PLUMBING PIPE AND PIPE FITTINGS

SECTION 15065

PART 1  GENERAL

1.1  DESCRIPTION OF WORK

A. Work included in this Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Sanitary drainage and vent system piping.
2. Domestic water system piping.
3. Natural gas system piping.
4. Equipment drain piping.

1.2  RELATED WORK SPECIFIED ELSEWHERE

A. Section 15090: Support and Anchors
B. Section 15100: Valves
C. Section 15200: Noise, Vibration and Seismic Control
D. Section 15355: Fuel/Gas Piping
E. Section 15450: Plumbing Systems

1.3  APPLICABLE PUBLICATIONS: THE PUBLICATIONS LISTED BELOW FORM A PART OF THIS SPECIFICATION TO THE EXTENT REFERENCED. THE PUBLICATIONS ARE REFERRED TO IN THE TEXT BY THE BASIC DESIGNATION ONLY.

A. American National Standards Institute (ANSI) Publications:

2. B16.9  Factory Made Wrought Steel Butt Welding Fittings
3. B16.11 Forged Steel Fittings, Socket Welding and Threaded
4. B16.12 Cast Iron Threaded Drainage Fitting
5. B16.18 Cast Bronze Solder Joint Pressure Fittings
6. B16.21 Nonmetallic Gaskets for Pipe Flanges
7. B16.22 Wrought Copper and Bronze Solder-Joint Pressure Fittings
8. B16.39 Malleable Iron Screwed Fittings
9. B18.2.1 Square and Hex bolts and Screws, including Hex Cap Screws and Lag Screws
10. B18.2.2 Square and Hex Nuts
11. B31.1 Power Piping
12. B31.9 Building Service Piping
13. B40.1 Gages, Pressure, Indicating Dial Type, Elastic Element

B. American Society for Testing and Materials (ASTM) Publications:
1. A 47 Malleable Iron Castings
2. A 53 Pipe, Steel, Black and Seamless Steel Pipe
3. A 74-82 Cast-Iron Soil Pipe and Fittings
4. A 183 Carbon Steel Track Bolts and Nuts
5. A 307 Carbon Steel External and Internally Threaded Standard Fasteners
6. A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
8. A 536 Ductile Iron Castings
9. B 32 Solder Metal
10. B 88  Seamless Copper Water Tube
11. C 564  Rubber Gaskets for Cast-Iron Soil Pipe and Fittings

C. American Society of Mechanical Engineers (ASME) Publications:
   1. ASME Boiler and Pressure Vessel Code and Interpretations
   2. Section VIII - Pressure Vessels - Division 1

D. American Welding Society Inc. (AWS) Publication:
   1. A5.8-76  Brazing Filler Material

E. Copper Development Association Inc. Publication:
   1. Copper Tube Handbook

F. Underwriters Laboratories Inc. (UL).

G. Cast Iron Soil Pipe Institute Publications 301-78 and 310-78.


1.4 QUALITY ASSURANCE

A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

B. Supply all equipment and accessories new and free from defects.

C. Supply all equipment and accessories in compliance with the applicable standards listed in article 1.04 of this section and with all applicable national, state and local codes.

D. All items of given type shall be the products of the same manufacturer.

E. Welding materials and labor to conform to ASME code and applicable state Labor Regulations.

F. Use fully qualified welders licensed by state authorities.
G. Each length of pipe, fitting, trap, fixture or device used in any piping system shall be stamped or indelibly marked with:

1. Weight or quality.

2. Maker's name or mark.

1.5 SUBMITTALS

A. Manufacturer's Literature and Data

1. Piping and Fittings, Gaskets, Brazing and Soldering Metals, Piping Accessories, Shop Drawings and Catalog Cuts: Submit shop drawings and catalog information showing plan, elevations, dimensions, capacities.

PART 2 PRODUCTS

2.1 CLASSES AND MAXIMUM WORKING PRESSURES:

A. Equipment and piping components shall be suitable for use under the maximum working pressures indicated. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications.

2.2 PIPE SERVICES

A. Relief, Safety Valve discharge, Steel, Schedule 40, welded or screwed ASTM A53 Grade B

B. Equipment Drains and Overflow, Condensate drains Copper Type L, ASTMB88 Atmospheric vent, Make-up water

C. Drainage Systems

1. Underground
   a. Sanitary Hubless CI to CISPI 301

2. Aboveground (inside building)
   a. Sanitary and vent Hubless CI to CISPI 301
3. Sanitary piping to meet requirements of National Sanitation Foundation standard 14.

D. Domestic Water Piping

1. Underground Type K ASTM B 88 soft temper copper tubing, wrapped.

2. Inside, above ground Type L hard copper ASTM B 88

3. Exposed at plumbing fixtures and all kitchen, Chrome plated brass pipe fixtures and equipment:

E. Natural gas

1. Inside building: Schedule 40, steel pipe welded or screwed, mill wrapped or coated as if for underground service.

2.3 PIPING AND FITTINGS

A. Pressure Piping

1. Pressure piping shall be:
   a. Ferrous and copper piping conform to requirements of ANSI Safety Code for Pressure Piping, B31.1.
   b. Be commercially round and straight.
   c. Be of uniform quality and workmanship.
   d. Be free from all defects.
   e. Be identified.

2. Pressure ratings herein are "W.O.G." or "Water Working Pressure."

   a. 2-1/2” and larger.
   c. Steel welding-neck flanges and flanged fittings, ANSI B16.5, 150 psi.
4. Copper Tubing:
   a. ANSI H23.1.
   b. Wrought-copper, solder joint fittings, ANSI B16.22, in sizes available.
   c. Cast-bronze solder-joint fittings, ANSI B16.18, only in sizes not available in wrought copper.
   d. Cast bronze, threaded, ground-joint unions, ANSI B16.18, 2" and smaller.
   e. Cast-bronze, flanged unions, ANSI B16.24, 150 psi class, 2-1/2" and larger.

5. Brass:
   a. Standard weight and red brass pipe, 85 percent copper, 15 percent zinc, ANSI H27.1.
   b. 125 psi threaded brass fittings, ANSI B16.15

B. Drainage Piping:
   1. Cast Iron pipe and fittings with hubless joints to CISPI 310.
   2. Clamp-All or Anaco Husky for waste piping above and below grade and vent piping below grade, stainless steel clamp for vent piping above grade.
   3. Copper Tubing:
      a. ASTM B-306, Type DWV, hard temper.
      b. Cast-bronze, solder-joint drainage fittings. ANSI B-16.23 or wrought copper ANSI B16.29.

C. Fittings shall be long radius fittings, except fittings in vent piping may be short radius fittings. Minimum Size piping shall be 2 inches for buried piping and 1.5 inches for aboveground piping.


E. Flange Gaskets:
   1. Full faced or flat ring type to suit flange facings, selected from one of following materials:
a. **Steel Piping Systems:**

   1) Full face fluorinated elastomer.
   2) 1/16" thick.

b. **Domestic Hot and Cold Water:**

   1) Red rubber, ASTM D1330.
   2) 1/16" thick.
   3) Similar to Crane Style 555. Garlock 3000.

2. Gaskets coated with thread lubricant when being installed.

F. **Flange Bolts, Nuts and Washers:**

1. Steel piping, carbon steel conforming to ASTM A307, grade B, and material for nuts shall conform to ASTM A194, grade 2. Dimensions of bolts, studs, and nuts shall conform to ANSI B18.2.1 and ANSI B18.3.2 with threads conforming to ANSI B1.1 coarse type with class 2A fit for bolts and studs, and class 2B fit for nuts.

2. Copper piping systems, bronze bolts.

G. **Unions:**

1. Steel piping 2-1/2" and smaller:

   a. 250 psi: ground joint
   b. Similar to Grinnell Fig. J-3, Watts 3004.

2. Steel piping larger than 2-1/2": welding flanges.

3. Copper Piping:

   a. Similar to Nibco No. 733.

4. Other systems to match piping.

H. **Dielectric Unions, flanges, waterways, couplings:**

1. 2-1/2" and smaller:

   a. 250 psi WOG conforming to ASTM F-492-77
b. Threaded ends, electro-zinc plated steel body with thermoplastic liner.

c. Similar to Victaulic "Clearflow".

2. Dielectric unions shall not be used.

2.4 ESCUTCHEONS, FLASHINGS AND SLEEVES

A. Escutcheons:

1. Similar to Grinnell Fig. 2 for copper tubing.

2. Similar to Grinnell Fig. 13 for steel pipe.

3. Brushed chrome plated brass.

B. Flashings for pipes through roofs:

1. See Architectural drawings.

2. Secure pipe below roof to prevent relative movement.

C. Sleeves; of following types as required:

1. Minimum 22 gauge, galvanized steel sleeves if removed entirely after concrete pour, Schedule 40 PVC if remaining after pour.

2. With welded PVC flange to serve as water stop in waterproofed walls.

2.5 SHOCK ABSORBERS

A. For Copper Piping:

1. Brass body, with diaphragm or piston, pre-charged similar to Watts Series 15, "or approved equal".

2. In domestic water system, bearing National Sanitation Foundation Seal.

2.6 FLEXIBLE COUPLINGS

A. Provide flexible couplings at pump suctions and discharges. Use molded spherical or convoluted rubber couplings at flanged pump and braided hose at screwed pump connections.
B. Molded-rubber covered, "Twin Sphere" type design, multi-layered cord fabric design suitable for working pressures ranging from negative ten psi to positive 50psi on continuous basis. Backing rings and other flange plates shall be of galvanized steel. For unrestrained applications provide stainless steel wire restraints.

C. Metal Flexible Connectors: Provide flexible connectors fabricated of Grade E phosphor bronze, monel or corrugated stainless steel tube covered with comparable bronze or stainless steel braid restraining and pressure cover. Stainless steel grade shall be 340. Live lengths shall be as indicated, but not less than that recommended by the manufacturer for continuous vibration application.

2.7 EXPANSION JOINTS

A. 304 or 321 stainless steel bellows type with stainless steel flow liner, carbon steel flanges, minimum 3" axial compression. Similar to Hyspan series 2500.

2.8 EXPANSION TANK

A. Heavy duty replaceable butyl rubber bladder 135 PSIG rated, removable for inspection. Fabricated steel shell designed and constructed per ASME Section VIII, Division

1. Maximum operating temperature 240 degree F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Arrangement:

1. piping is diagrammatically indicated. Install generally as shown.

2. Do not scale Drawings for exact location of piping.

3. Install piping to coordinate with other trades and accommodate field conditions.

4. Piping arrangement unless otherwise noted:

   a. Arrange piping neatly along walls.

   b. In neat, horizontal groups.

   c. Each group to be in one plane, in so far as possible.
d. Piping connections to equipment shall be arranged so that removal of equipment or components of equipment and similar work can be accomplished with the least amount of disassembly or removal of the piping system. Piping connected to equipment with vibration isolators shall be provided with flexible connections conforming to vibration and sound isolation requirements of other Sections of this Division.

5. Do not sleeve structural members without consent of Architect.

6. Maintain minimum 1" clearance from adjacent work, including insulation, except as noted or approved.

7. Install piping concealed above ceilings or in walls unless otherwise indicated.

8. All steel pipe and fittings, not insulated or wrapped to be cleaned.

B. Expansion, Contraction and Bending:

1. Install piping with provisions for expansion and contraction.
   a. Provide expansion loops, offsets, swing joints, and/or expansion joints where indicated or otherwise required. Nesting of grooved joint couplings for expansion provision not permitted.

2. Do not spring or force piping during installation.

3. Do not bend piping without use of pipe bending machine.

C. Sloping, Air Venting and Draining:

1. Sanitary Drainage Piping:
   a. Slope horizontal sanitary drainage piping 1/4" per foot minimum, unless shown otherwise or approved by Owner.
   b. Make all changes in direction of drainage piping by use of 45-degree wyes, long turn tee wyes, long sweep quarter bends, sixth, eighth or sixteenth bends.
   c. Short-turn sanitary tees permissible on horizontal to vertical where space conditions require.

2. Provide drain valves and hose adaptors at all low points in piping on Domestic systems, other systems provide drain valves and hose adaptors at system low point and at equipment connections.
D. Valves:
   1. Install at equipment to allow maintenance or isolation, and to establish proper
      and sequential operation of the complete system.

E. Piping Specialties:
   1. Locate and orient thermometers and gauges to permit observation by personnel
      standing on floor.
   2. Provide instrument cocks at pressure gauges.
   3. Provide straight runs of piping upstream and downstream from flow meters as
      recommended by manufacturer.

F. Copper:
   1. Crimping of copper tubing, piping or fittings is prohibited.
   2. Isolate copper pipe and tubing from contact with steel.
   3. For branch drops and rises to plumbing fixtures, anchor branch to wall with
      drop-ear ell or tee.
   4. On exposed piping wipe clean all solder joints.

G. Care of Floors:
   1. Do not set pipe vises or threading machines on any unprotected concrete
      floors.
   2. Cover floor when making plumbing connections to avoid staining floors with
      oil, white or red lead or other substances.
   3. Contractor shall bear cost of removing any stains.

3.2 SYSTEMS INSTALLATION

A. Domestic Water:
   1. Connect copper tubing to fixtures with hard brass fittings.
   2. Chrome plated where exposed at fixtures.
a. Prevent damage to chrome-plated surfaces.

B. Waste, Vent Water

1. Provide accessible cleanouts:
   a. 100 feet on center, maximum, for soil and waste piping.
   b. 100 feet on center, maximum, for storm water piping.

2. Install cleanouts accessible.

3. Install grade cleanouts in 16" x 16" x 4" thick concrete block.
   a. Slope top of concrete down to edges.
   b. 45 degree bevel top corner edges.

C. Threaded Joints for steel, copper pipes.

1. Sealed with sealant compounds or teflon tape.

2. Sealant compounds:
   a. General Service: John Crane JC-40, Permatex "Blue", "or equal".
   b. Fuel gas, refrigerant: John Crane No. 2 Plastic Lead Seal "or equal".

D. Soldered and Brazed Joints:

1. Use 95-5, tin-antimony for domestic water, solder for other copper piping.
   Use flux meeting ASTM B813 requirements. Assemble solder joints in accordance with ASTM B828.

2. Brazing filler material BCuP-3 or BCuP-4 to AWS A5.8 during brazing of the pipe connections, the interior of the pipe shall be purged continuously with dry nitrogen. Use a flow meter and regulator to control flow rates.

3. Clean surfaces to be jointed, of oil, grease, rust and oxides.
   a. Remove grease form fittings by washing in solution of 1/16 sodium carbonate and three gallons hot water.
   b. Clean socket of fitting and end of pipe thoroughly with emery cloth to remove rust and oxides.

3.3 ADJUSTMENT AND CLEANING
A. General:

1. During construction:
   a. Keep openings in piping closed to prevent entrance of foreign matter.
   b. Clean pipe, fittings and valves internally.
   c. Hammer welds to remove slag and weld beads.

3.4 DISINFECTION OF WATER SYSTEMS:

A. After domestic water systems have been installed and tested, all piping shall be sterilized by the following method:

1. Inject a solution of chlorine gas and water containing not less than 50-ppm of free chlorine into the system, in such a manner as to ensure that the entire system is completely filled with the solution. During this procedure all valves shall be operated and outlets shall be tested for residual chlorine. Continue injection until all outlets indicate at least 50-ppm of free chlorine.

2. After injection, isolate the system and hold solution in retention, for a period of not less than 24-hours. Make tests for residual chlorine after retention. If such tests indicate less than 50-ppm of residual chlorine, repeat the entire procedure. After satisfactory sterilization has been effected, flush the system with water from any acceptable source, until all traces of chlorine have been removed or until the chlorine content is not greater than that in the existing supply.

B. Until sterilization of the water system has been made, the Contractor shall maintain signs at all outlet locations stating that the water system has not been sterilized and the water shall not be used for human consumption.

C. Prior to filing of Notice of Completion, submit a certificate of sterilization/chlorination, together with bacteriological reports, stating the work has been done in accordance with the requirements set forth above.

3.5 FIELD QUALITY CONTROL

A. General Tests:

1. Less than 100 psi operating pressure & vacuum lines.
   a. Test hydrostatically to 150 psi.
   b. Pluming waste and vent test as Section 15450

2. Duration: 2 hours.
a. With system valves capped and pressure apparatus disconnected.
   
   1) Pressure change: none
   2) Compensate for temperature change.

3.Leaks and defects:
   a. Repair or replace as directed.
   b. Without additional cost.

4. Test concealed piping prior to concealment.

5. Refer to other section for tests to plumbing systems and other special piping systems.


7. Furnish written report and certification that tests have been satisfactorily completed.

8. It is the Contractor's responsibility to plan for the testing procedure and to provide all necessary plugs, flanges and fittings, or to temporarily cap pipes to perform the tests.

   END OF SECTION