SECTION 15060

PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included

1. Chemical piping
2. Drainage piping
3. Waste and vent piping
4. Potable water supply piping
5. Potable hot and cold water piping
6. Sample lines
7. Discharge piping from air release valves and air vacuum valves
8. Natural gas piping
9. Floor drain fittings and piping
10. Sample taps
11. Laboratory piping
12. Other miscellaneous piping as required

B. Provide piping complete with all fittings, jointing materials, hangers, supports, anchors and necessary appurtenances

C. Additional Requirements Specified Elsewhere

1. Section 01340: Shop Drawings, Product Data and Samples
2. Section 01400: Quality Control
3. Section 01600: Materials and Equipment

D. Related Requirements Specified Elsewhere

1. Section 02200: Earthwork
2. Section 02615: Ductile Iron Pipe
3. Section 02617: Steel Pipe
4. Section 02622: Plastic Pipe
5. Section 02641: Valves and Accessories
6. Section 02708: Pressure Pipelines and Appurtenances
7. Section 02709: Gravity Pipelines and Appurtenances
8. Section 15070: Pipe Supports
9. Section 15082: Plumbing Insulation
10. Section 15400: Plumbing
11. Division 11: Equipment

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. In accordance with all Pikes Peak Regional Building Department codes, laws and regulations of the state
2. In case of apparent conflict, state and local requirements govern over these specifications
3. In absence of state and local regulations, National Plumbing Code applies
4. Gas piping: Per National Fire Protection Association

1.3 SUBMITTALS

A. Shop Drawings and Product Data in Accordance with Section 01340

1. Sufficient data to verify compliance with the specifications
2. General piping layout and laying schedule or marking diagram

B. Test Reports: Reports of Field Tests

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Pipe: Galvanized or Black as Scheduled

1. Standard Weight: ASTM A120, standard weight (Schedule 40) or FS WW-P-406, Weight A
2. Nipples
   a. CS5, extra strong (Schedule 80)
   b. "Close" nipples permitted only by special authorization in each case
3. Fittings
   a. Malleable iron: ANSI B16.3 or FS WW-P-521
      1) Ungalvanized pipe: Type I, black
      2) Galvanized pipe: Type II, galvanized
   b. Drainage: FS WW-P-491
   c. Forged steel: Schedule 40, 2000 lb. for standard weight pipe
      1) Socket welding: ANSI B16.11; Bonney, Crane, Porter or equivalent
      2) Threaded: Bonney, Crane, Porter or equivalent
   d. Flanged: Cast iron, 125 lb., ANSI B16.1
   e. Welding: ANSI B16.9
   f. Unions
      1) Malleable Iron: FS WW-U-531, Class 2
         a) Galvanized pipe: Type B, galvanized
         b) Ungalvanized pipe: Type A, black
      2) Forged steel: Tongue-and-groove flange type; Crane 1589 with cranite gaskets or equivalent
4. Flanges
   a. ANSI B16.1, 125 lb. or ANSI B16.5, 150 lb.
   b. Flange bolts and nuts: ASTM A307, length such that after installation bolts will project ⅛" to ⅜" beyond outer face of nut

c. Flange gaskets: ASTM D1330, Grade I, red rubber, ring-type, ⅛" thick
5. Mechanical couplings: Dresser "Style 38," Smith-Blair "Type 411," or equivalent
6. Expansion joints
   a. 2½" and smaller: Flexonics "Model H Expansion Compensators," or equivalent
   b. 3" and larger: Flanged end with stainless steel bellows, "Flexonics Free Flexing Expansion Joint," or equivalent
7. Grooved couplings: Mil-C-10387; Gustin-Bacon "Gruvagrip Series 100," Victaulic "Style 77," or equivalent

B. Copper Tubing

1. Water tubing: ASTM B88; FS WW-T-799, Type K; or FS WW-T-775; soft temper and cadmium plated for chlorine service
2. Fittings
   a. Flared: ANSI B16.26
   b. Solder: ANSI B16.18 or B16.22
   c. Compression: Crawford "Swagelok," Hoke "Gyrolok," Imperial "Hi-Seal," Parker-Hannifin "CPI," Weatherhead "Self Align" or equivalent
   d. Insulating
      1) Threaded: PSI "Delrin Insulating Couplings," Vallet "V-Line Insulating Couplings," or equivalent
      2) Flanged: EPCO "Dielectric Flange Unions," PSI "Type E Flange Insulation," or equivalent
3. Solder: Solid wire, ASTM B32, no lead solder
4. Soldering flux: Paste Type, FS O-F-506, Type I, Form A
5. Brazing filer metal: ASTM C260, BCuP-5; Engelhard "Silvaloy 15," Goldsmith "GB-15", or equivalent
6. Brazing Flux: Paste Type, FS O-F-499, Type B
7. Expansion joints: Flexonics "Model HB Expansion Compensators" or equivalent

C. Polyvinyl Chloride (PVC) Pipe

1. Chemical service and exposed nonpotable water service
   a. Pipe: ASTM D1785, Schedule 80, PVC 1120, with NSF seal
      1) Schedule 40 PVC, ASTM 1785, where noted on the Drawing
   b. Fittings: ASTM D2464, or D2467, PVC I; by pipe manufacturer with NSF seal
   c. Flanges: Diameter and drilling per ANSI B16.5, 150 lb.
   d. Flange bolts and nuts: Type 304 stainless steel, install such that bolts project ⅛" to ⅜" beyond the outer face of the nut
   e. Flange Gaskets: Full face, ⅛" thick, neoprene or plasticized PVC
   f. Expansion joints: Belmont "Style 3915," Resistoflex "Style R6905" molded expansion joint, or equivalent

D. Chlorinated Polyvinyl Chloride (PVC) Pipe

1. Potable water service
   a. Pipe: ASTM D2846, Schedule 80, with NSF seal
      1) Schedule 40 PVC, ASTM 2846, where noted on the Drawing
   b. Fittings: ASTM F437, ASTM F438, or ASTM F439 with NSF seal

c. Flanges: Diameter and drilling per ANSI B16.5, 150 lb.
d. Flange bolts and nuts: Type 304 stainless steel, install such that bolts project ⅛" to ⅜" beyond the outer face of the nut
e. Flange Gaskets: Full face, ⅛" thick, neoprene or plasticized PVC
f. Expansion joints: Belmont "Style 3915," Resistoflex "Style R6905" molded expansion joint, or equivalent

E. High Density Polyethylene (HDPE) Pipe

1. Refer to Section 02623

F. Cast Iron Soil Pipe

1. Pipe and fittings
   a. Service weight: ASTM A74, service weight
   b. Hubless: CISPI 301
2. Jointing materials
   a. Lead: FS QQ-C-40, Type I
   b. Packing: Hooven & Allison "Sure Seal White Oakum," Sealite "White Oakum Caulking Yarn 110," or equivalent
   c. Rubber gaskets: ASTM C564; where permitted by local codes

G. Natural Gas Service Line Pipe

1. High density polyethylene
   a. Design basis: ENDOT Industries Endopoly Premium PE 3408 high density polyethylene pipe
   b. Size: ASTM D2239 (IPS-ID controlled)
   c. Pressure rating: 200 psi
   d. Conformance: AWWA C901, ASTM D2239, ASTM D3350

H. Plastic Lined Pipe

1. Dow Chemical "Saran Lined Steel Pipe," International Protected Metals "Plasteel," without outside coating or equivalent

I. Polypropylene Pipe

1. Pipe and fittings: Schedule 40
2. ASTM F1412 compliant

J. Reinforced Plastic Tubing

1. Wire reinforced placticized PVC
2. Cobon "Cobovin Type S," Newage "Vardex" or equivalent

K. Hose: ID Not Smaller Than Nominal Size

1. Rubber hose
   a. For chlorine: Chlorine resistant wrapped hose as manufactured by Wallace & Tiernan, or equivalent
   b. For sludge service: Acid-chemical transfer hose, Gates “40HW,” or equivalent
2. Couplings
   a. Insert type: Schedule 40 PVC or other material suitable for service conditions, 18-8 stainless steel clamps, or equivalent
   b. Quick-disconnect: Bronze, Dover "OPW Kamlok Quick Coupler," Evertite "Quick Couplings," or equivalent
3. Plant washdown hose
   a. Gates “35B,” Goodall “N-501,” or equivalent
   b. Couplings: Cast brass, long shanks, threads to match hose bibs

L. Accessories

1. Watertight and dust-tight pipe sleeves: O-Z Electrical Manufacturing Company, Incorporated, "Thruwall" and "Floor Seals," or equivalent
2. Modular, rubber, sealing elements: Thunder Line Corporation, "Link Seal," or equivalent
3. Thread tape: Teflon; John Crane "Thread Tape," Garlock "Plasti-Thread," Hoke "EZ Sea,l" or equivalent
4. Sealant: Thiokol or urethane as specified in Section 07900 - Joint Sealants
5. Gauge cocks: Bronze, tee handle; Lunkenheimer 1178, Powell 915, or equivalent
6. Snubbers: Operating and Maintenance Specialties "Ray Snubbers," Ashcroft "Series 1112," or equivalent

M. Protective Coatings

1. Tape wrap: FS HH-T-30 Coal tar base; Protecto Wrap "200," Tapecoat "CT," or equivalent
2. Coal tar coating: Tenemec "46-465.H.B. Tnemecol," or equivalent
3. Plastic coated pipe: 3M "Skotchkote," or equivalent

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Install as specified and indicated on Drawings or, in the absence of detailed piping arrangements, in a manner acceptable to the Engineer
   a. Install exposed piping neatly, in lines paralleling building lines
2. Provide a shutoff valve and union at the water supply connections to each fixture and unit of equipment, whether shown on the Drawings or not
3. Provide a union within 2' of each threaded end valve unless other means for easy removal of the valve are available

4. Provide unions where required for equipment removal whether indicated on the Drawings or specified
5. Do not install piping to obstruct openings and passageways
6. Cut pipe to measurement taken at the site, not from the Drawings
7. Layout piping to provide for expansion and contraction
8. Provide taps for pressure gauge connections with a nipple, snubber, and gauge cock
9. Provide expansion joints at not greater than 60' intervals in exposed or submerged PVC piping. Refer to Section 15070 - Pipe Supports for additional requirements
10. Securely anchor piping at the midpoints between expansion joints
11. "Snake" buried PVC into trench and keep as cool as possible during installation
12. Keep shaded and cover with backfill immediately after installation
13. Hold pipes free of contact with building construction so that noise will not be transmitted by pipe expansion
14. Arrange potable water piping and nonpotable water piping (within buildings) for complete drainage
15. Uniformly grade all piping whether buried or exposed and provide complete venting to eliminate air traps
16. Pipe stuffing box leakage from water sealed pumps to nearest point of drainage
17. Provide insulating fittings in all piping wherever copper tubing or fittings are connected to iron or steel pipe or fittings

B. Drainage Piping

1. Conform, in general, to locations indicated on Drawings
2. Slope horizontal drainage and waste pipes at ¼"/ft. where possible, but never less than ⅛"/ft.
3. Provide cleanouts in finished floors or in partition walls as indicated on the Drawings
    a. Nickel-bronze access cover and frame with securing screw or as indicated on the Drawings
4. Install bell-ups flush with floor surface
5. Lay on uniformly descending grades
6. Properly handle and store pipe with premolded joints
7. Properly lubricate joints before installation

C. Joints

1. Make pipe joints carefully and neatly
2. Threaded
    a. ANSI B2.1, NPT fully and cleanly cut with sharp dies
    b. No more than 3 threads exposed after installation
    c. Ream pipe ends after threading to remove burrs
    d. Apply thread tape to joints in all plastic piping
    e. Apply thread tape or joint compound to joints in other piping
3. Compression
    a. Cut pipe ends squarely, remove burrs
    b. Clean contact surfaces with steel wool

4. Flared
    a. Cut tubing ends squarely, remove burrs
    b. Scratches or grooves in flared ends are not allowed
5. Soldered and brazed
    a. Braze joints in 2" or larger copper tubing
    b. Solder or braze lines smaller than 2" where solder fittings are specified
    c. Thoroughly clean joint surfaces with flint paper and coat with thin film of flux
    d. Install tubing to full depth of socket
    e. Do not overheat metal or flux
    f. Uniformly heat joint to melt filler metal on contact
    g. Remove surplus filler metal and flux while joint is still hot
6. Solvent welded
    a. Cut PVC pipe ends square and smooth and wipe clean
    b. Apply solvent cement to outside of the pipe and the inside of the fitting socket with a small brush
    c. Immediately push the coated surfaces snugly together and rotate approximately ½ turn to insure uniform cement distribution
    d. Remove excess cement by wiping
7. Flanged
    a. Tighten bolts sufficiently to slightly compress gasket and effect a seal, but not so tight as to distort flanges
8. Welded: ANSI B31.1, and per "Code for Pressure Piping"

D. Pipe Sleeves

1. Provide for pipes passing through concrete or masonry
2. Install before concrete is placed or masonry is laid
3. Where passing through floors, install so the sleeve projects between 1" and 2" above the floor
4. Sleeves passing through slabs or walls with one side against soil, exposed to the elements, or submerged shall be sealed with a modular sealing element or a watertight pipe sleeve
5. If pipe is insulated, extend insulation through sleeves
6. For future pipe installation provide sleeves and seal ends with plastic caps or plugs
7. Make dust and gas tight through room walls and floor
8. 6" or smaller; special dust tight sleeves
9. Greater than 6"; seal with modular sealing elements, or caulk with oakum and seal both sides with Thiokol or Urethane sealant; refer to Drawings for additional requirements

E. Chemical Piping

1. Install so that the lines are readily accessible for cleaning
2. At each point where flexible tubing or hose is connected to rigid piping, provide quick disconnect coupling
3. Install chlorine and sulfur dioxide gas and vent piping without liquid traps
4. Install an elbow down and corrosion resistant insect screen on the open end of each vent

F. Insulation

1. Install neatly
2. Clean, dry, and test pipe before applying
3. Tightly butt end joints
4. Hold seams and joints with manufacturer's standard adhesive
5. Paste jacket laps neatly
6. Point joints with insulating cement
7. For flanges, fittings, and valves, use molded insulated or insulating cement of same thickness as insulation
8. Pass through hangers
9. Provide saddles to prevent pipe support by insulation

G. Protective Coating

1. Tape wrap all buried black steel pipe including joints except where plastic coated pipe is specified
2. Thoroughly clean surfaces immediately before wrapping
3. Tape wrapping shall be two-ply (half-lap) application
4. Tape wrap joints in plastic coated pipe after installation
5. Apply one coat of coal tar paint to joints in buried galvanized steel piping
6. Paint exposed threads of submerged galvanized piping with zinc rich paint

H. Anchorage

1. For unrestrained buried piping, provide reaction blocking, anchors, joint harnesses or other acceptable means of preventing pipe movement caused by internal pressure at
   a. Unlugged bell and spigot or all bell tees
   b. Y-breakers
   c. Bends deflecting 11¼° or more
   d. Plugs
2. Other locations: Provide reaction blocking anchorages or other supports for fittings in fills or other unstable ground, above grade or exposed in structure, as indicated on the Drawings or as required to prevent movement
3. Concrete thrust blocks
   a. Provide on all unrestrained tees, Y-branches, bends deflecting 11¼° or more and plugs, whether blocking is indicated on the Drawings or not, where piping is subject to heads in excess of 13 psi
   b. Bearing area per Construction Standards
   c. Extend from fitting to solid undisturbed earth
   d. Installed so joints are accessible for repair
   e. If adequate support against undisturbed earth cannot be obtained, provide metal harness anchorages across the joint and secure by anchoring to the pipes or fittings or other anchorage facilities as required for adequate support

3.2 FIELD QUALITY CONTROL

A. Test each line at the Contractor's expense in the presence of and to the satisfaction of Engineer

B. Provide all testing equipment, materials, tools, appliances and devices, and labor

C. Test Conditions

1. See piping schedule on the Drawings and Section 02708 for test pressures and mediums

D. Procedure for Small Diameter Piping

1. Disconnect all fixture devices and other accessories which may be damaged by the specified test pressure
2. Plug or cap ends as required
3. Test for two hours with no loss in pressure
4. Determine leakage by loss of pressure, soap solution, chemical indicator or other positive method
5. After pressure testing, test all chlorine gas and sulfur dioxide gas piping for leakage with specified gas at operating pressure
   a. Clean and dry piping before admitting gas
   b. Admit gas slowly
   c. Check for leakage with a swab soaked in ammonia solution and waved near each fitting
   d. Do not apply ammonia solution to fittings
   e. White fumes are evidence of leakage
   f. Purge all gas from lines before repairing
6. All joints shall be tight
   a. Repair leaking joints
   b. Repeat tests on repaired lines
7. Test drainage and venting systems by filling with water to level of highest vent stack
   a. Thoroughly flush system
   b. Rod line as required to remove any blockage or partial blockage
   c. Plug openings as necessary
   d. Test for drop in water level after 30 minutes
   e. Hold water for 30 minutes without any drop in water level

3.3 CLEANING

A. General

1. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when erected
2. Blow all lines thoroughly before placing in service

3.4 PIPING SCHEDULE

A. Standard Weight Galvanized Steel Pipe

1. With threaded drainage fittings (galvanized or black)
   a. 3" and smaller equipment and floor door drain piping
   b. 3" and smaller drainage and waste piping inside buildings

c. Floor drain piping except where cast iron soil pipe or ductile iron pipe is specified
d. Plumbing vent piping

2. With threaded malleable iron fittings (all 2½" and smaller piping for the following services)
   a. All pipe sleeves except where plastic lined or watertight/dust-tight sleeves are required
   b. Sump pump discharge piping
   c. Grinder pump discharge piping
   d. Seal water piping
   e. Air release piping
   f. All piping not otherwise specified
3. With flanged fittings (all 3" and larger piping for the following services)
   a. Where required for connections to flanged piping systems
   b. All piping not otherwise specified

B. Black Steel Pipe

1. Standard weight with threaded malleable iron fittings (2½" and smaller)

C. Cast Iron Soil Pipe

1. 4" and 6" drainage piping buried beneath floors or underground except when ductile iron pipe is indicated on Drawings
2. 4" and 6" drainage piping inside structures

D. Copper Water Tubing

1. Hard drawn with solder fittings (to be used for 3" or smaller piping inside structures or buildings only where specifically noted on Drawings
   a. Potable (cold) water supply piping
   b. Potable (hot) water supply piping
   c. Sample piping
   d. Air release and air vacuum valve drain piping
   e. Supply and drain lines to instrumentation sampling cells
2. Soft annealed with flared fittings (1¼" or smaller) submerged or in contact with earth

E. HDPE Pipe

1. Natural gas service lines
2. Nonpotable water service lines from main to building
3. Potable water service lines where shown on Drawings
4. Size as shown on Drawings

F. Polypropylene Pipe

1. Acid waste drain and vent piping
2. Size as shown on Drawings

G. Plastic Lined Pipe

1. Sleeves for copper tubing, except were water/dust-tight sleeves are required

H. Chromium-Plated Copper or Brass

1. Exposed plumbing fixture supply piping

I. PVC Pipe

1. With solvent welded joints
   a. Chemical solution piping where buried or submerged
   b. Potable water supply piping inside buildings (CPVC)
   c. 2" and smaller chemical diffusers
2. With threaded joints (2½" or smaller)
   a. Chemical vent piping
   b. Chemical solution piping in interior locations
   c. Potable and nonpotable water piping in interior locations
3. With flanged or union joints
   a. To facilitate disassembly
   b. At each valve, device, and item of equipment
   c. Join flanges or unions to pipe by solvent welding unless otherwise specified

J. Reinforced Plastic Tubing

1. Flexible connections in chemical piping
2. Where indicated on the Drawings

K. Hose

1. Washdown hoses
   a. 50' length of ¾" hose with each heavy duty hose rack
   b. Complete with couplings for each hose
2. Hydrant hoses
   a. 100' length of 2" fire hose compatible with 2" hydrant

L. Pipe, Fitting, Flange and Valve Insulation

1. All domestic hot water piping
2. Cold water piping in concealed areas
3. Nonpotable water piping in concealed areas

END OF SECTION