

**GENERAL:**

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1. The scope of this document is to provide instruction for the installation and testing of buried steam and condensate distribution piping.

**DESIGN GUIDELINES:**

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**Materials**

1. Pipe and Pipe Fittings

1.1. Drawings shall indicate piping with the following abbreviations:

- 1.1.1. Medium Pressure Steam: MPS
- 1.1.2. Medium Pressure Condensate: MPC
- 1.1.3. Pumped Condensate: PC
- 1.1.4. Manhole Drain: D

1.2. Fabrication:

- 1.2.1. 2" and under in chase, tunnels and manholes: Socket Welded
- 1.2.2. 2" and under for accessible steam trap piping in manholes and tunnels: Threaded
- 1.2.3. 2-1/2" and above: Welded and Flanged

1.3. 1.3. Pipe:

- 1.3.1. Seamless Carbon Steel, ASTM A53 Grade B
- 1.3.2. Steam (MPS): Schedule 40 to 10", 0.375" wall for 12" and above.
- 1.3.3. Condensate (MPC, PC): Schedule 80
- 1.3.4. All threaded pipe: Schedule 80

1.4. Fittings:

- 1.4.1. 2" and under in chase, tunnels and manholes: Class 3000 Socket weld forged steel fittings. ASTM A105, ANSI B16.11.
- 1.4.2. 2" and under steam trap piping in manholes and tunnels: Class 2000 Threaded forged steel fittings. ASTM A105, ANSI B16.11.
- 1.4.3. 2-1/2" and above: Butt welding carbon steel, ASTM A234, ANSI B16.9, elbows to be long radius unless otherwise called for. Use Standard Weight with Schedule 40 and 0.0375" wall pipe, Extra Heavy with Schedule 80 pipe.

1.5. Unions and Flanges:

- 1.5.1. Unions: Class 2000 forged steel, threaded, ASTM A105.
- 1.5.2. Flanges: 150 lb. forged steel welding neck, ASTM A105, ANSI B16.5
- 1.5.3. Gaskets: Steam and Condensate: Spiral wound, Class 150, Style CG or CGI, 304 SS/ Industrial Grade "Flexicarb" as manufactured by Flexitallic Group, Houston, Texas, or approved equal.
- 1.5.4. Bolting: ASTM A193, Grade B7 alloy steel stud bolts with heavy hex nuts, ASTM A194, Grade 2H.
- 1.5.5. Link Assembly: Seal annular space for piping passing through walls with interlocking synthetic rubber link assembly, Model "T" Link-Seal® as

manufactured by PSI-Thunderline Corporation, Houston TX, or approved equal.

#### 1.6. Sump Pump Discharge

- 1.6.1. Fabrication: Up to 3": Brazed joint with threaded valves.
- 1.6.2. Pipe: Seamless copper tubing, ASTM B88, Type K, hard drawn.
- 1.6.3. Fittings: 1/2" and above: Wrought copper solder joint pressure fittings, ANSI B16.22.
- 1.6.4. Brazing Fill Metal: AWS BCuP-5 (15% Ag, 80%Cu, 5%P).
- 1.6.5. Unions: Wrought copper/cast copper alloy.
- 1.6.6. Flanges: 150 lb. wrought copper, sweat connection, ANSI B16.24.
- 1.6.7. Gaskets: 1/16" non-asbestos compressed gasket material. Chesterton 195, Garlock 3000, or equal.
- 1.6.8. Bolting: ASTM A307, Grade B, heavy hexagon carbon steel bolts with heavy semi-finished hexagonal nuts.

### **Installation**

#### 1. Cleaning

- 1.1. Prior to assembly of pipe and piping components, all loose dirt, scale, oil and other foreign matter on internal or external surfaces shall be removed by means consistent with good piping practice. Chips and burrs from thread cutting operations shall be blown out of pipe before assembly. Cutting oil shall be removed from internal and external surfaces.
- 1.2. During fabrication and assembly, slag and weld spatter shall be removed from pipe joints by peening, chipping and wire brushing.

#### 2. Pipe Erection

- 2.1. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Any items which are unsuitable, cracked or otherwise defective shall be rejected and removed from the job immediately.
- 2.2. Pipe lines shall be run straight and true with a minimum use of joints and with only such offsets as may be required to clear interferences, to provide necessary clearance or headroom, or provide the necessary flexibility in the piping system.
- 2.3. Changes in direction of pipe lines shall be made with approved fittings or pipe bends only. Miter joints in welded pipe assemblies shall not be used except where approved by Project Manager.
- 2.4. Expansion joints shall be used in lieu of large expansion loops.
- 2.5. Backing rings shall not be used on butt welded joints.
- 2.6. All prefabricated piping shall be arranged with extra tangent, loose flanges, field joints or other provisions to permit field adjustment to suit construction tolerances and to avoid interferences.
- 2.7. Provide flanges or unions at all final connections to equipment, traps and valves to facilitate dismantling. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shut-off valves.

- 2.8. Pipe shall be cut to exact measurement and installed without springing or forcing. Particular care shall be taken to avoid creating, even temporarily, undue loads, forces or strains on valves, equipment or structural elements with piping connections or piping supports.
  - 2.9. All threaded pipe work is to be assembled with full threads, including all fittings, valves, unions and specialties. Threads shall be full and clean cut and the pipe shall be reamed and filed, removing all burrs from the interior. Threaded work shall be made up with a suitable pipe joint compound.
  - 2.10. All pipe shall be erected and supported in such a manner as to provide for expansion and contraction without harmful strain to structural members, pipe and pipe supports.
  - 2.11. Consideration shall be given to insulation thickness when routing piping such that adequate clearance is provided to avoid interfering with insulation.
  - 2.12. All piping in pipe trenches shall be welded regardless of size.
3. Branch Connections
    - 3.1. Branch connections shall be made with standard tees and 45° laterals of the type required for the service.
    - 3.2. In place of standard tees and 45° laterals in black steel piping systems, integrally reinforced weld-on fittings may be used providing branch the line is at least two pipe sizes under run pipe size.
4. Draining and Venting
    - 4.1. Maintain constant slope so lines are pitched for venting and drainage. No lines shall have pockets due to changes in elevation unless proper provisions for draining and venting are provided.
    - 4.2. Provide 1/2" drain valves fitted with 3/4" hose thread adapter at all low points of steam or condensate piping systems to permit complete or sectionalized draining.
    - 4.3. Provide manual air vents at the high points of condensate piping systems.
5. Sleeves
    - 5.1. Furnish and install sleeves for all pipes passing through walls and partitions. Refer to "Construction Standard - Steam and Condensate Pipe Wall Penetration" drawing.
    - 5.2. Sleeves shall be standard weight steel pipe having square cut ends with anchoring lugs welded on. Horizontal sleeves through walls and partitions shall be grouted in place and flush with finished wall faces.
    - 5.3. Size sleeves such that internal diameter is a minimum of 2" larger than O.D. of bare pipe for uninsulated lines and 2" larger than O.D. of insulation and jacket for insulated lines. Center pipes in sleeves.
    - 5.4. Lines entering buildings through sleeves shall be sealed with a high temperature link assembly placed on outside of insulation jacketing.
6. Dielectric Connections
    - 6.1. Pipe joints connecting copper tubing to steel or iron valves and piping shall be insulating, dielectric connections. Such joint, including dielectric material, shall be

rated to withstand the temperature, pressure and other characteristics of the service for which it is to be used, including testing pressure.

- 6.2. Screwed joints shall be made with insulating unions and couplings.
- 6.3. Flanged joints shall be made up with flange insulation kits consisting of a suitable gasket, bolt sleeves and washers.

**Testing**

1. Leakage Testing

- 1.1. Tests shall be performed prior to cleaning, insulating, or concealing pipe. Notify Owner’s Representative 48 hours in advance of testing.
- 1.2. Prepare and keep records of each system or section of system tested. Test reports shall include, but not necessarily be limited to, the following:
  - 1.2.1. Identification of piping system or section tested.
  - 1.2.2. Date of test and date of Project Manager’s approval signature.
  - 1.2.3. Testing medium and method or description of test procedure.
  - 1.2.4. Test pressure, duration of test and recorded pressure drop.
- 1.3. Pressure tests shall apply to piping only with all equipment, traps, relief valves and instruments blocked off or disconnected. In no case shall piping or any component be subjected to pressures exceeding 90% of their published rating. All system valves within section being tested shall be open. Provide temporary restraints on expansion joints and flexible connections during pressure testing.
- 1.4. Blanks shall be furnished and installed wherever necessary to prevent cold test water from coming in contact with hot valves. Remove blanks after testing.
- 1.5. Pressure tests shall apply to piping as indicted in the following schedule. The pressure shall be gradually raised to the value given and the source then blocked off. Pressures shall be observed after the pipe and contents have stabilized at the ambient temperature and the source of test pressure shut-off. All joints shall be visually examined during test. Leaks shall be repaired and complete testing procedure repeated. Upon successful completion and approval of the tests, the piping shall be relieved of pressure, drained, and cleaned.
- 1.6. Leakage Test Schedule

| Service                          | Operating Pressure<br>Psig | Hydrostatic Test Pressure<br>Psig | Minimum Time (hours) |
|----------------------------------|----------------------------|-----------------------------------|----------------------|
| Steam (MPS)                      | to 75                      | 150                               | 1                    |
| Medium Pressure Condensate (MPC) | to 100                     | 150                               | 1                    |
| Pumped Condensate (PC)           | to 100                     | 150                               | 1                    |

- 1.7. All new piping not specifically listed above shall receive an initial service leak test by gradually bringing the system up to normal operating pressure and examining for leaks.

- 1.8. On any given construction project, the Owner reserves the right to contract with an independent testing firm to complete ultrasonic shearwave weld inspections on randomly selected field welds. If the results of these tests indicate poor quality welds, those “failed” welds shall be replaced at no additional cost to the project. If further ultrasonic inspection is required to assure quality weld workmanship, these tests shall be at the expense of the contractor, and any and all defective welds shall be replaced at no additional cost to the project.
2. Final Inspection and Adjusting
  - 2.1. After each installation is completed, tested for leaks, cleaned and approved by Owner’s Representative, it shall be filled with the fluid it is to carry. Each system shall be tested in actual operation. All valves, safety devices and equipment shall be operated and final adjustments made to place the system in operation. Such operation shall be demonstrated to the satisfaction of the Owner’s Representative.

### **Commissioning**

1. MU: Steam and condensate shall be turned on by Energy Management Utility Distribution personnel only. Owner’s Representative will coordinate.

### **REFERENCES**

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