

SECTION 15060

BASIC PIPING MATERIALS AND METHODS

PART 1 – DESIGN DIRECTIVES

1.1 SUMMARY

- A. This Section specifies piping materials and installation methods common to more than one section of Division 15 and includes joining materials, piping specialties, and basic piping installation instructions.

1.2 DESIGN CRITERIA

- A. The drawings shall reflect pipe locations where there is sufficient space to properly support all pipes, including allowances for insulation and pipeline accessories.
- B. The designer shall include expansion loops or incorporate expansion devices in all piping systems. Expansion loops shall be dimensioned, length and width, as well as where in the length of pipe the loop is to be located. Clearly indicate and dimension locations of guides and anchors. Where expansion joints are used, they shall be scheduled on the drawings. Fully detailed anchors & guides are the designer's responsibility and shall be clearly located on the drawings.
 - 1. Expansion loops in steam systems shall be designed for 300°F, 30 psig.
- C. Dielectric devices shall be used wherever dissimilar piping materials are joined. Waterway fittings are preferred rather than dielectric unions. Brass valves (control, isolation, or check) shall serve as dielectric separators. Dielectric unions may be used only where waterway fittings or brass valves are impractical.
- D. The designer is responsible for determining and scheduling the size of the openings in all strainers.
- E. The designer shall indicate on the drawings the general location of the chemical treatment system. The flow schematic shall include the basic components (filter feeders and side stream filters) including valves.
- F. Where direct burial underground pipe is included in a project, the design documents shall clearly indicate and accurately dimension the path of the pipes, including elevations. Clearly indicate locations of expansion loops and all anchors. Details of anchors shall be indicated on the drawings.
- G. Emergency generator exhaust systems shall conform to steel pipe & fitting requirements as specified for steam piping systems.

1.3 QUALITY ASSURANCE

A. DEFINITIONS:

- 1. Welding Procedure Specification, WPS. It must have a specific procedure number, date written and identification of the person who wrote it.
- 2. Procedure Qualification Record, PQR. This is the record that indicates the procedure to be followed is a valid procedure.

3. Welding Operator Qualifications test, WPQ. This is a record, including bend test results or radiographic test results, for each welder. The WPQ is based on that company's procedure. It shall be certified and dated by the test agency within 12 months of the start of the work for the welder.
- B. Welding and brazing procedure qualifications:
 1. Contractor shall submit for review the Contractor's standard welding and brazing procedures (forms WPS or BPS). Procedure shall be submitted on PQR form as described in the ASME Boiler and Pressure Vessel Code.
 2. The PQR shall be supported by the appropriate WPS and BPS.
- C. All welders shall be certified to the WPS and BPS as listed on the Contractor's PQR. Certifications are to be performed by an independent testing laboratory within twelve months prior to the commencement of work.
 1. Each welder is to stamp the pipe adjacent to each weld performed by him/her. The Contractor is required to, via the submittal process, provide a list of each welder's name and the mark used by each welder.
- D. Tack welding may be performed by non-certified welders. All tack welds, whether performed by certified or non-certified welders, must be ground out and removed.
- E. Contractor option: In lieu of submitting the contractor's welding procedures, the contractor may adopt Dartmouth College's procedure #1.1.1.2 Rev. 0 and ASME/ANSI B31.1, latest edition. The welding procedure is available from DC Facilities Operation and Management.
- F. No welding may take place until a satisfactory reviewed submittal is complete. It is the contractor's responsibility to provide a submittal in a timely fashion so as not to delay the project.
- G. Soldering and brazing procedures for refrigeration piping shall conform to ANSI B9.1 "Standard Safety Code for Mechanical Refrigeration."

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Provide end caps on each length of pipe and tube. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes. Elevate a minimum 2" above grade/floor and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS

- A. Refer to the individual piping system specification sections in Division 15 for specifications on piping and fittings relative to that particular system.
- B. All pipe and fittings shall be fabricated in the USA or Canada.
- C. Elbows for all pipe sizes over 2" diameter shall be long radius type (1.5 pipe diameter to centerline of pipe).
- D. Use reducers, increasers, or reducing tees for change of pipe size. Bushings are not allowed.

- E. Forged steel (3,000#) branch connectors (ie “Weld-O-Lets”, “Thread-O-Lets”), per the limits set forth in Part 3 of this section, may be used to create branch connections in steel piping systems. All branch connectors shall be 3,000# fittings.

2.2 JOINING MATERIALS

- A. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- B. Comply with SFA-5.8, Section II, “ASME Boiler and Pressure Vessel Code” for brazing filler metal materials appropriate for the materials being joined. Copper- phosphorus alloy brazing filler metal; BCuP-5 (Staysilv), containing 15% silver (Ag), 5% phosphorus (P), remaining elements are copper (Cu).
- C. Soft solder shall be 95% tin, 5% Antimony.
- D. Gasket type shall be spiral wound 304 stainless steel/graphite (Flexitallic type GC or equal) type for raised faced joints. Flat faced joints shall have full faced, non asbestos gaskets suitable for the intended service. Red rubber gaskets are not allowed.

2.3 DIRECT BURIAL PIPE

- A. Underground steam pipe shall be a dual insulation, factory prefabricated system with an interstitial air space. The outer cover (exposed to the soil) shall be 1/8" FRP or HDPE casing. Outer insulation shall be polyurethane, inner insulation shall be mineral wool, and the interstitial air space shall be maintained via steel conduit. The interior carrier pipe shall be schedule 40 ERW steel pipe. System shall be provided with provisions to allow an air test of the outer casing.
 - 1. Insultek - Dual Con
 - 2. Perma-Pipe - Multi-Therm 500.
 - 3. Rovanco Piping Systems, Inc. – Insul 800 High Temperature Conduit
 - 4. Thermacor Process, LP – Duo-Therm 505
- B. Underground (steam) condensate and chilled water pipe shall be a factory prefabricated insulated piping system with a 1/8" HDPE or 0.060" PVC jacket and polyurethane insulation. The interior carrier pipe shall be steel ERW pipe, schedule 80 for condensate and schedule 40 for chilled water.
 - 1. Insultek - 250 steel system
 - 2. Perma-Pipe - XTRU-THERM
 - 3. Rovanco Piping Systems, Inc. – Insul-8
 - 4. Thermacor Process. L.P. – HT-406

2.4 PIPING SPECIALTIES

- A. Escutcheons shall be chrome plated, stamped steel, hinged, split ring escutcheon, with set screw or plastic style snap on type escutcheons: Provide chrome plated for exposed finish areas, plain finish for mechanical rooms and areas that will be painted.

- B. Unions:
 - 1. Malleable iron, Class 150 for steel piping systems and low pressure service; cast bronze, 125 w.s.p. for copper piping systems and low pressure service.
 - 2. Dielectric unions: Watts Regulator 3000 series
 - a. Use standard 'GA' gaskets for water, air gasoline, propane or as recommended by the manufacturer.
 - b. Use 'GB' gaskets for steam or high temperature (>210° and <300°).
- C. Dielectric Waterway Fittings: Electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining. Victaulic style 47-TT or equal.
- D. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 20 mesh perforations. Provide strainers with 125 psi working pressure
- E. Cast iron body for non-steam steel piping systems, cast steel for steam systems, and cast bronze body for copper piping systems. Include removable screen retainer with blowdown fitted valve and pipe plug.
 - 1. Condensate systems and strainers prior to steam traps shall be cast iron.
- F. Mechanical sleeve seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. Manufacturer shall be Link Seal by Thunderline Corp.
- G. Flexible connectors shall be stainless steel bellows with woven flexible bronze wire (for copper piping systems) or stainless steel (for steel piping systems) reinforcing protective jacket; minimum 150 psig working pressure, maximum 250° F operating temperature. Connectors shall have flanged or threaded end connections to match equipment connected; and shall be capable of 3/4" misalignment.
 - 1. Keflex, Div. of Flex-Weld, Inc.
 - 2. Mason Ind., Inc.
 - 3. Metraflex

PART 3 – EXECUTION

3.1 GENERAL

- A. Examine areas and conditions under which pipe and piping accessories are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the Installer.
- B. It is the responsibility of the contractor to coordinate the work of his trade with all other trades prior to the commencement of construction. Any conflicts must be brought to the attention of the Architect/Engineer/owner. Any work requiring removal and reinstallation due to the lack of coordination shall be the responsibility of the contractors with no additional cost to the owner.

3.2 PREPARATION

- A. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.3 INSTALLATIONS

- A. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.
- B. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.
- C. Install piping tight to slabs, beams, joists, columns, walls and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- D. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves. All valves and piping specialties must be accessible when all of the trades have completed their work.
- E. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve with hose connection, cap and chain. Install vents at high points. Pitch water piping to permit air to be vented to system high points and to permit complete drainage to low points. Always use eccentric fittings in horizontal piping when pipe is pitched.
- F. Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals.
- G. Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.
- H. Temporarily cover the open ends of all pipes not actively being installed and at the end of each work day to prohibit the influx of foreign materials.
- I. Arrange piping to provide adequate provision for thermal expansion and contraction. Arrange branches to individual heating units to take up motion or strain by installing three elbows.
- J. All branches from a main shall be provided with isolation valves.
- K. Direct burial piping systems shall be set in a sand bed, minimum 12" around the pipe. Outer casings for all pipe systems shall be pressurized to 5 psi, and the charge shall remain on during the backfill operation to insure system integrity.

3.4 FITTINGS AND SPECIALTIES

- A. Use fittings for all changes in direction, at all branch connections, and for change in pipe size.
- B. The creation of new outlets from the run of straight copper pipe / tube using a mechanical tool to create the connection (i.e. 'T' Drill) is allowed only in non pressure piping systems (i.e. gravity condensate).
- C. Remake leaking joints using new materials.
- D. Install dielectric waterway fittings to connect piping materials of dissimilar metals.

- E. Bronze bodied valves and devices installed in steel piping systems do not require dielectric fittings. Iron bodied valves and devices installed in copper systems require dielectric fittings.
- F. Install strainers on steam systems with the wye oriented horizontally. Install strainers immediately preceding steam traps with wye oriented vertically down. Install strainers for water systems with wye oriented vertically down.
- G. Welded forged steel branch connections may be used to create branch pipe taps in steel piping systems when the main to branch size ratio is not greater than three to one, and the maximum branch pipe size is 2 1/2". Do not 'fish mouth' pipe to create branch piping runs.
- H. Reductions in pipe size made with eccentric reducers shall have the tops level for water piping and bottoms level for steam piping.
- I. Run all horizontal building drains at uniform pitch. Follow indicated lines generally, but make exact layout on the job to work actual fitting dimensions, align piping and avoid interferences. Unless otherwise specified or required by code, provide proper support to maintain uniform fall of 1/4" /foot for lines 3 inches and smaller and 1/8" /foot for lines larger than 3 inches.
- J. Mechanical Sleeve Seals: Install per manufacturer's recommended practices. Insure the structure penetration is properly sleeved, refer to DC Standard, "BASIC MECHANICAL MATERIALS AND METHODS for requirements.
- K. Provide side stream filters in condenser water and chilled water systems where flow is ≥ 400 gpm. Install filter feeders provided by the chemical treatment contractor in heating and glycol systems. Furnish isolation valves serving filter feeders near the mains and near the filter feeders.

3.5 JOINTS

A. Steel Pipe Joints:

- 1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Ream threaded ends to remove burrs. Apply pipe joint sealant (Rectorseal No. 5) or Teflon tape suitable for the service for which the pipe is intended on the male threads at each joint. Teflon tape shall not be used for oil services.
- 2. Pipe Larger Than 2": Weld pipe joints in accordance with ASME Code for "Power Piping," B31.1 and per the contractor's tested Welding Procedure Specification (WPS).
 - a. Install weld neck flanges at all valves, appurtenances, and equipment with flange type connections. Paint all welds with a high temperature, rust inhibitive paint prior to installing insulation. Clean flange faces and install gaskets. Align flange surfaces parallel. Use suitable lubricants, such as Never Seize, on bolt threads. Tighten bolts gradually and uniformly with a torque wrench. Do not mate flat face flanges with raised face flanges.

B. Non ferrous Pipe Joints:

- 1. Brazed Joints: For copper tube and fitting joints, braze joints in accordance with the AWS "Soldering Manual", the contractor's tested Procedure Qualification Record, ANSI B31.1 - Standard Code for Pressure Piping, "Power Piping", ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration and the following:

- a. Fill and allow a trickle flow of an inert gas (ie., nitrogen) through the pipe and fittings during brazing to prevent formation of scale. Caution must be exercised not to allow the inert gas to deplete the oxygen, causing asphyxiation.
2. Soldered Joints: For copper tube and fitting joints, solder joints in accordance with the AWS “Soldering Manual” and “The Copper Handbook”. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making soldered joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.

END OF SECTION 15060