Facility Design Guidelines: Workplace, Architecture & Engineering

Piping, Valves and Fittings
MasterFormat Section 23-20-01

The guidelines described herein shall be used on all projects, unless USAA’s Project Variance Request process has been used to secure an approved, project-specific variance.

<table>
<thead>
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<th>Revision</th>
<th>Date</th>
<th>Comments</th>
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<td>01</td>
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Relevant Documents
TBD

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Pipe and Pipe Fittings
B. Valves

1.2 PROJECT RECORD DOCUMENTS
A. Record actual locations of valves, etc. and prepare valve charts.
B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
C. Valves: Manufacturer’s name and pressure rating marked on valve body.
D. Welding Materials and Procedures: Conform to ASME Code and applicable state regulations.
E. Welder’s Certification: In accordance with ASME BPVC Sec. IX. Submit welder’s certifications prior to any shop or field fabrication. Welder’s certifications shall be current within six months of submission.
F. Maintain one copy of each document on site.

1.3 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
B. Installer: Company and installer specializing in performing the work of this section with minimum of three years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect and handle products to site.
B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
C. Provide temporary protective coating on cast iron and steel valves.
D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 STEEL PIPING:
A. Section applies to all piping systems providing for welded piping, fittings, and other appurtenances. Specific systems requiring welded piping include, but are not limited to: chilled water, hot water, steam, and steam condensate.
B. Pipe: Unless otherwise indicated, chiller and boiler plant piping shall be Schedule 40, and underground and building piping shall be Standard weight, Grade A or B, seamless black steel pipe conforming in all details to Standard ASTM Designation A53, A106, and A135, latest revisions. Steam condensate shall be Schedule 80.

C. Fittings:
1. All weld fittings shall be domestic made wrought carbon steel butt-welding fittings conforming to ASTM A234 and ASME/ANSI B16.9, latest edition, as made by Weldbend, Tube Turns, or Hackney Ladish Inc.
2. Attach only to pipe with a hole for the entire length. Each fitting shall be stamped as specified by ASME/ANSI B16.9.
3. Fittings which have been machined, remarked, printed, or otherwise produced domestically from non-domestic forgings or materials will not be acceptable. Each fitting is to be marked in accordance with MSS SP-25.
4. Markings shall be placed on the fittings at the farthest point from the edge to be welded to prevent disfiguring from the welding process.
5. Submittal data for these fittings shall include a letter signed by an official of the manufacturing firm certifying compliance with these guidelines.
6. All screwed pattern fittings specifically called for shall be Class 150 malleable iron fittings of Grinnell Company, Crane Company, or Walworth Company manufacture (Class 300 for unions).

D. Fabrication:
1. Piping shall be fabricated according to the latest ASME/ANSI B31 Code for Pressure Piping.
2. Welded piping and fittings in chiller and boiler plants shall be fabricated in accordance with ASME/ANSI Standard B31.1 – Power Piping.
3. Direct buried piping mains shall be fabricated in accordance with ASME/ANSI Standard B31.3 – Process Piping. Standard B31.9 – Building Services Piping may be used within buildings.
4. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.
5. Ensure complete penetration of deposited metal with base metal in welds.
6. Contractor shall provide filler metal suitable for use with base metal. Contractor shall keep inside of fittings free from globules of weld metal.
7. All welded pipe joints shall be made by the fusion welding process, employing a metallic arc or gas welding process.
8. All pipe shall have the ends beveled 37-1/2 degrees and all joints shall be aligned true before welding. Except as specified otherwise, all changes in direction, intersection of
lines, reduction in pipe size, and the like shall be made with factory-fabricated welding fittings.

9. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.

10. Align piping and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

11. Do not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

12. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

13. Remove dirt, scale and other foreign matter from the inside of piping, by swabbing or flushing, prior to the connection of other piping sections, fittings, valves or equipment.

14. In no cases shall Schedule 40 pipe be welded with less than three passes, including one stringer/root, one filler, and one lacer. Schedule 80 pipe shall be welded with not less than four passes including one stringer/root, two filler, and one lacer. In all cases, the weld must be filled before the cap weld is added.

15. Procedure of Assembling Screw Pipe Fittings: All screw joints shall be made with taper threads properly cut. Joints shall be made tight with Teflon applied to the pipe threads only and not to fittings. When threads are cut on pipes, the ends shall be carefully reamed to remove any burrs. Before installing pipe that has been cut and threaded, the lengths of pipe shall be upended and hammered to remove all shavings and foreign material.

E. Weld Testing:

1. All welds are subject to inspection, visual, X-ray and/or Ultrasound, for compliance with specifications. The contractor will provide a testing laboratory for the purposes of performing inspections and/or X-ray testing.

2. The contractor shall be responsible for all labor, material and travel expenses involved in the re-inspection and re-testing of any welds found to be unacceptable. In addition, the contractor shall be responsible for the costs involved in any and all additional testing required or recommended by ASME/ANSI Standards B31.1, B31.3, and B31.9, due to the discovery of poor, unacceptable, or rejected welds.

3. Welds lacking penetration, containing excessive porosity or cracks, or found to be unacceptable for any reason, must be removed and replaced with an original quality weld as specified herein. All qualifying tests, welding and stress relieving procedures shall, moreover, be in accord with Standard Qualification for Welding Procedures, Welders and Welding Operators, Appendix A, Section 6 of the ASME/ANSI B31 Code for Pressure Piping, current edition.

2.2 PIPING - UNDERGROUND - TYPE 'A': (SMALL SYSTEMS – 50’ OR LESS)

A. Underground water piping shall be Schedule 40 black steel and shall be fabricated and insulated with Foamglas, Insul-Phen or approved equal.

B. All piping shall be clean when it is installed. Before installation it shall be checked, upended, swabbed, if necessary, and all rust or dirt from storage or from lying on the ground shall be removed. The Contractor is cautioned to exercise rigid control of the interior cleanliness of the pipe as it will be impossible to flush clean after assembly.

C. Piping shall be temporarily supported on blocks in the excavation to an adequate height to make all welds and apply insulation. Blocks shall be removed after insulation is applied and supported.
on shields resting on permanent blocks of an inert material such as concrete construction blocks. Temporary blocks shall have a dimensional height greater than the permanent blocks equal to the thickness of the insulation plus saddle. At the Contractor's option he may insulate the pipe prior to lowering into the excavation on a compacted sand fill bed set to line and grade, leaving bell holes for welding and completion of insulation at the joint.

D. After the insulation has been applied on buried pipe and all joints and sealed as specified above the insulation shall be protected in lieu of metal jacketing with a heavy duty flexible jacket of 50 mil rubberized bitumen adhesive laminated to a 10 mil polyethylene film equal to Polyguard Products ‘Insulrap 50’ and installed in accordance with the manufacturer’s directions.

2.3 PIPING UNDERGROUND TYPE 'B': (WATER SYSTEMS WITH TEMPERATURES NOT EXCEEDING 210 DEG F)

A. Provide a factory pre-insulated underground piping system of straights and fittings, as described herein. Products deviating from any aspect of this guidelines must be submitted for approval ten (10) days prior to bid date. All pre-insulated pipe and fittings shall be factory fabricated to job dimensions and designed to minimize the number of field welds. Where possible, straight sections shall be supplied in 40-foot random lengths with piping exposed at each end for field joint construction. The system shall be computer analyzed by a PE registered engineer of the piping system manufacturer, having a minimum of five (5) years’ experience, to determine stress on the carrier pipe and anticipated pipe thermal movement. The system design shall be in strict conformance with ANSI B31.3, latest edition.

B. The manufacturer shall furnish written installation procedures and provide on-site field technical assistance if necessary during the initial periods of installation.

C. Carrier pipe shall be standard weight, carbon steel, ASTM A53, A106, Grade B, seamless. All joints shall be butt-welded for 2 1/2" and greater, and socket or butt-welded for 2" and below. Pipe fittings shall be forged, long radius bends, beveled for butt welding, having a wall thickness equal to the pipe.

D. Insulation shall be 90-95% close cell polyurethane foam having the following properties:
   1. Thermal Conductivity (k-value) - 0.13 BTU-in./hr.-ft 2-°F minimum at 73° per ASTM C518.
   2. Density - 1.7 to 2.5 lb./cu. ft per ASTM D1622.
   3. Compressive Strength - 17 psi minimum per ASTM D1621.
   4. Flexural Strength - 25 psi minimum per ASTM D790.
   5. Closed Cell Content - 90% minimum per ASTM D6226.
   7. Water Permeability - 3 perm inches maximum per ASTM E96.
      a. To assure that there are no insulation voids, each factory pre-insulated pipe unit shall be infrared inspected at the factory, or, visually checked prior to application of the outer protective jacket. Minimum thickness shall be as specified for the medium carried in the pipe.

E. Jackets for pre-insulated piping, including fittings, shall be seamless high-density urethane polymer (HDUP), HDPE, or, fiberglass reinforced polyester resin (FRP). Jackets that are mitered, taped or wrapped will not be allowed. Jackets shall have the following minimum properties:
   1. Tensile Yield Strength - 3,000 psi minimum per ASTM D638
   2. Ultimate Tensile Strength - 3,600 psi minimum per ASTM D638
   3. Elongation - 50% minimum per ASTM D638
   4. Compressive Strength - 4,000 psi minimum per ASTM D695
   5. Water Absorption (24 hr.) - 0.6% maximum per ASTM D570
   6. Impact Strength (0.125") - Non-break per ASTM D256 (Method A)
F. For systems where the entire factory applied insulation surface on the carrier pipe can be visual inspected, jackets applied directly to insulation surfaces shall be a minimum thickness of 80 mils for pipe sizes 6" and below, 100 mils for sizes 8"-12", 120 mils for sizes 14"-20", and 150 mils 24" and larger. For systems requiring injection of urethane foam into the annulus between the carrier pipe and jacket, the jacket thickness shall be 50% thicker than the above minimums.

G. Pre-insulated pipe and fittings shall be provided with factory End Seals. End Seals may be constructed of the same material as the jacket, or, cross-linked polyolefin heat shrink seals, bonded to the jacket and the core pipe protecting and sealing the insulation.

H. Carrier pipe shall be hydrostatically tested to 150 psig, or 1½ times the operating pressure, whichever is greater. After testing of the carrier pipe, all field joints shall be insulated, with kits provided by the pre-insulated pipe manufacturer. Field insulation of fittings shall not be acceptable. Field joint insulation shall be applied only in straight sections by pour foam in situ, using molds furnished by the system manufacturer. Field joint insulation surface shall be sealed with a heat shrinkable sleeve.

I. Underground piping shall be bedded in compacted clean sand, in 6" layers, or fine gravel 8" under, around and 6" over pipe. Cover with densely compacted select stabilized backfill. Piping trenches within 8'-0" from building shall not have pea gravel or sand but shall be selected backfill densely compacted and stabilized as specified elsewhere.

2.4 PIPING UNDERGROUND TYPE 'C': (STEAM, CONDENSATE, AND WATER SYSTEMS WITH TEMPERATURES EXCEEDING 210 DEG F)

A. General: The insulated pipe conduit systems where noted on the Drawings shall be a heavy steel mechanically sealed, testable, prefabricated, insulated piping system. The system shall include the inner pipe and fittings, outer steel casing, insulation materials, pipe supports, anchor, end seals, expansion loops and bends, and corrosion protective coating. The system when installed shall have a continuous drainage and venting system through its entire length.

B. Conduit: Conduit shall be 10-gauge smooth wall galvanized steel having all outside surfaces of the conduit (except for overhead lines) machine-coated with high melting point VOC free, urethane elastomer, to a minimum thickness of 50 mils, structurally reinforced with an interposed layer of fiberglass mesh applied spirally under tension or a high solids epoxy, reinforced with a fiberglass membrane, applied to a 50 mil thickness. All coatings shall be holiday tested at factory to 6,000 volts before shipping. Conduit closures shall be furnished with the conduit at a ratio of one closure for each fabricated item or length. Closures shall consist of 10-gauge steel suitably rust-proofed and in cylindrical form with a single horizontal split and shall be field welded over adjacent units. After test, as soon thereafter as possible, all field welds on closures shall be cleaned of all welding slag, burned coating, mud, etc. by wire brushing and grinding of weld high points. Closure shall then be covered with shrink-wrap in accordance with the system manufacturer’s approved instructions, using materials supplied. Finished closure shall then be holiday tested to 6000 volts. All materials and insulation required for complete field closure shall be furnished with the conduit.

C. Pipe and Pipe Support Guides: All piping in conduit shall be as specified in this section for the service required, except that condensate piping shall be Schedule 80. All ferrous pipe field joints shall be welded by competent mechanics and tested under hydrostatic pressure. Concealed pipe welds in prefabricated conduit fittings shall be factory tested the same as specified for field welds prior to assembly. Piping shall be suitably spaced and supported in conduit by specially designed full round insulating support-guides and shall permit the pipe to expand and/or contract freely without stress or wear on the pipe or insulation as well as provide for drainage and free air circulation.
D. Expansion Loops, Ells, and Tees: Prefabricated ells, loops, and tees shall be furnished and installed where shown on Drawings and shall consist of pipe, insulation, and conduit conforming to the same specification as hereinbefore specified for straight runs. Expansion loops shall be of proper design in accordance with stress limits indicated by ASME Code for Pressure Piping, District Heating Section. Loop piping shall be installed in conduit suitably sized to handle indicated pipe movement. All inner pipe loops and expansion bends shall be cold sprung 50% in the field by the Contractor. Submit details and calculations to Engineer prior to fabrication.

E. End Seals and Glands: Terminal ends of conduits inside manholes, pits, or building walls shall be equipped with end seals consisting of a steel bulk head plate welded to the pipe and conduit. Where there is no anchor within five feet of a terminal end, conduits shall be equipped with gland seals consisting of a packed stuffing box and gland follower mounted on a steel plate welded to end of conduit. Ends seals or gland seals shall be equipped with drain and vent openings located diametrically opposite on the vertical center line of the mounting plate and shall be shipped to the job site with plugs in place. Terminate all conduits 2" beyond the inside face of manhole or building walls to protect any exposed piping insulation from damp-wall condensation.

F. Leakplates: To provide an effective moisture barrier, conduits shall be equipped with leakplates in building or manhole walls, but only when there is an anchor plate within five feet outside the wall. Leakplates shall consist of a steel plate flange 4" larger in outside diameter than the conduit, welded to the conduit only and located in the wall approximately 6" from the end of the conduit.

G. Anchors: Prefabricated plate anchors shall be furnished and installed where shown on Drawings and shall consist of a steel plate welded to pipe and conduit. The steel plate shall be 3/8" thick for 6-5/8" to 10-3/4" conduit, 1/2" thick for 12" to 22" conduit and 3/4" thick for conduit over 22". A concrete block shall be cast over the plate and conduit shall be large enough for firm anchorage into undisturbed trench sidewalls and/or bottom. The concrete block to be at least 30" in length and extend a minimum of 9" beyond the top and bottom of anchor plate.

H. Conduit Air Test: All field welds at conduit closures shall be tested for leaks before applying shrink-wrap. During testing all field welds shall be checked with soapsuds, and re-welded if necessary until air tight at 15 lbs. pressure. The Contractor shall furnish all necessary equipment and labor to perform the air test, including air compressor, gauges, conduit caps, temporary pipe and connections, etc., and complete the test to the satisfaction of the Engineer of Record.

I. Pipe Insulation: All pipe or pipes in conduit shall be insulated for the medium carried in the pipe.

J. Manufacturer's Field Service Instructor: Who is technically qualified to determine whether or not the installation is being made in accordance with the manufacturer's recommendations shall be present during critical periods of installation, including cold springing, and test of the system. On completion of the installation, the Contractor shall deliver to the Owner a certificate from the manufacturer stating that the installation has been made in accordance with the manufacturer's recommendations.

K. Provide a sacrificial anode system designed for a minimum life of 20 years. The design is to be based on soil resistivity measurements and a complete soil analysis. The system shall be given a complete check for proper potential readings immediately after the installation and again after the system has been in operation for six months, at which time any modifications or adjustment are to be made. Provide dielectric flanged connection where the insulated pipe conduit system terminates.

L. Provide a control box to maintain a constant pre-set pressure on the conduit. System will alarm to any time the conduit system has required additional air to maintain the pre-set pressure. Use the control air compressor and extend an air line to the nearest air in the building.
M. Prior to backfilling, all surfaces of the conduit system, including field closures, shall be holiday tested to 6,000 volts. Repair all holidays in accordance with manufacturer’s recommendations. A 4-inch layer of sand or fine gravel shall be placed and tamped in the trench to provide a uniform bedding for the conduit. The entire trench shall be evenly backfilled with a similar material as the bedding in 6 inch compacted layers to a minimum height of 6 inches above the top of the insulated piping system. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable excavated soil.

2.5 VALVES:

A. Prefer all valves be of threaded or flanged type. Solder connected or grooved fitting valves are not preferred by maintenance personnel at USAA facilities. All valves shall be located such that the removal of their bonnets is possible. All flanged valves shown in horizontal lines with the valve stem in a horizontal position shall be positioned so that the valve stem is inclined one bolt hole above the horizontal position. Screw pattern valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. All valves must be true and straight at the time the system is tested and inspected for final acceptance. Valves shall be installed as nearly as possible to the locations indicated in the Construction Drawings. Any change in valve location must be so indicated on the Record Drawings.

B. All bronze and iron body gate and globe valves shall be the product of one manufacturer for each project. Manufacturers of other types may not be mixed on the same project; i.e., all butterfly valves shall be of the same manufacturer, all ball valves shall be of the same manufacture, etc.

C. All bronze valves used in circulating systems and steam systems (low and medium pressure) shall be Class 150 SWP. Iron valves used for low and medium pressure steam systems shall be Class 125. Iron valves used for high pressure steam systems shall be Class 250. All gate and globe valves shall be union bonnet design.

D. Metal used in the stems of all bronze gate, globe and angle valves shall conform to ASTM B371 Alloy 694, ASTM B99 Alloy 651, or other corrosion resistant equivalents. Written approvals must be secured for the use of alternative materials. Alloys used in all bronze ball, gate, globe, check, or angle valves shall contain no more than 15% zinc. No yellow brass valves will be allowed.

E. Class 300 valves shall be constructed of all ASTM B61 composition.

F. All iron body valves shall have the pressure containing parts constructed of ASTM A126 class B iron. Stem material shall meet ASTM B16 Alloy 360, ASTM 371 Alloy 876 silicon bronze, ASTM B584, or their equivalent. Gates and globes shall be bolted bonnet with OS&Y (outside screw and yoke) and rising stem design. A lubrication fitting is preferred on yoke cap for maintenance lubrication of the yoke bushing. [Austin Campus only: All iron body gate valves shall have the body constructed of ASTM A395 ductile iron.]

G. All cast steel body valves shall have the pressure containing parts constructed of ASTM A216-GR-WCB carbon steel. Gate and globe valves shall be bolted bonnet outside and screw and yoke design with pressure-temperature rating conforming to ANSI B16.34. Stems shall meet ASTM designation A182-F6 chromium stainless steel. Wedges on gate valves may be solid or flexible type and shall meet ASTM A182-F6 chromium stainless steel on valves from 2" to 6". Sizes 8" and larger may be A216-WCB with forged rings or overlay equal to 182-F6. Seat ring shall be hard faced carbon steel or 13% chromium A182-F6 stainless. Handwheels shall be A47 Grade 35018 malleable iron or ductile iron ASTM A536.

H. All forged steel body valves shall have the pressure containing parts constructed of ASTM A105, grade 2 forged carbon steel. Seat and wedges shall meet ASTM A182-F6 chromium stainless
steel. Seat rings shall be hard faced. Valves shall conform to ANSI B16.34 pressure-temperature rating.

I. All valves shall be repackable under pressure, with the valve in the full open position. All gate valves, globe valves, angle valves and shutoff valves of every character shall have malleable iron hand wheels, except iron body valves 2-1/2" and larger which may have either malleable iron or ASTM A126 Class B, gray iron hand wheels.

J. Packing for all valves shall be free of asbestos fibers and selected for the pressure-temperature service of the valve. It is incumbent upon the manufacturer to select the best quality standard packing for the intended valve service. Valves 12" and larger located with stem in horizontal position shall be drilled and tapped in accordance with MSS-SP-45 to accommodate a drain valve and equalizing by-pass valve assembly.

K. Balancing and/or shutoff valves for hot water systems 2” inches and smaller shall be three-piece, full port, bronze body ball valves with stainless steel ball and stem. They shall have PTFE seats, packing and gasket, bronze gland follower, adjustable stuffing box, steel lever type handle with plastic sheathed operating handle, adjustable memory stops, and shall be class 150 SWP/600 WOG, screwed pattern. Manufacturer shall certify ball valves for use in throttling service. Stem extensions shall be furnished for use on insulated lines.

L. Shutoff valves for chilled water 2” and smaller shall be two-piece, full port, bronze body ball valves with stainless steel ball and stem. They shall have PTFE seats, packing and gasket, bronze gland follower, adjustable stuffing box, steel lever type handle with plastic sheathed operating handle, adjustable memory stops, and shall be class 150 SWP/600 WOG, screwed pattern. Manufacturer shall certify ball valves for use in throttling service. Stem extensions shall be furnished for use on insulated lines.

M. All balancing and/or shutoff valves 2 1/2” and larger shall have tapped full lug butterfly valves with aluminum bronze discs of ASTM B148 Alloy C955 and 316, 416, or 420 stainless steel shafts. Design must incorporate bushing between shafts and body of material suitable to provide a bearing surface to eliminate seizing or galling.

N. All balancing and/or shutoff valves must be capable of providing a bubble tight seal at 200 psi for valves up to 12", and 150 psi for larger valves, when used for end of line service, without requiring the installation of a blind flange on the downstream side.

O. All butterfly valves shall be absolutely tight against a pressure differential of 150 psi. Liners shall be resilient material suitable for 225 °F temperature and bodies of ductile iron. Butterfly valves 2 1/2" through 6" shall have lever handles which can be set in interim positions between full open and full closed. Butterfly valves 8" and larger, and butterfly valves used for balancing service, regardless of size, shall have heavy duty weather proof encased gear operators with malleable iron handwheel or crank.

P. Check Valves for Water Systems: Valves 2" and smaller shall have bronze bodies and a regrinding disc and seat with screw-in cap. Valves 2 1/2" and larger shall have iron bodies and be non-slam wafer type with stainless pins and springs, and bronze or stainless steel plates.

### 2.6 GUIDELINES OF QUALITY FOR VALVES:

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<th>Size</th>
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* Requires extended stem in insulated lines.

1. Note: Valves 8" and larger, and valves used for balancing service regardless of size, shall have heavy-duty weatherproof encased gear operators.

2.7 UNIONS:
   A. Provide and install two-piece unions at proper points to permit removal of pipe, valves and various equipment and/or machinery items without injury to other parts of the system. No unions will be required in welded lines or lines assembled with solder joint fittings except at all valves, equipment items, machinery items and other special pieces of apparatus. Unions 2" and smaller in ferrous lines shall be Class 300 AAR malleable iron unions with iron to brass seats, and 2 1/2" and larger shall be ground flange unions. Unions in copper lines shall be Class 125 ground joint brass unions or Class 150 brass flanges if required by the mating item of equipment. Companion flanges on lines at various items of equipment, machines and pieces of apparatus shall serve as unions to permit removal of the particular items. Unions connecting ferrous pipe to copper or brass pipe shall be dielectric type equal to EPCO.
   B. In all water lines where the material of the pipe is changed from ferrous to copper or brass, a two-piece dielectric union shall be used at the transition.

2.8 FLANGES:
   A. All 150 lb. and 300 lb. ANSI flanges shall be weld neck and shall be domestically manufactured, forged carbon steel, conforming to ANSI B16.5 and ASTM A181 Grade I or II or ASTM A105-71 as made by Tube Turns or Hackney Ladish Inc. Slip on flanges shall not be used. Each fitting shall be stamped as specified by ANSI B16.9. Flanges which have been machined, remarked, painted or otherwise produced domestically from imported forgues will not be acceptable. Flanges shall have the manufacturer’s trademark permanently identified in accordance with MSS SP-25.
   B. Contractor shall submit data for firm certifying compliance with these guidelines. Bolts used shall be carbon steel bolts with semi-finished hexagon nuts of American Standard Heavy dimensions. All thread rods will not be an acceptable for flange bolts. Steam system flange bolts
shall have a tensile strength of 105,000 psi and an elastic limit of 81,000 psi and be rated at least ANSI Grade V. Other bolts shall have a tensile strength of 80,000 psi and an elastic limit of 36,000 psi and be rated at least ANSI Grade I.

C. Flat faced flanges shall be furnished to match 125 lb cast iron flanges on pumps, check valves, strainers, etc. with full flange gaskets. Bolting of raised face flanges to flat faced flanges is not allowed.

D. Flange Gaskets
   1. Gaskets shall be placed between the flanges of all flanged joints.
   2. Gaskets for steam piping - All steam flange joints shall use Flexitallic Class 150 spiral wound for low pressure applications and Flexitallic Class 300 spiral wound gaskets for medium or high pressure applications. Raised and flat face flange gaskets shall be Flexitallic compression gauge (CG) style. External ring shall be Type 304 stainless steel and color coded yellow. Filler material shall be Flexite Super and color coded with pink stripe. Equivalents may be submitted with all design data so that an evaluation of the gasket can be made.
   3. Gaskets for all other applications: Gaskets shall be ring form gaskets fitting within the bolt circle of their respective flanges. Gaskets shall be 1/16” thick asbestos free material recommended for service by Anchor, Garlock, or John Crane. The inside diameter of such gaskets shall conform to the nominal pipe size and the outside diameter shall be such that the gasket extends outward to the studs or bolts employed in the flanged joint.

E. Flange Bolt Installation:
   1. Bolt Lubrication: Bolts shall be well lubricated with a heavy graphite and oil mixture.
   2. Inspection -Engineer of Record shall verify hot torqueing of all medium and high pressure steam flange bolts.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION
   A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
   B. Remove scale and dirt, on inside and outside, before assembly.
   C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION
   A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
   B. Route piping in orderly manner and maintain gradient.
   C. Install piping to conserve building space and not interfere with use of space.
   D. Group piping whenever practical at common elevations.
   E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
   F. Provide clearance for installation of insulation and access to valves and fittings.
   G. Provide access where valves and fittings are not exposed. Coordinate access door location with architectural features.
   H. Establish elevations of buried piping outside the building to ensure a minimum of cover.
I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting. Refer to Division 09.

L. Install bell and spigot pipe with bell end upstream.

M. Install valves with stems upright or horizontal, not inverted.

3.4 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot (1%) minimum.

B. Maintain gradients through each joint of pipe and throughout system.

C. Slope water piping and arrange to drain at low points.

END OF SECTION