

SECTION 22 11 00 – FACILITY WATER DISTRIBUTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Domestic water piping, above grade.
2. Unions and flanges.
3. Valves.
4. Pipe hangers and supports.
5. Flow control valves.
6. Strainers.
7. Water hammer arrestors.
8. Thermostatic mixing valves.
9. Di-electric connections.

B. Related Sections:

1. Section 07 84 00 – Firestopping: Product requirements for firestopping for placement by this section.
2. Section 08 31 13 – Access Doors and Frames: Product requirements for access doors for placement by this section.
3. Section 22 00 01 – General Plumbing Requirements.
4. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
5. Section 22 05 53 – Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
6. Section 22 07 00 – Plumbing Insulation: Product and execution requirements for pipe insulation.
7. Section 26 05 03 – Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.02 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z21.22 – Relief Valves for Hot Water Supply Systems.
 - 2. ANSI/NSF 61 – Drinking Water Components – Health Effects.
 - 3. NSF/ANSI 14 – Plastic Piping System Components and Related Materials
- B. American Society of Mechanical Engineers:
 - 1. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 3. ASME B16.26 – Cast Copper Alloy Fittings for Flared Copper Tubes.
 - 4. ASME B31.9 – Building Services Piping.
 - 5. ASME B40.1 – Gauges - Pressure Indicating Dial Type - Elastic Element.
 - 6. ASME Section VIII – Boiler and Pressure Vessel Code - Pressure Vessels.
 - 7. ASME Section IX – Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- C. American Society of Sanitary Engineering:
 - 1. ASSE 1010 – Performance Requirements for Water Hammer Arresters.
 - 2. ASSE 1011 – Performance Requirements for Hose Connection Vacuum Breakers.
 - 3. ASSE 1012 – Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
 - 4. ASSE 1013 – Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
 - 5. ASSE 1017 – Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
 - 6. ASSE 1019 – Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
 - 7. ASSE 1070 – Performance Requests for Water Temperature Limiting Devices.
- D. ASTM International:
 - 1. ASTM A182 – Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature

Service.

2. ASTM A269 – Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 3. ASTM A276– Standard Specification for Stainless Steel Bars and Shapes.
 4. ASTM A312– Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 5. ASTM B32 – Standard Specification for Solder Metal.
 6. ASTM B42 – Standard Specification for Seamless Copper Pipe, Standard Sizes.
 7. ASTM B88 – Standard Specification for Seamless Copper Water Tube.
 8. ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Applications.
 9. ASTM E1 – Standard Specification for ASTM Thermometers.
 10. ASTM E77 – Standard Test Method for Inspection and Verification of Thermometers.
 11. ASTM F708 – Standard Practice for Design and Installation of Rigid Pipe Hangers.
 12. ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
 13. ASTM D2765 – Standard Test Method for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics
 14. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
 15. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
- E. American Welding Society:
1. AWS A5.8 – Specification for Filler Metals for Brazing and Braze Welding.
- F. American Water Works Association:
1. AWWA C651 – Disinfecting Water Mains.
- G. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
 2. MSS SP 67 – Butterfly Valves.

3. MSS SP 69 – Pipe Hangers and Supports – Selection and Application.
4. MSS SP 70 – Cast Iron Gate Valves, Flanged and Threaded Ends.
5. MSS SP 71 – Cast Iron Swing Check Valves, Flanged and Threaded Ends.
6. MSS SP 78 – Cast Iron Plug Valves, Flanged and Threaded Ends.
7. MSS SP 80 – Bronze Gate, Globe, Angle and Check Valves.
8. MSS SP 85 – Cast Iron Globe & Angle Valves, Flanged and Threaded.
9. MSS SP 89 – Pipe Hangers and Supports – Fabrication and Installation Practices.
10. MSS SP 110 – Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Electrical Manufacturers Association:

1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

I. Plumbing and Drainage Institute:

1. PDI WH201 – Water Hammer Arrester Standard.

J. Underwriters' Laboratories

1. ANSI/UL 263 – Standard Fire Tests of Building Construction and Materials

1.03 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal procedures.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings and accessories. Submit manufacturer's catalog information and pipe joining methods: Solder, primer and glue, brazing, etc..
2. Valves: Submit manufacturer's catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturer's catalog information including load capacity.
4. Domestic Water Specialties: Submit manufacturer's catalog information, component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Shop Drawings of water system.

1.04 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 – Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of valves and equipment.
- C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.
- D. Record actual locations of valves, etc. and prepare valve charts.
- E. Test reports and inspection certification for all systems listed herein.
- F. Provide a certificate of completion detailing the domestic water system chlorination procedure and all laboratory test results.
- G. Submit location of access panels which vary from quantities or locations indicated on Contract Drawings.
- H. Provide full written description of manufacturer's warranty.
- I. Backflow preventer test report.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years of documented experience..

1.06 QUALITY ASSURANCE

- A. All work shall be in accordance with Texas Commission on Environmental Quality (TCEQ) Chapter 290 – Public Drinking Water.
- B. All piping materials shall be manufactured and tested according to applicable ANSI, ASTM, ASME, AWWA and CISPI standards.
- C. Unless otherwise noted, all piping materials shall be domestically manufactured in the USA.
- D. Piping Systems Materials:
 - 1. Note: Piping systems shall use consistent materials throughout each system. Materials for each piping system shall not be "mixed". Exception: where required due to above/below grade conditions; allowed due to inside building/outside building conditions; or where indicated by drawings or specifications.

2. Note: Lead containing solders shall not be used at any place in any system.
 3. All domestic water piping, fittings, valves and appurtenances shall be certified to ANSI/NSF 61.
- E. Manufacturer's name and pressure rating shall be permanently marked on valve body.
- F. The Contractor shall notify the manufacturer's representative prior to installing any copper press fittings. The Contractor shall obtain the representative's guidance in any unfamiliar installation procedures. The manufacturer's representative of copper press fittings shall conduct periodic inspections of the installation and shall report in writing to the Contractor and Owner of any observed deviations from manufacturer's recommended installation practices.
- G. Manufacturer Qualifications: Company shall have minimum three years documented experience specializing in manufacturing the products specified in this section.
- H. All grooved joint couplings, fittings, flanges, valves, and specialties of the same type shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- I. Installer Qualifications:
1. Company shall have minimum three years documented experience specializing in performing the work of this section.
 2. Installation of plumbing systems shall be performed by individuals licensed by the Texas State Board of Plumbing Examiners as a Journeyman or Master Plumber. Installation may be performed by Apprentice Plumbers provided they are registered with the Texas State Board of Plumbing examiners and under direct supervision of a licensed plumber. All installation shall be supervised by a licensed Master Plumber.
 3. All installers of copper press fittings shall be trained by the fitting manufacturer's appointed representative. Written notification of training shall be submitted to Owner prior to any installation.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.
- B. Accept valves and equipment 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.

- F. Store piping and equipment in a safe place, dry, enclosed, under cover in a well ventilated area.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 – Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

1.09 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Section 01 70 00 – Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish 1-year manufacturer warranty for domestic water piping.

1.11 EXTRA MATERIALS

- A. Section 01 70 00 – Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish 1 packing kit for each size valve, 1 loose key for outside hose bibs, service kits for 1 pump seal for each pump model.

PART 2 PRODUCTS

2.01 DOMESTIC WATER PIPING – ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type L, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F. or Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.
 - 3. Thread fitting: Pipe joint compound shall be lead free, non-toxic, low VOC and ANSI/NSF6/compliant. Temperature service range 10°F to 300°F.
 - 4. Press fittings: At contractor's option, copper piping 2 inch and smaller may be joined using copper or copper alloy press fittings with factory installed sealing elements of EPDM material.

2.02 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with [soldered] [brazed joints].
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.

2.03 GLOBE VALVES

- A. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, hand wheel, Buna-N composition discs.

2.04 BALL VALVES

- A. 2 inches and Smaller: MSS SP 110, 400 psi WOG two-piece bronze body, chrome-plated brass ball, full port, Teflon seats, blow-out proof stem, locking lever handle with balancing stops.
- B. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two-piece body, chrome-plated bronze ball, full port, Teflon seats, blow-out proof stem, locking lever handle with balancing stops.
- C. Neck Extensions: Provide valves with extended round stem/necks where valves are installed in piping to be insulated. Stem/necks must permit operation of valve without damage to the insulation vapor barrier system. Nibco Nibseal or equal.

2.05 CHECK VALVES

A. Horizontal Swing Check Valves:

1. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc.
2. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.

B. Spring Loaded Check Valves:

1. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat.
2. 2-1/2 inches and Larger: MSS SP 71, Class 125, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

2.06 FLOW CONTROL VALVES

- A. Construction: Class 150, Brass or bronze body, temperature and pressure test plug on inlet, combination blow-down or back-flush drain.
- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 5 psi.

2.07 RELIEF VALVES

- A. Pressure Relief:
 - 1. ANSI Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure Relief:
 - 1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.08 STRAINERS

- A. 2 inch and Smaller: Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- B. 2-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.
- C. 5 inch and Larger: Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

2.09 WATER HAMMER ARRESTORS

- A. ASSE 1010: Copper construction, piston type sized in accordance with PDI WH-201.
- B. Pre-charged suitable for operation in temperature range -100 to 300 degrees F and maximum 150 psi working pressure.
 - 1. Bellows Type
 - 2. Piston Operated

2.10 THERMOSTATIC MIXING VALVES

- A. Point of use mixing valve. Thermostatic mixing valve shall have body of brass or bronze with paraffin based thermal actuation. Valve shall be complete with integral checks with screens, and an adjustment cap with locking feature. Valve shall be ASSE Standard 1070 listed and shall maintain control down to 0.5 gpm. Valve shall maintain a mixed water temperature from 80° to 120°F \pm 3°F. Set to deliver 110°F (unless indicated otherwise). Valve shall be capable of controlling mixed temperature while hot supply temperature

ranges from 120°F to 180°F and withstand a maximum pressure of 150 psi. The minimum required differential between entering cold and hot water and mixed water shall be 15°F or lower.

2.11 DIELECTRIC CONNECTION

- A. Provide Dielectric isolation between dissimilar metal piping. NOTE: Brass/bronze valves shall not be acceptable for dielectric isolation under this specification.
- B. Two inch connections may be either dielectric union or isolating flange as required.
- C. Two and one-half inch and larger connections shall incorporate isolating flange kits. Flanges copper pipe shall consist of Class 150 cast copper alloy companion flange with flat face
- D. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- E. Dielectric waterway fittings shall have a copper-silicon casting or a zinc electroplated steel pipe body with high temperature stabilized polyolefin polymer liner; manufactured by Victaulic, Style 647 or PPP, Inc. Series 19000, or Owner approved equal by Anvil.
- F. Dielectric unions shall be rated at 250 psi, ground-joint type with inert, non-corrosive thermoplastic sleeve. End connection materials shall be compatible with respective piping materials; manufactured by EPCO Sales, Inc or Watts. Provide models to suit applicable transitions.
- G. Dielectric flanges shall be rated at 175 psi, have nylon bolt isolators and dielectric gasket. Materials shall be compatible with respective piping materials; manufactured by EPCO Sales, Inc or Watts. Provide models to suit applicable transitions.
- H. Flange insulation kit contain one "E: full face Trojan style insulation gasket manufactured from Nema grade G-10 glass reinforced epoxy retainer with a Nitrile seal, two insulation washers manufactured from Nema grade G-10, two steel (SEA zinc plated steel) back-up washers and one Nema Grade G-10 sleeve for each bolt.
- I. Dielectric Nipples:
 - 1. Manufacturer's: Subject to compliance with requirements.
 - 2. Grinnell Mechanical Products.
 - 3. Precision Plumbing Products, Inc.
 - 4. Victaulic Company.
 - a. Description :
 - 1) Standard: IAPMO PS 66
 - 2) Electroplated steel nipple, complying with ASTM F1545
 - 3) : 300 psig at 250 deg.F

- 4) End connection: Male Thread or grooved.
- 5) Lining: Inert and non corrosive, propylene.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Section 01 30 00 – Administrative Requirements: Coordination and project conditions.
- B. Verify excavations are to required grade, dry and not over-excavated.

3.02 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.

3.03 INSTALLATION – HANGERS AND SUPPORTS

- A. Install hangers and supports in accordance with Section 22 05 29. Provide non-metallic coatings or inserts on attachments for electrolytic protection where attachments are in direct contact with copper piping.

3.04 INSTALLATION – ABOVE GROUND PIPING

- A. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- D. Group piping whenever practical at common elevations.
- E. Slope piping and arrange systems to drain at low points.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
- H. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.
- 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 exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
- L. Install domestic water piping in accordance with ASME B31.9.
- M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.
- N. Install unions downstream of valves and at equipment or apparatus connections.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- Q. Install gate, ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- R. Install ball valves for throttling, bypass, or manual flow control services.
- S. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- T. Provide spring loaded check valves on discharge of water pumps.
- U. Provide flow controls in water circulating systems.
- V. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
- W. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
- X. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to each fixture or group of fixtures.
- Y. Utilize slow closing valves only. Do not install or allow quick closing valves.

3.05 PIPE JOINTS

- A. Welded: Beveling, spacing and other details shall conform to ASME B31.9 and AWS B2.1.
- B. Threaded: Treads shall conform to ASME B1.20. Joint compound shall be applied to male threads only and joints shall be made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound for corrosion protection.
- C. Soldered: Solder joints shall be made in accordance with ASTM B828. The temperature of the joint during soldering shall not be raised above the maximum temperature limitation of the flux.
- D. Press Fittings:

1. The installer of copper press type fittings shall be a factory qualified installer, licensed within the jurisdiction and familiar with the installation of the specific copper press joint system being utilized.
2. Copper press fittings shall be installed using the proper tool, actuator, jaws and ring as instructed by the press fitting manufacturer.
3. Copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions.
4. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark to assure the tubing is fully engaged in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

3.06 WATER-HAMMER ARRESTORS

- A. Provide water hammer arrestors as shown on the plans and as necessary to prevent water hammer from occurring. As a minimum, provide as follows.
1. A minimum of one arrestor shall be installed for each fixture header serving up to three fixtures. A minimum of two arrestors shall be installed for each fixture header serving four to seven fixtures. A minimum of three shall be installed for each fixture header serving eight or more fixtures.
 2. Note: "Header" refers to horizontal pipe from which adjacent fixtures are directly connected without intervening horizontal or vertical runs or offsets.
 3. Provide permanently sealed air chamber type water-hammer arrestor at all water closet locations.
 4. Provide an arrestor for each single fixture with a quick closing valve (e.g. single lever handles; wrist blades, push/pull faucets, self-closing faucets, flush valves, solenoid valves, etc.).
 5. NOTE: Washing machines and other solenoid operated equipment shall have arrestor (not air chamber) provided for each piece of equipment/fixture.
 6. Air chambers are not acceptable under any circumstance.
 7. Where indicated, provide water hammer arrestors integral to the fixture (lavatory, sink etc.) supplies equal to Precision Plumbing Products "Mini-Angle Stop". Provide all washing machine and icemaker connections with water hammer arrestors integral to the connection box.

3.07 FIELD QUALITY CONTROL

- A. Section 01 40 00 – Quality Requirements and 01 70 00 – Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

3.08 CLEANING AND DISINFECTION

- A. Domestic Water Piping: Domestic cold water and hot water piping shall be thoroughly flushed, cleaned and disinfected in accordance with the appropriate procedure described in the latest edition of ANSI/AWWA C651 or as described in this section. Cold and hot domestic water piping shall be thoroughly flushed with potable water to remove all foreign particles. The piping shall then be sterilized by filling the systems with a solution of chlorine containing 50 PPM of chlorine this solution shall stay in the piping for a minimum period of 24 hours; or the piping shall be filled with a solution of chlorine containing 200PPM of chlorine and this solution shall stay in the piping for a minimum of 3 hours. During which time all valves shall be opened and closed several times in order that all parts of the valve shall be in contact with the solution. After the sterilization period, the system shall be drained and flushed with clean potable water until the residual chlorine content is not greater than 0.2 PPM.
- B. Bacteriological test shall be performed by a third party testing lab hired by the contractor. SUBMIT testing lab qualification for review and approval by the Owner and A/E. The testing lab shall not have less than five (5) years experience with water testing.
- C. The above procedure shall be performed prior to final connections to utility or existing piping systems in the building to assure no chlorine or other contamination migrates into systems.
- D. Within one week (7 days) days after cleaning is completed, submit written report signed by supervising craftsman and contractor principal certifying cleaning and sterilization was conducted as specified.
- E. Take samples no sooner than 24 hours after flushing, from at minimum of 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.
- F. The cleaning and disinfection of water lines shall not be done sooner than 3 weeks prior to owner occupancy. If it has been more than 3 weeks then the contractor shall , at his own expense, clean and disinfect the pipe again not sooner than 3 weeks before owner occupancy.

3.09 TESTING

- A. Each system installed under this contract shall be cleaned and tested to appropriate plumbing code for each particular application.
- B. Testing shall also include any additional requirements from the authority having jurisdiction.
- C. Equipment, material, power, and labor necessary for the cleaning, flushing, sterilization, inspection and testing of systems covered within this Specification Section shall be furnished by the Plumbing Contractor. All testing and inspection procedures shall be in accordance with Division 01 and Special Condition requirements of this Contract.
- D. For any requested inspection, the Contractor shall complete prior inspections and tests to ensure that items are ready for inspection and acceptance by the Owner and/or Architect/Engineer. The Contractor shall be responsible for any and all costs incurred by Owner and/or Owner representatives, including consultants, resulting from a review or inspection that was scheduled prematurely.

- E. The Contractor shall conduct the tests and the Owner's Construction Inspector will witness and approve the results.
- F. Verify systems are complete, flushed and clean prior to testing. Isolate all equipment subject to damage from test pressure. Test and inspect for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. Piping being tested shall not leak nor show any loss in test pressure for duration specified.
- G. Leave piping uninsulated, uncovered and unconcealed until it has been tested and approved. Where any portion of piping system must be concealed before completion of entire system, the portion shall be tested separately as specified for the entire system prior to concealment. Contractor shall expose all untested covered or concealed piping.
- H. In cases of minor installation and repairs where specified water and/or air test procedures are deemed impractical, Contractor shall obtain written approval from Owner's Representative to perform alternate testing and inspection procedures. Alternate testing and inspection procedures for minor installation and repairs shall include visual evaluation of installed components by Owner's Representative during a simulation of use.
- I. The water utilized for tests shall be obtained from a potable source of supply.
- J. Prepare testing reports. If testing is performed in segments, submit separate report for each segment, complete with diagram or clear description of applicable portion of piping. After inspection has been approved or portions thereof, certify in writing the time, date, name and title of the persons reviewing the test. This shall also include the description of what portion of the system has been approved. Obtain approval signature by Owner's Representative. A complete record shall be maintained of all testing that has been approved, and shall be made available at the job Site. Upon completion of the work, all records and certifications approving testing requirements shall be submitted to the Owner's Representative before final payment is made.
- K. Gauges used for testing shall have increments as follows:
 - 1. Tests requiring a pressure of 10 psi or less shall utilize a testing gauge having increments of 0.10 psi or less.
 - 2. Tests requiring a pressure of greater than 10 psi but less than or equal to 100 psi shall utilize a testing gauge having increments of 1 psi or less.
 - 3. Tests requiring a pressure of greater than 100 psi shall utilize a testing gauge having increments of 2 psi or less.
- L. Separately test above and below ground piping.
- M. Do not introduce test water into piping systems when exposure to freezing temperatures is possible.
- N. Do not introduce test water into sections of piping located above existing sensitive areas and/or equipment that may be damaged or contaminated by water leakage. Coordinate with Owner's Representative to determine areas and/or equipment considered as being sensitive.

- O. Defective work or material shall be reworked and replaced, and inspection and test repeated. Repairs shall be made with new materials. Pipe dope, caulking, tape, dresser couplings, etc., shall not be used to correct deficiencies.
- P. The Contractor shall be responsible for cleaning up any leakage during flushing, testing, repairing and disinfecting to the original condition any building parts subjected to spills or leakage.
- Q. Domestic hot water system:
 - 1. Test Remote fixtures to determine hot water is available within 30 seconds. Provide a report and a drawing indicated fixtures tested and the duration of time to provide 110 °F.
 - 2. Record temperature at each return pump.
- R. Pressure test all water piping in accordance with the applicable plumbing code and local AHJ.
- S. All testing of pumps shall be by owner representative and a report shall be provided.
- T. Equipment, material, power, and labor necessary for the cleaning, flushing, sterilization, inspection and testing of systems covered within this Specification Section shall be furnished by the Plumbing Contractor. All testing and inspection procedures shall be in accordance with Division 01 and Special Condition requirements of this Contract.
- U. For any requested inspection, the Contractor shall complete prior inspections and tests to ensure that items are ready for inspection and acceptance by the Owner and/or Architect/Engineer. The Contractor shall be responsible for any and all costs incurred by Owner and/or Owner representatives, including consultants, resulting from a review or inspection that was scheduled prematurely.

END OF SECTION