PIP PNSC0011
Installation of ASME B31.3 Metallic Piping
PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

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# PIP PNSC0011
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1. Introduction

1.1 Purpose
This Practice provides requirements for the installation of ASME B31.3, Process Piping.

1.2 Scope
This Practice describes the requirements for the installation of piping fabricated in accordance with PIP PNSC0001. Underground piping is not part of this Practice.

2. References
Applicable parts of the following Practices and industry codes and standards shall be considered an integral part of this Practice. The edition in effect on the date of contract award shall be used, except as otherwise noted. Short titles will be used herein where appropriate.

2.1 Process Industry Practices (PIP)
- PIP PNC00001 - Pipe Support Criteria for ASME B31.3 Metallic Piping
- PIP PNSC0001 - Fabrication and Examination Specification for ASME B31.3 Metallic Piping
- PIP PNSC0021 - Specification for Leak Tests of Piping
- PIP REIE686 - Recommended Practices for Machinery Installation and Installation Design
- PIP VESPMI01 - Positive Material Identification Specification

2.2 Industry Codes and Standards
- American Society of Mechanical Engineers (ASME)
  - ASME B1.20.1 - Pipe Threads, General Purpose, Inch
  - ASME B31.3 - Process Piping
  - ASME PCC-1 - Guidelines for Pressure Boundary Bolted Flange Joint Assembly

3. Definitions

owner: The party who owns the facility wherein the piping will be used

4. Requirements

4.1 General

4.1.1 Field piping fabrication and examination shall be in accordance with PIP PNSC0001.

4.1.2 Rework and repairs shall be in accordance with this Practice.
4.1.3 Prior to installation, visually examine prefabricated piping internally to ensure that foreign matter has been removed.

4.2 Storage and Handling

4.2.1 Storage

4.2.1.1 Pipe, valves, and fittings shall not be stored directly on the ground.

4.2.1.2 Stacking shall be done in a manner to avoid damage to pipes or coatings.

1. Contractor shall stack pipe on nominal 4” x 4” timbers providing a minimum 3 ½” clearance for proper loading/unloading access. Stacking timber shall be new and nail free.

2. Bottom layer of pipe shall rest on no less than five timbers spaced 4 feet on center. Second layer of pipes shall rest on no less than four timbers spaced 5 feet on center. Remaining layers of pipes, not to exceed two, shall rest on no less than three timbers.

3. Contractor shall verify and segregate each material type according to the positive material identification process as defined in PIP VESPMI01.

4. Stainless steel, aluminum, and high alloy piping shall be stored under cover to prevent atmospheric corrosion and chloride contamination such as Microbiological Induced Corrosion (MIC) or chloride stress cracking.

4.2.1.3 Pipe shall be segregated and stacked by material type and schedule. Do not stack carbon steel, stainless steel, and high alloy pipe on the same storage rack.

4.2.1.4 End protectors on flanges, weld bevels, threads, and socket ends shall be firmly attached to prevent entrance of foreign material during shipping and storage.

4.2.1.5 Items that cannot be individually protected shall be maintained in a water proof storage box or container.

4.2.2 Handling

4.2.2.1 All material shall be handled with care to prevent damage.

4.2.2.2 Stainless steel, alloy, lined and coated pipe and fittings shall be lifted with wide fabric or rubber-covered slings and hooks. Material shall be handled without direct contact with carbon steel chains, cables, tools or equipment. Contamination to pipe from any ferritic sources shall be avoided.

4.2.2.3 Storage banding for pipe shall be of a non-contaminating and compatible material.

4.2.2.4 Provide barrier paper between pipe and banding materials or truck tie-down straps to prevent abrasion of exterior coatings.
4.2.2.5 Contractor shall visually inspect every pipe and component and reject any item that contains an injurious defect. Injurious defects are internal or external surface gouges, scars, scratches, blisters, or discontinuities that produce a notch effect or reduce the specified wall thickness by 5 percent or more.

4.2.2.6 Contractor shall visually inspect every pipe and component to ensure that no contamination has occurred to pre-cleaned piping or components during loading, transportation, and offloading.

4.3 Assembly

4.3.1 Threaded Joints

4.3.1.1 Threads shall conform to the requirements of ASME B1.20.1.

4.3.1.2 Pipe ends shall be reamed clean after threading.

4.3.1.3 Thread joint sealant shall be applied to the male ends only and in a manner that will prevent the compound from reaching the interior of the pipe. Manufacturer’s instructions shall be followed.

4.3.1.4 Unless otherwise specified, thread joint sealant shall be PTFE anaerobic sealing compound or PTFE tape.

4.3.1.5 Unless otherwise specified, PTFE tape shall not be used in instrument air piping.

4.3.1.6 Unless otherwise specified, no threaded joints shall be seal welded.

4.3.1.7 If seal welds are specified, threads shall be free of dirt, grease, and thread compounds.

4.3.2 Flanged Joints

4.3.2.1 Flanges

1. Flange faces shall be parallel within 0.5 percent.

2. Bolt holes shall be aligned within 1/8-inch (3-mm) maximum offset.

3. Flanges with damage to the gasket contact face that prevent the seating of the gasket or sealing of the assembly shall be repaired or replaced.

4. Bolt holes of flanges shall straddle the vertical centerline of the pipe unless otherwise shown or noted on Contract Documents.

5. Verify proper clearance for the correct operation of butterfly and/or wafer type check valves.

6. Flange connections are recommended to separate dissimilar materials.

4.3.2.2 Bolting

1. Flange bolts and studs shall be long enough to penetrate completely through the nuts, but shall not protrude more than one-bolt diameter.
2. Extra bolt length is required for bolt tensioners.

3. Bolting shall be uniformly tightened by a series of crossovers to assure uniform loading of the gasket without over-stressing the bolts or flanges.

4. In assembling flanged joints in which the mechanical properties of one flange differ widely from those of the other (e.g., a steel flange against a cast iron, lined, or plastic flange), special care shall be used in tightening to the minimum torque necessary to seat the gasket.

5. Washers shall be used only with the permission of the owner.

6. Bolts, nut faces, and nut bearing surfaces shall be lubricated before installation. Owner shall advise which lubricants are compatible with the process fluid and the temperature.

7. Tighten bolts to required torques using appropriate torque wrenches and torque amplifier tools. Reference ASME PCC-1 or manufacturer’s instructions for recommended torque tolerances.

8. Pipes, cheater bars, or other makeshift leverage devices on wrenches shall not be utilized to tighten bolts.

9. For wafer body valves or instruments with wafer bodies that are installed in pipelines, utilize double end threaded studs and nuts to install devices. Stud diameter and quantity shall not be less than that required for pipe flanges under the respective Piping Specification Class. Stud thread lengths shall be kept to a minimum, but shall not be less than two thread pitches beyond the nut.

10. For tapped lugged body valves or instruments with tapped lugged bodies, utilize hex head cap screws of proper length to secure devices in piping and engage a sufficient amount of threads on the device to withstand the working line pressures.

4.3.2.3 Gaskets

1. The correct gasket shall be properly seated (only one gasket in any joint).

2. Unless specified by the owner, gasket compounds shall not be used.

3. A spiral wound gasket shall be compressed until the raised face of each flange contacts the gauging ring all the way around.

4. Once compressed, a gasket shall not be reused.

5. All gaskets and gasket surfaces shall be clean and dry prior to assembly.

4.3.2.4 Electrical Isolation Kits

1. Electrical isolation kits, if specified, shall be installed after pressure testing, unless the test symbol is “F.”
2. Care shall be taken not to damage the bolt sleeves and gasket.
3. Welding and other ground leads shall not be installed such that the electrical current flow is through isolated flanges.
4. A continuity check to verify isolation shall be performed.

### 4.3.3 Valves

4.3.3.1 Valve manufacturer’s installation instructions, including bolt torque, shall be followed.

4.3.3.2 Valve handles shall be oriented as shown on the drawing, vertically if not shown (unless in a vertical line).

4.3.3.3 Handle shall be modified if required to operate the valve.

4.3.3.4 Check, globe, butterfly, and other valves that require specific orientation shall be installed as shown on the drawing.

4.3.3.5 Wafer body valves shall be centered in the pipeline.

4.3.3.6 Valves with soft seals and seats with brazed or welded ends or those that require seal welds shall have all internals components protected per manufacturer’s instructions and recommendations. Valve internals that are removed for protection shall be bagged, sealed, and kept in a safe location. Valve internals that were removed for protection shall be reinstalled in the same valve from which they were removed following manufacturer’s recommendations and instructions.

4.3.3.7 Coping the insulation at the valve stem is not acceptable.

4.3.3.8 Valves equipped with chain wheels shall have their stems arranged so the chains may be operated without interference. Chain heights shall be 4 feet above the operating level unless otherwise noted on Contract Documents. A safety cable and hook connected to operator wheel is recommended on chain wheel installations.

4.3.3.9 Butterfly valves with resilient seats shall not be wedged or forced between the companion flanges. Fabrication of adjacent piping shall be in a manner that does not require forcing of the valve into position. Butterfly valves shall be installed with the disc set in the open position before tightening the bolts. After the bolts have been tightened, check valve operation through its complete opening and closing cycle to assure operation of the valve.

### 4.4 Erection

#### 4.4.1 General

4.4.1.1 Piping shall be erected in accordance with the drawings.

4.4.1.2 Detailed drawings and manufacturer’s instructions shall be followed carefully when installing expansion joints, inline instruments, valves, steam traps, and other special components.
4.4.1.3 Connections and hot taps to existing piping or equipment shall not be permitted until the owner specifically authorizes work to proceed.

4.4.1.4 The owner shall witness all connections to existing piping or equipment.

4.4.2 Alignment

4.4.2.1 Any distortion of piping to bring the piping into alignment for joint assembly that introduces a detrimental strain in equipment or piping components shall be prohibited.

4.4.2.2 Heating can be used to correct piping misalignment in ferritic materials provided that a written procedure is submitted to and approved by the owner.

4.4.3 Equipment Connections

4.4.3.1 Equipment manufacturer’s limitations on piping end reactions shall be followed in making equipment connections.

4.4.3.2 Piping connections to rotating equipment shall be made in accordance with PIP REIE686.

4.4.4 Supports, Anchors, and Other Restraints

4.4.4.1 Permanent supports, anchors and other restraints, including supplementary structural steel as required for supports shall be erected. Support steel shall be of structural quality without sharp corners or edges.

4.4.4.2 Type and spacing of supports indicated on the drawings shall be used.

4.4.4.3 Pipe shall not visibly sag and shall be braced to avoid excessive sway, as required by the owner. Install anchors, guides, spring hangers, or expansion loops to permit expansion and contraction as shown on the drawings and as required by the owner.

4.4.4.4 See PIP PNC00001 for piping support criteria.

4.4.4.5 Temporary lugs and supports attached to the piping by welding shall be removed by cutting them off and grinding the remaining fin flush with the pipe.

4.4.4.6 Hanging pipe directly from other pipe, duct, or conduit is not recommended.

4.4.4.7 Maximum hanger rod length shall be 8 feet. Hanger rods shall be continuous with no mechanical couplings or welded sections.

4.4.4.8 Threaded support components shall have full thread engagement, with a minimum of two thread pitches exposed beyond nut.

4.4.4.9 Drill or punch bolt holes in existing structural steel members, no flame cuts are recommended.

4.4.4.10 Welding transversely across the tension flanges of any installed structural member is not recommended.

4.4.4.11 Install spring supports in compliance with Manufacturer’s instructions. Maintain shipping blocks in springs until line closure and pressure test.
are complete. Check spring adjustment in the installed position and after 1 operating cycle is complete.

4.4.4.12 Temporary supports required for erection and hydrostatic pressure testing shall be the responsibility of the field fabrication/installation contractor.

4.4.4.13 Shoe type pipe supports shall be centered over the pipe support in the cold position unless indicated otherwise on the contract documents.

4.4.3 **Cold Spring**

4.4.3.1 Cold springing shall be permitted only when specified and shown on the drawings.

4.4.3.2 If cold spring is specified, an examination shall be made of supports and restraints for conditions that can either prevent desired movement or cause undesired movement. Potential problems shall be reported to the owner.

4.4.3.3 If the cold spring gap or overlap is not as specified, the piping shall be refabricated.

4.5 **Cleaning and Protection**

4.5.1 Contractor shall take precautions during fabrication and erection to prevent entrance of foreign matter into piping or equipment. Contractor shall remove loose rust, slag, weld splatter, dirt, oil, grease or other foreign substances from interior surfaces of piping prior to connecting piping to equipment. Prior to fabrication in shop or field, remove scale or foreign materials present in pipe. After fabrication and during erection, open ends of pipelines shall be capped or plugged to keep out dirt and other materials until pipelines are connected to equipment. Clean completed piping with air, steam or water flushed to the satisfaction of Owner before final connection to the equipment.

4.5.2 Specialty services and equipment (oxygen, acid, compressors, etc.) may require additional cleaning procedures as specified by the Owner. Coordinate with Owner or Owner’s representative for approved procedures.

4.5.3 Cleaning and testing are separate operations and shall not be combined.

4.5.4 Temporary strainers shall remain in place until their removal is approved by Owner. Maintain a log of temporary strainers installed and removed. Where rigid pipe supports are furnished adjacent to strainers, such supports shall accommodate removal of the strainers. Install cone strainers with the cone pointed upstream of the normal flow.

4.5.5 Piping which is contiguous with special equipment will be cleaned to same requirements as special equipment. Approval of cleaning procedure and supervision by owner or manufacturer’s representative is recommended.

4.6 **Inspection and Testing**

4.6.1 At the completion of the installation, piping systems shall be dry, clean, and free from dirt, slag, and other loose foreign materials.
4.6.2 A walk-down to verify that the work is in accordance with the Piping and Instrumentation Diagrams (P&IDs) and drawings.

4.6.3 Leak tests shall be performed in accordance with PIP PN0021.

4.6.4 Underground line joints shall be left exposed until after completion of field of pressure and leakage testing. Partial backfilling shall be placed and compacted, if required for pipe anchoring, so that the pipe joints remain exposed for visual inspection during pressure testing. Do not pressure test underground lines with concrete thrust blocks until the concrete has adequately cured.

4.6.5 It is not recommended to paint or insulate over pipe joints until pressure test and leak testing has been completed by Owner and jurisdictional authority.