

**1 PART 1 GENERAL****2 DESCRIPTION**

3 Provide pipe, pipe fittings, piping specialties, pumps and related items required for complete piping system.

4  
5 Related Work: The requirements of Section 22 05 00, Common Plumbing Materials and Methods, also apply  
6 to this section.

**7 QUALITY ASSURANCE**

8 General: ASTM, and ANSI Standards are indicated. In addition, special standards are referenced where  
9 neither ASTM nor ANSI Standards are applicable.

10  
11  
12 Labeling: All piping shall be continuously and legibly labeled on each length as required by codes and  
13 standards and including as a minimum, country of origin, manufacturer's identification marking, wall thickness  
14 designation, and applicable standards and approvals. Fittings shall be labeled as required by the referenced  
15 standard. Tubular fixture traps shall be stamped with manufacturer's mark and material thickness.

16  
17 Potable Water Valves: Potable water piping materials not limited to faucets, mixing valves, or pressure  
18 reducing valves. Valves shall meet NSF Standard 61, Section 9, for drinking water faucets and shall be brass  
19 construction. Brass components which contact water within the faucet shall be from brass which contains no  
20 more than 3 percent lead by dry weight.

21  
22 Concealed Plastic Piping: No concealed plastic piping inside the building unless approved by Code or  
23 Governing Authorities.

24  
25 Definitions: Where piping fluid is not indicated in the following paragraphs, provide similar piping materials for  
26 similar fluids (i.e., "make-up water" = "domestic water"; "wet stand pipe" = "fire sprinkler pipe"; "drainage  
27 piping" = "sanitary/storm sewer piping").

28  
29 Plumbing System Disinfection shall be performed by an experienced, qualified, chemical treatment agency.

**30 STORAGE AND HANDLING**

31 Provide factory-applied end caps on each length of pipe and tube. Maintain end caps through shipping,  
32 storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of  
33 pipe and tube. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by  
34 packaging with durable, waterproof wrapping.

**35 SUBMITTALS**

36  
37 Submit catalog data for each product specified.

**38 PART 2 PRODUCTS****39 PIPING MATERIALS****40 Copper Pipe and Tube:****41 Application:**

42 Domestic water.

43 Priming lines.

44  
45 Pipe: ASTM B88. Produced by American manufacturer only. Foreign produced piping is not  
46 allowed.

47 Above Ground Domestic Water: Type L hard temper copper with soldered joints.

48 Underground Domestic Water and Priming Lines: Type L soft annealed with no joints or type

49 K hard tempered copper with silver soldered joints.

50 Fittings: Wrought copper solder-joint fittings, ANSI / ASME B16.22.

**51 Cast Iron DWV Pipe:**

52 Application: 1-1/2" and larger.

53 Sanitary waste

54 Plumbing vent

1 Pipe: Hubless cast iron soil pipe, CISPI 301-05/ASTM A 888-05. Produced by American  
 2 manufacturer only. Foreign produced piping is not allowed.  
 3 Fittings: Hubless cast iron fittings: CISPI 301-05/ASTM A 888-05.  
 4 Couplings:  
 5 Standard Duty: No-hub couplings meeting CISPI 310 and incorporating ASTM C 564 gasket,  
 6 type 301 SS corrugated shield and type 301 SS clamping bands. Two clamping bands on 1-  
 7 1/2" thru 4" pipe and four bands on 6" thru 10" pipe.  
 8 Heavy Duty: No-hub couplings meeting ASTM C 1540, and FM 1680. ASTM C 564 neoprene  
 9 gasket, type 304 SS corrugated shield and type 304 SS clamping bands. Four bands on 1-  
 10 1/2" thru 4" pipe and 6 bands on 5" thru 10" pipe.  
 11 Couplings to Dissimilar Pipe in Concealed Locations: Fernco "ProFlex" with stainless steel  
 12 support collar or approved substitute.  
 13 Manufacturers: Cast iron pipe and fittings – AB&I, Charlotte Pipe, Tyler Pipe, or approved. All pipe  
 14 shall be labeled by the manufacturer.  
 15

16 Plastic Pipe – Drain, Waste, Vent (DWV):  
 17 Application:  
 18 Sanitary waste below slab only; unless noted otherwise.  
 19 Plumbing vent where concealed.  
 20 Pipe:  
 21 Poly(vinyl chloride) (ASTM D1784) (PVC) solid core plastic drain, waste and vent pipe (ASTM  
 22 D2665 and D1785) and fittings (ASTM D2665) (DWV).  
 23 Fittings: Provide fittings of the type indicated, matching piping manufacture. Where not otherwise  
 24 indicated, provide fittings produced and recommended for the service indicated by the piping  
 25 manufacturer.  
 26

27 Plastic Pipe:  
 28 Application:  
 29 Below grade domestic water.  
 30 Above grade domestic water where concealed and when continuously supported per  
 31 specification.  
 32 Priming lines if covered and protected from damage and light.  
 33 Pipe:  
 34 Cross-linked polyethylene (PEX) tubing manufactured by PEX-a or Engel Method for Water  
 35 Service: Tested/listed to ASTM E84, ASTM F876 and F877, and CSA B137.5 listed certified  
 36 to NSF standards 14 and 61. Rated for 100 PSI at 180° F. UPONOR, AQUAPEX or  
 37 approved.  
 38 Fittings: ASTM F1960 cold expansion fittings. Provide fittings of the type matching piping  
 39 manufacture and recommended by the piping manufacturer for the service indicated.  
 40

41 Plastic Pipe:  
 42 Application:  
 43 Waste pipe from science classrooms below grade and above grade.  
 44 Plumbing vent for science classrooms.  
 45 Pipe and material manufactured from CPVC Type IV, Grade I compounds with a minimum cell  
 46 classification of 23447. Pipe and Fittings shall conform to ASTM F 2618. Pipe shall be Schedule 40  
 47 dimensions. One-Step solvent cement shall be specially formulated for chemical waste applications  
 48 and conform to ASTM F 493. All pipe, fittings and cement shall be supplied as a system by a single  
 49 manufacturer and shall be certified by NSF International for use in corrosive waste drainage systems  
 50 and shall bear the mark "NSF-cw." Charlotte Pipe and Foundry Co., or approved.  
 51

52 **MISCELLANEOUS PIPING MATERIALS**

53 Insulating (Dielectric) Fittings: Do not use, see Part 3.  
 54

55 Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with  
 56 installation requirements.

57 Tin-Antimony Solder: ASTM B32, Grade 95TA.  
 58 Lead-Free Solder: ASTM B32, Grade HB. Harris "Bridgit" approved.  
 59 Silver Solder: ASTM B32, Grade 96.5TS.

1 Flux: Water soluble paste flux.  
 2 Brazing filler rod: BCuP rod to suit conditions.  
 3

4 Sleeve Seal: Rubber-link pipe wall and casing closure. Thunderline Link-Seal. For fire rated wall, floor or  
 5 ceiling penetrations, 3-M "CP-25" caulk, "No. 303" putty and/or "PSS 7904" sealing system.  
 6

7 Strainers: "Y-pattern," iron or bronze body rated for pressures indicated with blow-off connection and 20  
 8 mesh stainless steel screen.  
 9

10 Tracer Wire: 14 gauge, single strand, copper wire with blue insulation for water, green for sanitary and storm  
 11 sewers, and yellow for gas. 3M "DBY" direct bury splice kit required at all splices.  
 12

13 **PIPING SPECIALTIES**

14 Cleanouts:

15 Manufacturer: Jay R. Smith, Zurn, Wade, Watts, Josam, Mifab, or approved substitute.

16 Types:

17 Tile Floor Cleanouts: Smith 4053-U with square heavy-duty nickel bronze top, bronze plug,  
 18 and vandalproof screws. Adjustable top where cast into floor slab.

19 Carpeted Floor Cleanout: Smith 4023-U-X with round heavy-duty nickel bronze top, bronze  
 20 plug, carpet clamping device, and vandalproof screws. Adjustable top where cast into floor  
 21 slab.

22 Concrete Floor Cleanout: Smith 4023 with round heavy-duty nickel bronze top. Stainless  
 23 steel shallow cover and vandalproof screws. Adjustable top where cast into floor slab.

24 Wall Cleanouts: Smith 4472-U, bronze ferrule with raised head bronze plug, stainless steel  
 25 shallow cover and vandalproof screws.

26 Outside Area Walks and Drives: Smith 4253-U-G with galvanized cast iron body, top secured  
 27 with vandalproof screws, and bronze plug. Install in 18" x 18" x 6" deep concrete pad flush  
 28 with grade.  
 29

30 Drains:

31 Zurn, Jay R. Smith, Josam, Watts, Wade and Mifab are approved. Numbers scheduled on drawings  
 32 represent minimum acceptable standard for locations involved. Where CECO is listed previously  
 33 listed manufactures are approved.

34 Cast iron construction with acid resistant coating, anchor flange, and other options as indicated by  
 35 model number.

36 Install 4 pound sheet lead flashing, extending not less than 10" from and clamped to all drains not  
 37 completely cast-in-place in a homogeneous material.  
 38

39 Flashing: Minimum 4# sheet lead; to extend horizontally 10" from edge of vent penetrations or rain drain body  
 40 and vertically 12" minimum up from roof turned over and down into hub of vent or finished with bronze cap  
 41 providing counterflashing for screwed pipe.  
 42

43 Priming Valves:

44 Electrically operated priming station with header sized for number of outlets required. Provide with  
 45 120v power supply, timer, and solenoid valve tested per UL. Provide with IAPMO approved  
 46 atmospheric vacuum breaker. Provide in recessed wall box with access door per Section 22 05 00.  
 47 P.P.P. Inc., PT Series or approved.

48 Flow operated valves Jay R. Smith 2699 only. Locate in closets, under counters or in walls behind  
 49 access panels as specified in Section 22 05 00.

50 McIntosh Primes: Manufactured for connection to flush valve to be with gasket chrome supply line  
 51 and wall escutcheon.

52 Use copper or PEX specified previously for all underground priming lines.  
 53

54 Traps: Except chrome plated fixture traps. Recessed drainage pattern for threaded pipe and same grade as  
 55 pipe for cast iron and plastic pipe; with cleanout plugs in trap body in all above grade locations.  
 56

57 Domestic Water Balancing Valve: Lead free brass or bronze body or 300 Series stainless steel body with  
 58 stainless steel trim. Victaulic TA Series 76X or approved substitute.  
 59

1 **EMERGENCY SHOWER/EYEWASH MIXING VALVE**

2 Thermostatic mixing valve for operation of single emergency eye wash or emergency shower. Unit shall  
3 include a built-in cold water by-pass, rough bronze finish, solid bimetal thermostat, locking temperature  
4 regulator with limit stop factory set for 90 degrees, integral check stops, and dial thermometer and recessed  
5 stainless steel cabinet with door and lock. ANSI 7358.1-2014, & ASSE 1071 Certified and low lead compliant.  
6 Guardian Model numbers are listed, Haws approved.

7 Performance: MV-1 unit shall have a flow range of 2-GPM to 6-GPM with a maximum  
8 pressure loss of 30-PSI and come with a full 1-year warranty. Guardian G3607 LF.  
9

10 **BACKFILL MATERIALS**

11 Subbase Materials: A graded mixture of gravel, sand, crushed stone or crushed slag.

12  
13 Finely-Graded Subbase Material: Well graded sand, gravel, crushed stone or crushed slag, with 100%  
14 passing a 3/8" sieve.

15  
16 Backfill Material: Soil material suitable for compacting to the required densities, and complying with AASHTO  
17 designation M145, Group A-1, A-2-4, A-2-5, or A-3.

18  
19 Stabilization Fabric: Nonwoven stabilization and drainage fabric. Mirafi 140S or 140M.

20 **PART 3 EXECUTION**

21 **UTILITY SERVICE**

22 Plumbing Utility Connections: Complete installation. Contact local serving utilities to determine conditions  
23 involved and make or arrange to have connection made at proper time and pay all costs involved.  
24

25 Sanitary and Storm Sewers: Connect sanitary and storm sewers as shown on the Drawings and as required  
26 by the serving utility. Verify depth, size and location prior to installation of the new sewer systems.  
27

28 Water Service: Connect to water system.  
29

30 **PIPE INSTALLATION**

31 General: Install pipe, tube and fittings in accordance with recognized industry practices and plumbing code  
32 standards. Install each run accurately aligned with a minimum of joints and couplings, but with adequate and  
33 accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment.  
34 Reduce sizes (where indicated) by use of reducing fittings.  
35

36 Piping Runs: Route piping close to and parallel with walls, overhead construction, columns and other  
37 structural and permanent-enclosure elements of the building. Install piping plumb and level except where  
38 pitched for drainage. If not otherwise indicated, run piping in the shortest route which does not obstruct  
39 usable space or block access for servicing the building or equipment and avoid diagonal runs. Wherever  
40 possible in finished and occupied spaces, conceal piping from view. Do not encase horizontal runs in solid  
41 (concrete or CMU) partitions.  
42

43 Ensure all copper piping is protected from contact with non-copper and plated supports. Provide strut cushion  
44 below clamp or 2 layers of UPC listed 10 mil tape.  
45

46 **PIPING JOINTS**

47 General: Provide joints of the type indicated in each piping system, and where piping and joint as  
48 manufactured form a system, utilize only that manufacturer's material.  
49

50 Cast Iron "No-Hub": All joints in accordance with the Cast Iron Soil Pipe Institute (CISPI) Designation No.  
51 310-97 "Installation Procedures for Hubless Cast Iron Soil Pipe and Fittings For Sanitary and Storm Drain,  
52 Waste and Vent Piping Applications." Horizontal runs of 5" and greater shall be braced as indicated in Figure  
53 4 for "rodding" restraints. Application of couplings as follows:

54 Standard Duty Couplings: All vent piping and all drainage and waste piping above grade.

55 Heavy Duty Couplings: All underground waste installations and any storm drain installations 2  
56 stories or more in height.  
57

1 Solder Copper Tube and Fitting Joints: In accordance ANSI B 828 with recognized industry practice. Cut  
2 tube ends squarely. Copper tubing shall be cut with a wheeled tubing cutter or approved copper tubing  
3 cutting tool. The tubing shall be cut square to permit proper joining with the fittings. Remove scale, slag, dirt  
4 and debris from inside and outside of tubing and fittings before assembly. The tubing end shall be wiped  
5 clean and dry. The burrs on the tubing shall be reamed with a deburring or reaming tool. Apply solder flux to  
6 joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in a manner which will draw  
7 solder full depth and circumference of joint. Wipe excess solder from joint before it hardens. "T-Drill" field  
8 formed tees may be utilized where the main is at least two pipe sizes larger than the branch.  
9

10 Insulating (Dielectric) Fittings: Where the "joining of ferrous and non-ferrous piping", use brass valve or brass  
11 nipple with length/nominal diameter ratio of 8 or greater rather than dielectric fitting.  
12

13 Changes in Direction: Use fittings for all changes in direction. Run lines parallel with building surfaces.  
14

15 Line Grades:

16 Drainage Lines: Run at maximum possible grade and in no case less than 1/4" per foot within  
17 building.

18 Vents: Pitch for drainage 1/4" per 10'.

19 Water: Pitch to low points and install hose bib drains. 3' minimum depth of ground cover for all lines  
20 outside building unless otherwise noted.  
21

22 Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good  
23 installation practice.  
24

25 Expansion: Provide loops, swing joints, anchors, runouts and spring pieces to prevent damage to piping or  
26 equipment.  
27

## 28 CLEANOUTS

29 Where required by code, at each change of sewer direction 45 degrees or greater and more than 10' long, at  
30 end of each branch or main and spaced not greater than 100' apart, as required by code and/or as shown on  
31 Drawings.  
32

## 33 MISCELLANEOUS PIPING EQUIPMENT

34 Floor, Wall and Ceiling Plates: Chrome plated pressed steel or brass screw locked split plates on all pipe  
35 penetrations in finished spaces.  
36

37 Strainers: Install in a manner to permit access for cleaning and screen removal and with blow-off valve.  
38

39 Trap Priming: Traps serving floor drains, floor sinks, catch basins, and similar fixtures shall be primed in  
40 accordance with Code requirements.  
41

## 42 EXCAVATING

43 General: Do not excavate for mechanical work until the work is ready to proceed without delay, to minimize  
44 the total time lapse from excavation to completion of backfilling. Comply with all applicable Federal and state  
45 safety regulations and local erosion control requirements.  
46

47 Width: Excavate for piping with 6" to 9" clearance on both sides of pipe, except where otherwise shown or  
48 required for proper installation of pipe joints, fittings, valves and other work. Excavate for other work to  
49 provide minimum practical but adequate working clearances.  
50

51 Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond  
52 indicated depths, and hand-excavate the bottom cut to accurate elevations. Support the following work on  
53 undisturbed soil at the bottom of the excavations:

54 Piping of 5" and less pipe/tube size.

55 Cast-in-place concrete.  
56

## 57 BASE PREPARATION

1 Subbase Installation: Where indicated, install subbase material to receive mechanical work, and compact by  
2 tamping to form a firm base for the work. For 4" and larger piping, horizontal cylindrical tanks and similar  
3 work, shape the subbase to fit the bottom 90 degrees of the cylinder, for uniform continuous support. Provide  
4 finely-graded subbase material for wrapped, coated and plastic pipe and tank. Shape subbases and bottoms  
5 of excavation with recesses to receive pipe bells, flanged connections, valves and similar enlargements in the  
6 piping systems and set bottom of trench at proper pitch and correct elevations with subbase material.

7  
8 Previous Excavations: Where piping crosses over an area more than 5' wide which has been previously  
9 excavated to a greater depth than required for the piping installation, provide suitable subsidence-proof  
10 support for the piping. Comply with the details shown, or where not otherwise shown, provide the following  
11 support system:

12       Excavate to undisturbed soil, in a width equal to the pipe diameter plus 2'. Install 8" courses of  
13       subbase material, each compacted to 95% of maximum density, as required to fill excavation and  
14       support piping.

#### 15 16 BACKFILLING

17 Do not backfill until installed mechanical work has been tested and accepted wherever testing is indicated.  
18 Install drainage fill where indicated, and tamp to a uniform firm density. Backfill with finely-graded subbase  
19 material to 6" above wrapped, coated and plastic piping and tanks, and to center line of other tanks (where  
20 recommended by tank manufacturer, use "pea gravel" backfill). Condition backfill material by either drying or  
21 adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required  
22 densities. Do not backfill with frozen materials.

#### 23 24 CLEANING

25 General: Clean all dirt and construction dust and debris from all mechanical piping systems and leave in a  
26 new condition. Touch up paint where necessary.

#### 27 28 Disinfection of Domestic Water Piping System:

29       Prior to starting work, verify system is complete and clean.

30       Open all drains and fixtures valves in the building starting with the valve nearest the water service line  
31       and permit the water to run clear for 10 minutes to eliminate grease, cuttings, flux, and foreign matter.

32       Inject disinfectant at beginning of water system to be disinfected. Introduce free chlorine in liquid  
33       form, throughout system to obtain concentration required by local Public Health Department  
34       regulations or 50 to 80 mg/L residual.

35       Bleed water from all potable water outlets to ensure distribution and test for disinfectant residual at  
36       minimum 15 percent of outlets.

37       Maintain disinfectant in system for 24 hours.

38       If final disinfectant residual tests less than 25 mg/L, repeat treatment.

39       Flush disinfectant from system until residual is equal to that of incoming water or 1.0 mg/L.

40       Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry,  
41       and analyze in accordance with AWWA C601. If any sample fails the analysis, repeat the procedure.

42       Include a copy of the bacteriological analysis in the Operating and Maintenance manuals.

43       If allowed by local jurisdiction, testing is acceptable in lieu of treatment.

#### 44 45 Sanitary and Storm Drainage System:

46       Remove construction debris from cleanouts, drains, strainers, baskets, traps, etc., and leave same  
47       accessible and operable. Place plugs in the end of uncompleted piping at the end of the day or  
48       whenever work stops.

49       Before final acceptance of completed sewer system, flush and clean the entire system with water.

50       Trap and remove solid material obtained from flushing and cleaning from the new system. Do not  
51       allow debris to enter the existing sewer system.

#### 52 53 TEST

##### 54 General:

55       Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation  
56       signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise  
57       concealing piping or connecting fixtures or equipment. Where part of the system must be tested to  
58       avoid concealment before the entire system is complete, test that portion separately, same as for  
59       entire system.

1 Provide all necessary temporary equipment for testing, including pump and gauges. Remove control  
2 devices before testing and do not use piping system valves to isolate sections where test pressure  
3 exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure  
4 and time.

5 Observe each test section for leakage at end of test period. Test fails if leakage is observed or if  
6 pressure drop exceeds 5% of test pressure.

7

8 **Repair:**

9 Repair piping system sections which fail the required piping test by disassembly and re-installation,  
10 using new materials to the extent required to overcome leakage. Do not use chemical stop-leak  
11 compounds, solder, mastics, or other temporary repair methods.

12 Drain test water from piping systems after testing and repair work has been completed.

13

14 **Sewer:** Furnish all facilities and personnel for conducting the test. Test in accordance with the requirements  
15 of the State Plumbing Inspector and local authorities.

16

17 **Plumbing Waste and Vent Piping:** Hydrostatic test by filling to highest point, but not less than 10' water  
18 column on major horizontal portion.

19

20 **Water Piping:** Hydrostatic pressure of 100 psig without loss for four hours.

21

22 **Tanks and Equipment:** Hydrostatic pressure to 1.5 times operating pressure but do not exceed maximum  
23 rated pressure.

24

25 **SUPERVISION AND START-UP**

26 Adjust flush valves, pressure reducing valves, water heater thermostats, and similar equipment.

27

28 **Master mixing valve start-up procedure:** Provide a factory authorized representative to review the installation  
29 of the mixing valve and verify that the adjustment has been completed by an authorized agent of the  
30 manufacture. Provide documentation in the O&M documents showing adjustment has been completed per  
31 manufacture instructions. Record supply and return temperatures. Work shall be completed prior to  
32 substantial completion.

33

34

35

END OF SECTION