PHYSICAL FACILITIES
2018 Consultant’s Handbook
Division 33 Utilities
6000 Fabrication, Testing, and Cleaning Of Hydronic and Steam Piping Systems

1 General
1.1 Materials and installations shall be in accordance with the following industry and association standards.
   • ASME B31.1 Power Piping Code
   • ASTM Materials
   • AWWA Water Piping
   • AWS Welding

1.2 Design Conditions:
   1.2.1 Hydrostatic test pressure shall be as defined for each system in the respective guideline listed above.
   1.2.2 Consult Utilities Engineering if an application is believed to be outside of these conditions.

2 Fabrication
2.1 All direction changes and branch connections shall be accomplished with prefabricated fittings. Pipe bends and hot taps will not be acceptable without prior approval of Utilities Engineering.

3 Welding
3.1 All pipe fitters and plumbers must present proof of current ASME certification before doing any welding on this job. All welders shall be approved by the Owner.
3.2 The welders identification symbol (submitted with current ASME Certification) must be stamped on all work welded by this welder. A ¼” stamp die must be used at each weld and the markings are to be clear and deep in the pipe so that the welder can always be identified.
3.3 The Contractor will be required to remove and remake any weld not properly identified with a die stamped identification symbol.
3.4 Non-destructive testing methods may be utilized as deemed necessary by the welding inspector.

4 Testing
4.1 Steam piping shall have an Initial Service Test performed per the requirements of ASME B31.1 – Power Piping Code.
4.2 Chilled Water piping shall have a Hydrostatic Test performed per the requirements of ASME B31.1 - Power Piping Code.
4.3 The Contractor shall furnish, install and maintain all necessary equipment (rated pumps, hoses, barrels, tanks, piping, blind flanges, blanks, fittings, caps, temporary pipe supports, etc., and other apparatus) to achieve test pressures under the specification, code or regulation.
4.4 The Contractor shall furnish, install and maintain all temporary lines from the supply to the system under test and shall remove them after the test is complete.
4.5 Test water shall be diverted as directed by Owner upon completion of the test.
4.6 Vents shall be suitably plugged for piping systems undergoing tests, when required.
4.7 The Contractor shall exercise due and reasonable care in the testing of piping and systems to ensure the safety of personnel. The Contractor shall furnish and install temporary pressure relieving devices for safety.
4.8 If there is a possibility that test media will freeze, a suitable antifreeze shall be added to the test media provided such addition will not affect normal operation.
4.9 Where piping will be adversely affected by water, a substitute fluid may be used with the Owner’s and /or Engineer’s approval.
4.10 One or more calibrated indicating test gages shall be connected directly to the piping as required to coordinate the pressuring operation and shall be mounted to be visible to the test operator controlling the pressure. The gage shall have dials that are calibrated over a range approximately two (2) times the test pressure.
4.11 Tests will not be performed until all anchors, hangers, supports, gages, plugs, bulkheads, blanks, and allied appurtenances are installed and properly tightened. Tests will be made against bulkheads or blanks and not against closed valves unless otherwise specified.
4.11.1 Install temporary spring hanger stops prior to filling pipe with water.
4.12 All flange and weld joints are to be left uncovered, unpainted and exposed during the testing.
4.13 Items installed in the system, but for which testing is not required, shall be isolated. Before applying pressure, all lines or systems shall be inspected to insure that all parts not included in the test are isolated.
4.14 Hammer testing will not be performed on piping during the pressure test.
4.15 The test temperature shall not be less than 60°F for hydrostatic tests; and 70°F for pneumatic tests. The test pressure shall be as stated in the respective section for individual systems. The Contractor shall monitor test medium temperature to ensure system temperature has stabilized prior to beginning test period.
4.16 Flanged pipe pieces removed from the lines to permit installation of blanks shall be tested separately.
4.17 The Contractor shall maintain a log for testing piping systems and shall note date, system, line number,
time and duration of test, test pressure, fluid or gas used, defects encountered during testing, and remedies taken to achieve test conformance, and shall be signed by the person performing the test. Test reports shall be submitted to the Owner in triplicate.

4.17.1 System temperature and pressure shall be recorded at least four (4) times during the test period.

4.18 All testing shall be witnessed by the Owner who shall countersign and receive all test reports.

4.19 After testing, all lines shall be cleaned and flushed to the Owner’s satisfaction.

4.20 The following equipment shall not be subject to the testing procedure:

- Equipment not having a specified test pressure
- Pumps, boilers and compressors
- Tanks
- Expansion Joints
- The inlet side of relief valves

4.20.1 The Contractor shall furnish and install spool pieces and blind flanges to assure equipment protection.

4.21 Valves shall be in the “open” position for the test, unless otherwise specified.

4.22 Automatic control valves shall always be in the open position unless provided with a bypass permitting application of the pressure on both sides.

4.23 Instrument piping, except the piping for locally mounted indicating pressure gauges and for pressure gages used for test, shall be separately tested up to the block valves. Inline instruments shall be tested with the piping.

4.24 Auxiliary lines and systems which are open to the atmosphere downstream of drain and vent valves shall not be pressure tested, unless specified.

4.25 Piping that connects to lines installed by others, shall be isolated from such lines by valves or test blanks located at or near the junctions. When necessary to include parts of such lines in the test, the Project Manager shall be given prior notice so that the test conditions may be mutually agreed upon.

4.26 Testing of two systems may be combined, if the prescribed test media and pressures of both systems are compatible and prior approval is obtained from the Project Manager.

4.27 The test pressure shall not be applied until the piping and its contents reach the same temperature.

4.28 The point of introduction of pressure shall be located upstream of all check valves and upstream of pressure release devices.

4.29 While maintaining the test pressure, all welded, threaded, flanged and packed joints shall be inspected for leaks. Test duration shall allow for complete inspection but shall not be less than three (3) hours.

4.30 Restrictions, such as flow nozzles and orifice plates which interfere with filling, venting or draining shall be removed from the piping.

4.31 Piping and vessels shall be provided with vents at all high points to prevent air pockets when filling. Such vents shall also be opened when emptying to avoid producing a vacuum. Contractor shall furnish and install all necessary vents and drains including valves.

4.32 Pneumatic testing shall be with clean compressed air. The pressure shall be applied gradually.

4.33 While maintaining the pneumatic test pressure, all welded, threaded, flanged and packed joints shall be inspected for leaks using a soap suds test.

4.34 If the source of pressure is higher than the maximum test pressure specified, a relief valve shall be used to guard against over pressurization. The relief valve shall be set to the test pressure specified plus 10 psi.

4.35 Any joint found leaking during a pressure test shall be repaired and retested to the satisfaction of the Project Manager.

4.36 Test blanks, temporary piping, supports, spring hanger pins, etc., shall be removed. The application of paint and insulation to piping and equipment shall be completed.

4.37 Material such as gaskets, bolting, etc., damaged during the test shall be replaced.

5 Cleaning and Flushing

5.1 All piping installed under this work package shall be cleaned and flushed as part of the work after hydrostatic or pneumatic testing.

5.2 The Owner shall furnish the following for cleaning and flushing.

5.2.1 Sufficient source of fresh water, steam and compressed air from existing plant.

5.2.3 Target drain for water used for flushing.

5.3 The Contractor shall furnish and install all temporary valves, hoses and fittings to connect piping systems to water mains and sewers. The Contractor shall also furnish a temporary back-flow preventer (reduced pressure type) at connection(s) to existing water mains.

5.4 The Contractor shall flush all chilled water pipes with potable water to clear out debris.

5.5 The Contractor shall drain all flushing and cleaning
water to the existing storm sewers and/or waste water detention tank at a flow rate not to exceed 500 GPM.

5.6 Piping systems must be maintained in clean conditions at all times. Reasonable precautions shall be taken to prevent entry of foreign material into the piping system.

5.7 Steam Piping

5.7.1 Piping system shall be thoroughly blown out with steam using full line pressure, to assure complete removal of all foreign matter after pressure testing.

5.7.2 All steam lines will be cleaned via a series of steam blows. Source of steam will be from the existing steam systems. All steam blowing must be coordinated and witnessed by the Owner or his representative.

5.7.3 All temporary piping to atmosphere and temporary supports to conduct the steam blow shall be furnished and installed by the Contractor.

5.7.4 The Contractor shall include means to protect valve trim, flow orifices, and other devices which could be damaged by shot and debris. Equipment installed by the Contractor and damaged by steam blows shall be repaired or replaced by the Contractor at no additional charge to the Owner.

5.7.5 Target coupons for steam blows shall be furnished and installed by the Contractor. Target coupons shall be a 1” x 1” bar of brass fitted through square holes in a 4” steel pipe on the discharge of the steam blow. Steam lines will be blown clear until accepted by the Owner.

5.8 Condensate and Non-Potable Water Piping

5.8.1 Individual pipe sections are to be blown clean using compressed air, using a wand or other means prior to assembly. The finished system is to be flushed clean with water.

5.8.2 After blowout, the piping shall be flushed with water a minimum of ½ hour or until approval of the Project Manager is granted before placed in service.

5.9 Temporary Piping

5.9.1 On all piping systems requiring cleaning or flushing, all operating mechanisms such as valves, cylinders, bearings, etc., shall be disconnected. A spool piece shall be installed at these points to allow a continuous circulation of cleaning media or flushing fluid.

5.9.2 Special care shall be taken to insure that materials not compatible with cleaning fluids are protected.

5.10 Cleaning Bypass Items

5.10.1 All pump relief valves, bypass valves and other valves that were closed during flushing shall be removed and thoroughly cleaned.