

SECTION 15100

PLUMBING PIPING

PART 1 –GENERAL

1.1 SYSTEM DESCRIPTION

- A. This section provides specifications for plumbing piping inside a building: Domestic water, industrial water, recycled water, reclaimed water, sanitary waste and vent storm drain piping. Roof drains, area drains, floor drains and floor sinks are also specified here.
 - 1. For piping outside the building see the related sections listed below.

1.2 DELIVERY, STORAGE, AND HANDLING

- A. Equipment Furnished by the Contractor: Specific provisions for delivery and storage locations, as well as handling, protection, and security measures shall be included in the Contract Documents.

1.3 SUBMITTALS - REFERENCE SECTION 01330

- A. In addition to the requirements of Section 01330 submittal procedures, a complete schedule of valves installed, together with drawings that identify the locations of numbered valves and the service which each controls, shall be submitted to the Project Manager.

PART 2 –PRODUCTS

2.1 PIPING

- A. Domestic Water and Industrial Water:
 - 1. Above Grade: ASTM B88 (ASTM B88M), TYPE L drawn copper tube.
 - 2. Below Grade: ASTM B88, Type K copper tube.
 - 3. Fittings: ASME B16.18 cast copper or ASME B16.22 wrought copper and bronze.
 - 4. Joints: ASTM B32, solder, grade 95
- B. Drainage Piping
 - 1. Sanitary Waste and Vent Pipe and Fittings
 - a. Below grade:
 - 1) Buried below floors, below grade, and within 5 feet of building perimeter: Hub and spigot cast iron piping conforming to ASTM A-74, standard weight soil pipe. All pipe and fittings shall be marked with CISPS trademark or receive prior approval by the engineer of

record.. Joint for hub and spigot pipe and fittings: ASTM C-565
Compression gaskets. Minimum size for pipe below building floors
shall be 3 inch.

Couplings at last connection: Heavy duty type 394 corrugated stainless
steel shield couplings having 4 sealing clamps for pipe sizes 1-1/4" to 4",
and 6 sealing clamps for pipe sizes 5" to 10", Anaco "Husky SD-4000,"
clamp-All 125, Tyler WB, MG Couplings, or equal, comply with FM
1680, Class 1.

Approved Alternate to above.

- 2) Buried below floors, below grade, and within 5 feet of building
perimeter: Cast-iron, no hub, service weight, with Husky, Clamp-All,
or equal, heavy duty stainless steel bands on all piping. Minimum
size for pipe below building floors shall be 3 inches.
- b. Above grade
 - 1) 1.5 inch and Smaller: Copper Type M or L DWV
fittings, soldered, Galvanized steel or cast iron no-hub.
Husky, Clamp-All, or equal, heavy duty stainless steel
bands on all piping.
 - 2) 2 inch and Larger: Copper Type M or L DWV fittings,
soldered, Cast-iron, no-hub
2. Lab Waste Vent Piping and Fittings:
 - a. Lab Waste Piping (Below Grade): George Fisher, Enfield, Orion, or
equal, conforming to ASTM D-2122, Schedule 80, flame retardant
polypropylene, (FRPP) piping and drainage pattern fitting with electric
heat coil fusion ends. Lab Waste Vent piping similar except use Schedule
40 piping.
 - b. Lab Waste Piping (Below Slab): Duriron, no known equal, 14.5%
silicone content cast iron piping, with mechanical joints for sizes up to 4",
and hub and spigot joints for 6" and larger piping. Use mechanical joints
at equipment and lab sink rough-ins
3. Corrosion Protection
 - a. 8 mils thickness polyethylene sleeve for underground piping
 - b. Tapecoat "TC", Protecto-Wrap, or equal, 35 mils thick, polymer film
with cold-applied tape coating, conforms to AWWA C-209.
4. Storm drainage
 - a. Below grade, exterior: Cast-iron, no-hub, heavy duty stainless
steel bands Husky, Clamp-All, or equal. Minimum size for
below grade pipe shall be 3 inch.
 - b. Buried below floors and within 5 feet of building perimeter:

- Cast-iron, no-hub, "Clamp-All" bands.
- c. Above grade: Cast-iron, no-hub, heavy duty stainless steel bands, Husky, Clamp-All, or equal.
- 5. Condensate drainage
 - a. Type DWV copper or type M copper.
- 6. Sub-soil drainage
 - a. 4 inch PVC pipe with 2 rows of 0.625 inch holes 120 degrees apart above horizon of pipe. Holes shall be not more than 4 inches apart along length of pipe. Wrap pipe in non woven filter fabric sock with 75 micron pores.
- C. Relief Valve Drain: Copper Type L with soldered fittings piped to drain of adequate capacity for the exterior of the building. Final location confirmed by the Project Manager based on flow calculations.
- D. Cleanouts:
 - 1. Cleanouts shall be furnished with brass countersunk plugs with lead seal for sanitary waste lines and matching plugs or removable caps or plugs for other piping in accordance with manufacturer's recommendations for the particular pipe material.
 - 2. Tee handle wrench shall be furnished to suit plugs.
 - 3. Stainless steel cover shall be provided in walls
 - 4. Clean outs will be installed at a minimum of 100 feet on 4" and larger and 50 feet on 3" and smaller. In addition, a cleanout will be installed at all lateral changes of direction.
 - 5. All restrooms will have cleanouts at last fixture on a system that would include restrooms with an individual fixture of a bank of fixtures.
 - 6. All drinking fountains will have cleanouts.
 - 7. All "J" traps will have cleanouts
- E. Roof Drains:
 - 1. RD-A: 1530 scupper drain with angle grate and 90 degree threaded outlet.
 - 2. RD-B: 1010-UDC to suit roof deck

PART 3 –EXECUTION

3.1 PIPING INSTALLATION

- A. General:
 - 1. Where galvanically dissimilar pipe materials interconnect, appropriate manufactured adapters or flanged connections with suitable gaskets shall be provided.

2. Piping shall be protected from damage and contamination during transport and construction. Exposed ends of piping shall be kept sealed prior to and during erection and at the end of each working day.
3. Copper tubing and piping shall be cut with dedicated wheel cutter. Cut ends shall be square to form proper seating in socket fittings. All cut ends shall be reamed and deburred. All piping needs to be flushed in compliance with current plumbing code.

B. Water System Piping: Piping shall be arranged, pitched, and valved for complete drainage and control of each system. Isolation valves to be installed per floor, per room per fixture.

C. Vents and Drains:

1. Vents shall be pitched to drain, collected at risers where practical, offset toward the center of the building, and extended through the roof. All traps and sumps shall be vented.
2. Relief Valve Drain: Union shall be installed on drain line on discharge side of relief valve within 3 inches (3") of relief valve.
3. Liquid Waste: Waste pipe centerline shall be located within 1 (1") inch of its corresponding fixture centerline where the waste pipe passes through the wall.

D. Piping Supports:

1. Spring vibration isolation pipe hangers shall be installed in mechanical rooms and areas sensitive to vibration. The drawings shall indicate specific areas where this requirement applies.
2. Plastic piping shall be supported as specified in UPC.

3.2 BRAZING AND SOLDERING

A. Brazing and Soldering:

1. Brazing: Use fifteen (15) percent silver, 80 percent copper and five (5) percent phosphorus for the following:
 - a. Domestic water pipe: 1-1/2 inches and larger.
 - b. Copper pipe: three inches (3") and larger.
 - c. Underground, or under floor piping.
 - d. No solder fittings underground.
2. Soldering: Use 95-5, tin-antimony solder for other copper piping.
3. Preparation/Installation:
 - a. Clean surfaces to be joined, of oil, grease, rust and oxides. Clean socket or fitting and end of pipe thoroughly with emery cloth to remove dust and oxides. After cleaning and before assembly or heating, apply Handy or Aircosil Flux to joint surface and spread

- evenly.
- b. Cut copper tubing with copper tub cutters, size with sizing tool, and thoroughly clean before application of flux and solder.
- c. All joints that show evidence of overheating, cracking, poor penetration, or other defects of fit-up or workmanship shall be replaced as directed by the Project Manager at Contractor's expense.

3.3 FIELD QUALITY CONTROL

A. General

1. Any deviation from the cleaning, installation testing, and certification requirements herein shall be approved in writing by the Project Manager.
2. All materials and workmanship shall be subject to inspection and examination by the Project Manager and/or Project Manager's representative at any place where fabrication or erection is carried on.
3. The Project Manager and/or the Project Manager's representative, reserves the right to reject all or any part of the system that does not conform to the requirements herein. Rejected materials or equipment shall be returned at the Contractor's expense for re-cleaning and certification.
4. The Project Manager and/or the Project Manager's representative reserves the right to remove random samples of the installed work sufficient to establish the quality of materials and workmanship. If such samples indicate materials and workmanship do not meet the contract specification, the Contractor shall be required to replace or re-clean the installed work at no expense to the University. The University shall reimburse the Contractor on a time and materials basis for such work if the system proves to be installed to specification.
5. All testing shall be done in the presence of the Project Manager and/or the Project Manager's representative.
6. Upon completion of this work, all systems shall be adjusted for use. Should any piece of apparatus or any material or work fail in any of these tests, it shall be immediately removed and replaced by new materials. The defective portion of the work shall be replaced by the Contractor in the presence of the Project Manager and/or the Project Manager's representative at no expense to the University.
7. Any leaks found shall be repaired in the following manner:
 - a. Brazed joint - Cut out and re-braze
 - b. Screw joint - Taken apart and re-done (do not use compound)

B. Pipe Testing:

1. All piping shall be tested as noted below unless more stringent testing is specified in other applicable sections.
2. Test pressures shall be maintained until all leaks have been identified.

3. Defective piping shall be repaired or replaced until tests are accomplished successfully.
4. Test gauges shall be installed at convenient process connections. After completion of testing, the gauges and source connection shall be removed and the specified process attachments replaced.

C. TESTING REQUIREMENTS

<u>System</u>	<u>Test Pressure</u>	<u>Testing Medium</u>	<u>Test Time</u>
Domestic Water	150 PSIG	Water	1 hour
Sanitary Sewer	10 Feet of head	Water	4 hours
Sanitary Vent	10 feet of head	Water	4 hours
Natural Gas	60-80 PSIG	Air	1 hour

3.4 CLEANING

A. General Cleaning Requirements: All pipe, fittings, valves, and system-related materials shall be cleaned before use. Contractor shall indicate in writing when each system is sufficiently clean for consideration by the Project Manager and/or the Project Manager's representative for acceptance. Tie-in to central systems shall not occur prior to receipt of written acceptance from the Project Manager and/or the Project Manager's representative.

B. Water Pipe Cleaning: All domestic cold and hot water piping shall be cleaned and disinfected as follows:

1. The Contractor shall employ an agency licensed to certify the disinfecting operation to provide the orthotolidine testing equipment and make tests, take water samples, procure bacteriological analysis, and issue written approval of satisfactory disinfection results for the Architect and Project Manager.
2. The Contractor shall furnish labor, equipment, materials, and transportation (except as specified in paragraph B.1 above) to disinfect domestic hot and/or water systems in conformity with procedure and standards described herein.
3. Disinfecting agent shall be chlorine gas (approved type for water system disinfection, and approved chlorinator), or hypochlorite, calcium or sodium, powdered or aqueous "Purex", "Clorox", or similar commercial product with 5.25 to sixteen percent (5.25-16%) available chlorine in water solution.
4. 3/4 inch service cock or valve shall be provided within three feet of the service connection for introducing a sterilizing agent into the lines.

5. After final pressure tests, each fixture or outlet shall be left wide open until flow shows only clear water.
6. With system full of water and under "main" pressure, all faucets shall be opened to permit simultaneous trickle flow.
7. The disinfectant shall be injected through the service cock by means of pump or other pressure device at a slow, even, continuous rate until an orthotolidine test at each outlet shows chlorine residual concentration of at least fifty (50) parts per million (PPM).
8. All outlets and valves shall be closed, including service valve at main, and injection cock, to retain chlorinated water. This condition shall be maintained for twenty-four (24) hours.
9. An orthotolidine test, after twenty-four (24) hour period, shall indicate a chlorine residual concentration of not less than 50 PPM. If not, the disinfection procedure shall be repeated until this standard is attained.
10. After satisfactory completion of above test, the system shall be flushed out until orthotolidine tests show chlorine residual of less than 0.5 PPM.
11. After satisfactory completion of disinfection procedure, the University Environmental Health & Safety Department may issue a temporary approval for immediate use of the piping system pending results of a bacteriological analysis of water samples.
12. After final flushing, water samples shall be bacteriologically tested and shall provide negative for coli-aero-genes organisms.
13. Analysis shall indicate total plate count less than one-hundred (100) bacteria per cubic centimeter, or equal to the control sample.
14. Upon satisfactory completion of bacteriological analysis, written approval of water system disinfection results shall be given to the Project Manager by the Environmental Health & Safety Department. If the analysis results are not satisfactory, the disinfection procedure shall be repeated until the specific standards are met.

C. Closed Systems Cleaning: All heating and cooling, or closed piping systems shall be cleaned as follows:

1. Fill the system with a suitable detergent/solvent solution. Concentration solution as recommended by the manufacturer.

2. Circulate the solution in the system for at least seventy-two (72) hours.
3. Blowdown the strainers and system low points for a minimum of three (3) minutes every eight (8) hours.
4. While maintaining circulation, bleed the system at the lowest point available (at a rate less than the make-up rate).
5. Continue to bleed the system until measured conductivity and pH, and total iron content are equal to make-up conductivity, pH, and total iron.
6. Perform final strainer and low point blowdowns.
7. Remove and clean the strainers thoroughly.
8. Visually inspect the system; if not satisfactory, repeat the cleaning process.
9. Immediately treat the system with an appropriate corrosion inhibitor at double the normal dose.

END OF SECTION