 1. Flange Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel of type to match pipe unless otherwise indicated.
        2. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
        3. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

1. EXECUTION
   * + 1. LP STEAM PIPING APPLICATIONS

Retain at least one pipe material in paragraphs below for each service required for Project. Services are specified separately to allow different pipe materials and joining methods for each. If materials and methods are the same for multiple services, combine the requirements by revising the paragraph titles. To allow Contractor to choose among various pipe materials, retain multiple materials for each required service. The change point for pipe materials and joining methods is specified, in this master, where the pipe size changes from NPS 2 to NPS 2-1/2 (DN 50 to DN 65). Revise this change point to suit office policy. See "Writing Guide" Article in the Evaluations.

If Project includes steam and condensate piping with pressure ranges both higher and lower than 15 psig (104 kPa), retain this article and the following "HP Steam Piping Applications" Article and identify the pressure range of steam piping on Drawings; use similar designations. If pressure range for systems on Project is limited to 15 psig (104 kPa) and lower, or is limited to higher than 15 psig (104 kPa), retain only the appropriate article and omit pressure designations on Drawings. See "Writing Guide" Article in the Evaluations for discussion of the most efficient way to revise this Section.

* + - * 1. LP Steam Piping, [**NPS 2 and Smaller] <Insert pipe size range>: [Schedule 40**] , Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
        2. LP Steam Piping, [**NPS 2-1/2 through NPS 12] <Insert pipe size range>: [Schedule 40**], Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
        3. LP Steam Piping, [**NPS 14 through NPS 18] <Insert pipe size range**>: Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
        4. LP Steam Piping, [**NPS 20 and Larger] <Insert pipe size range**>: Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
        5. Condensate piping above grade, [**NPS 2] <Insert pipe size range**> and smaller, shall be the following:

Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

* + - * 1. Condensate piping above grade, [**NPS 2-1/2] <Insert pipe size range**> and larger, shall be the following:

Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

* + - * 1. Condensate piping below grade, [**NPS 2] <Insert pipe size range**> and smaller, shall be the following:

Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

* + - * 1. Condensate piping below grade, [**NPS 2-1/2] <Insert pipe size range**> and larger, shall be the following:

Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

Piping in "LP Clean Steam Piping" paragraph below is intended for HVAC clean steam humidification applications.

* + - * 1. LP Clean Steam Piping:

LP clean steam piping above grade, [**NPS 2] <Insert pipe size range**> and smaller, to be the following:

[**Schedule 40] [Type 316]** stainless steel pipe; [**wrought] [or] [forged], [Class 2000**] [**Class 3000**] <**Insert class**>, same type stainless steel socket weld fittings.

LP clean steam piping above grade, [**NPS 2-1/2] <Insert pipe size range**> and larger, to be the following:

[**Schedule 40] [Type 316**] stainless steel pipe; same type stainless steel flanges and wrought stainless steel flanged fittings.

Piping in "Clean Steam Condensate Piping" paragraph below is intended for HVAC clean steam condensate from humidification applications.

* + - * 1. Clean Steam Condensate Piping:

Clean steam condensate piping above grade, [**NPS 2] <Insert pipe size range**> and smaller, to be the following:

[**Schedule 80], [Type 316**] stainless steel pipe; [**wrought] [or] [forged] [Class 2000] [Class 3000] <Insert class**> same type stainless steel socket weld fittings.

Clean steam condensate piping above grade, [NPS 2-1/2] <Insert pipe size range> and larger, to be the following:

[**Schedule 80], [Type 316**] stainless steel pipe; same type stainless steel flanges and wrought stainless steel flanged fittings.

* + - 1. HP STEAM PIPING APPLICATIONS
         1. HP Steam Piping, [**NPS 2 and Smaller] <Insert pipe size range>: [Schedule 40**], Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
         2. HP Steam Piping, [**NPS 2-1/2 through NPS 12] <Insert pipe size range>: [Schedule 40**], Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
         3. HP Steam Piping, [**NPS 14 through NPS 18] <Insert pipe size range**>: Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
         4. HP Steam Piping, [**NPS 20 and Larger] <Insert pipe size range**>: Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
         5. Condensate piping above grade, [**NPS 2] <Insert pipe size range**> and smaller, shall be the following:

Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

* + - * 1. Condensate piping above grade, [**NPS 2-1/2] <Insert pipe size range**> and larger, shall be the following:

Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

* + - * 1. Condensate piping below grade, [**NPS 2] <Insert pipe size range**> and smaller, shall be the following:

Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

* + - * 1. Condensate piping below grade, [**NPS 2-1/2] <Insert pipe size range**> and larger, shall be the following:

Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

* + - 1. ANCILLARY PIPING APPLICATIONS
         1. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
         2. Vacuum-Breaker Piping: Outlet, same as service where installed.
         3. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.
      2. INSTALLATION OF PIPING

Indicate piping locations and arrangements on Drawings if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

* + - * 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
        2. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
        3. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless otherwise indicated.
        4. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
        5. Install piping to permit valve servicing.
        6. Install piping free of sags and bends.
        7. Install fittings for changes in direction and branch connections.
        8. Install piping to allow application of insulation.
        9. Select system components with pressure rating equal to or greater than system operating pressure.
        10. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
        11. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
        12. Install steam supply piping at a minimum uniform grade of 0.2 percent or 1/4 inch per 10 feet downward in direction of steam flow.
        13. Install condensate return piping at a minimum uniform grade of 0.4 percent or 1/2 inch per 10 feet downward in direction of condensate flow.
        14. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
        15. Install branch connections to mains using[ **mechanically formed**] tee fittings in main pipe, with the branch connected to top of main pipe.
        16. Install valves according to the following Sections or other Sections as needed:

Section 230523.11 "Globe Valves for HVAC Piping."

Section 230523.12 "Ball Valves for HVAC Piping."

Section 230523.13 "Butterfly Valves for HVAC Piping."

Section 230523.14 "Check Valves for HVAC Piping."

Section 230523.15 "Gate Valves for HVAC Piping."

* + - * 1. Install unions in piping, [**NPS 2] <Insert pipe size**> and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
        2. Install flanges in piping, [**NPS 2-1/2] <Insert pipe size**> and larger, at final connections of equipment and elsewhere as indicated.
        3. Install shutoff valve immediately upstream of each dielectric fitting.
        4. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
        5. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
        6. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
        7. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.

On straight runs with no natural drainage points, install drip legs at intervals not exceeding [**300 feet] <Insert distance**>.

Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.

* + - * 1. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

Retain first paragraph below for piping that penetrates an exterior concrete wall or concrete slab.

* + - * 1. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
        2. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."
      1. INSTALLATION OF STEAM AND CONDENSATE PIPING SPECIALTIES
         1. Comply with requirements in Section 232216 "Steam and Condensate Heating Piping Specialties" for installation requirements for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.
      2. INSTALLATION OF HANGERS AND SUPPORTS

Retain first paragraph below for projects in areas that require seismic restraints.

* + - * 1. Comply with requirements for seismic restraints in Section 230548 "Vibration and Seismic Controls for HVAC."
        2. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for installation of hangers, supports, and anchor devices.
        3. Install the following pipe attachments:

Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.

Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.

Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

Spring hangers to support vertical runs.

* + - * 1. Install hangers for steel steam supply piping and steel steam condensate piping, with maximum horizontal spacing and minimum rod diameters shall be in accordance with Section 230529 “Hangers and Supports for HVAC Piping and Equipment, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
        2. Support horizontal piping within [**12 inches] <Insert dimension**> of each fitting.
        3. Support vertical runs of steel steam supply piping and steel steam condensate piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
        4. Interval of Support

Piping shall be supported at distances not exceeding the spacing specified in Table below, or in accordance with ANSI/MSS SP-58.

|  |  |  |
| --- | --- | --- |
| PIPING MATERIAL | MAXIMUM HORIZONTAL SPACING (feet) | MAXIMUM VERTICAL SPACING (feet) |
| Steel tubing | 8 | 10 |
| Steel pipe | 12 | 15 |

* + - 1. PIPE JOINT CONSTRUCTION
         1. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.
         2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
         3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

* + - * 1. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
        2. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
      1. TERMINAL EQUIPMENT CONNECTIONS
         1. Size for supply and return piping connections shall be the same as or larger than equipment connections.

Specify access doors and panels for walls and ceilings in Section 083113 "Access Doors and Frames." Show locations of access doors and panels on Drawings, and coordinate with architectural reflected ceiling and wall elevation Drawings.

* + - * 1. Install traps and control valves in accessible locations close to connected equipment.
        2. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
        3. Install vacuum breakers downstream from control valve, close to coil inlet connection.
        4. Install a drip leg at coil outlet.
      1. FIELD QUALITY CONTROL
         1. Prepare steam and condensate piping according to [**ASME B31.1, "Power Piping,"] [and] [ASME B31.9, "Building Services Piping,"]** and as follows:

Leave joints, including welds, uninsulated and exposed for examination during test.

Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

Flush system with clean water. Clean strainers.

Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

Retain paragraph below on projects requiring higher level of testing

* + - * 1. Weld Testing:

Non-Destructive Examination of Piping Welds:

Perform radiographic examination of 50 percent of the first 10 welds made and 10 percent of all additional welds made. The Director’s Representative reserves the right to identify individual welds for which the radiographic examination shall be performed. All welds shall be visually inspected by the Director’s Representative. The Director’s Representative reserves the right to require testing on additional welds up to 100 percent if greater than 25 percent of the examined welds fail the inspection.

An approved independent testing firm regularly engaged in radiographic testing shall perform the radiographic examination of pipe joint welds. All radiographs shall be reviewed and interpreted by an ASNT Certified Level III radiographer, employed by the testing firm, who shall sign the reading report.

Comply with ASME B31.1. Furnish a set of films showing each weld inspected, a reading report evaluating the quality of each weld, and a location plan showing the physical location where each weld is to be found in the completed project. The Director’s Representative and the CxA shall be given a copy of all reports to be maintained as part of the project records and shall review all inspection records.

Defective Welds: Replace and reinspect defective welds. Repairing defective welds by adding weld material over the defect or by peening are prohibited. Welders responsible for defective welds shall be requalified prior to resuming work on the project.

Retain "Testing Agency," "Manufacturer's Field Service," and "Perform the following tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" paragraph or if retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following tests and inspections [ **with the assistance of a Director’s Representative**]:

Procedures in subparagraphs below are paraphrased from ASME B31.9.

Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.

After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

* + - * 1. Prepare test and inspection reports.

END OF SECTION 232213