

**SECTION 22 66 00**  
**CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section describes the requirements for chemical waste systems, including piping, equipment and all necessary accessories as designated in this section.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures:
- B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Pipe Insulation.
- E. Section 13 05 41 - Seismic Restraint Requirements for Non-Structural Components

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Piping.
  - 2. Floor Drains.
  - 3. All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
  - American Society of Mechanical Engineers (ASME): (Copyrighted Society)
  - A13.1-07.....Scheme for Identification of Piping Systems
  - B16.11-01.....Forged Steel Fittings, Socket-Welding and Threaded
  - B16.12-98 (R 2006).....Cast Iron Threaded Drainage Fittings ANSI/ASME
  - B16.15-06(R 2006).....Cast Bronze Threaded Fittings ANSI/ASME

C. American Society for Testing and Materials (ASTM):

- A74-06.....Standard Specification for Cast Iron Soil Pipe  
and Fittings
- A183-03).....Standard Specification for Carbon Steel Track  
Bolts and Nuts
- A312-08.....Standard Specification for Seamless and Welded  
Austenitic Stainless Steel Pipe
- A733-03.....Standard Specification for Welded and Seamless  
Carbon Steel and Austenitic Stainless Steel  
Pipe Nipples
- C564-03a.....Standard Specification for Rubber Gaskets for  
Cast Iron Soil Pipe and Fittings
- D401-07.....Standard Specification for Propylene Plastic  
Injection and Extrusion Materials
- D2447-03.....Standard Specification for Polyethylene (PE)  
Plastic Pipe, Schedule 40 and 80, Based on  
Outside Diameter
- D2564-04e1.....Standard Specification for Solvent Cements for  
Poly (Vinyl Chloride) (PVC) Plastic Pipe and  
Fittings
- D2665-07.....Standard Specification for Poly (Vinyl  
Chloride) (PVC) Plastic Drain, Waste, and Vent  
Pipe and Fittings
- D4101-07.....Standard Specification for Propylene Plastic  
Injection and Extrusion Materials

D. International Code Council:

- IPC-06.....International Plumbing Code

E. Cast Iron Soil Pipe Institute (CISPI):

- 301-05.....Hubless Cast Iron Soil Pipe and Fittings for  
Sanitary and Storm Drain, Waste, and Vent  
Piping Applications
- 310-04.....Coupling for Use in Connection with Hubless  
Cast Iron Soil Pipe and Fittings for Sanitary  
and Storm Drain, Waste, and Vent Piping  
Applications

## **PART 2 - PRODUCTS**

### **2.1 CHEMICAL RESISTANT WASTE AND VENT PIPING**

- A. The material shall include connecting fittings in stacks or mains.
- B. The chemical resistant waste and vent piping shall be high silicon iron pipe and drainage pattern fittings conforming to ASTM A861. The cast iron pipe shall be close grained, containing not less than 14.25 percent silicon content.
  - 1. The joints shall be mechanical joint type with stainless steel clamps with TFE inner sleeve and CR outer sleeve.
  - 2. The joints shall be bell and Spigot Joint type joint using acid resistant packing and lead calking materials.
- C. The chemical resistant waste and vent pipe material shall be borosilicate glass pipe and drainage pattern fittings conforming to ASTM C1053.
- D. The chemical resistant waste and vent pipe material shall be extruded polypropylene plastic pipe and drainage pattern fittings conforming to ASTM F1412. The polypropylene pipe and fittings shall be schedule 40 and made from a polypropylene resin with a fire retardant additive complying with ASTM D4101 with fusion type fittings for all sizes.
- E. The chemical resistant waste and vent pipe material shall be PVDF pipe and drainage pattern fittings conforming to ASTM F1673. The PVDF pipe and fittings shall be schedule with fusion type fittings for all sizes.
- F. The chemical resistant waste and vent pipe material shall be type 316L stainless steel pipe and drainage pattern fittings conforming to ASME A112.3.1 and ASTM A 666. The stainless steel pipe shall have socket and spigot ends for gasket joints having piping manufacturer's FPM lip-seal rubber gaskets shaped to fit socket groove with plastic backup ring.

### **2.2 PIPING SPECIALTIES**

- A. Plastic dilution traps shall be corrosion resistant polypropylene with removable base and mechanical joint connections. The dilution tanks shall have a 3.8 liter (one gallon) capacity with a clear base. The dilution tank shall have two 40 mm or DN40 (NPS 1-1/2) top inlets and one 40 mm or DN40 (NPS 1-1/2) side outlet.
- B. High silicon iron dilution traps shall have 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 or NPS 2) as required for fixture and waste with mechanical joints, and conforming to ASTM A861.

- C. Glass drain line interceptor drum traps shall have 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 or NPS 2) as required for fixture and waste and conforming to ASTM C 1053.
- D. Corrosion resistant P-trap or drum trap shall have 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 or NPS 2) as required for fixture and waste and conform to ASTM A 861 for high silicon iron pipe with hubless joints, ASTM D4101 for polypropylene pipe with mechanical joints, ASTM D 3222 for PVDF pipe with mechanical joints, and ASTM C 1053 for glass pipe with coupling connections.

### **2.3 CLEANOUTS**

- A. Cleanouts shall be the same size as the pipe, up to 100 mm or DN100 (4 inches); not less than 100 mm or DN100 (4 inches) for larger pipe. Cleanouts for chemical waste drain pipe shall be of same material as the pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. A minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged chemical waste drain.
- B. Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. The cleanout shall be vertically adjustable for a minimum of 50 mm or DN50 (2 inches). When a waterproof membrane is used in the floor system, a clamping collar shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on drawings.
- C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. The vertical cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover shall be furnished with a minimum opening of 150 by 150 mm (6 by 6 inches) at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is

the size required. D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

## **2.4 FLOOR DRAINS**

A. Type L: Flushing Rim Drain. Heavy cast iron body, double drainage pattern with flushing rim and clamping device. Solid bronze gasketed grate approximately 275 mm (11 inches) in diameter, with 50 mm (2 inch) length of 20 mm (3/4 inch) brass pipe brazed or threaded into the center of the solid grate, pipe shall be threaded and provide brass cap with inter gasket (neoprene) to provide a gas tight installation. Attach deep seal P-trap to drain. Body and trap shall have pipe taps for water supply connections:

1. Drain Flange: Flange for synthetic flooring.

2. Cystoscopy Rooms:

a. Flush Valve: The flush valve shall be large diaphragm type flushometer, solenoid operated with a single circuit timer. Mount in valve cabinet.

b. Operation: Valve solenoid shall be cycled by a single circuit timer set to operate flush valve at five minute intervals. Timer shall be electrically connected to an "on - off" toggle switch and be provided with pilot light. Timer and flush valve shall operate only when timer/valve switch is in the "on" position.

c. Valve Cabinets:

1) General: Sheet metal not lighter than 1.6 mm thick (16 gauge), size as required, rigidly assembled with joints welded, and punched or drilled for passage of required pipes and services. Provide anchors for fastening cabinet in place. Front shall be flush with wall finish and shall have flush fitting, hinged doors, with latch. Door shall be arranged to not offer any obstruction when open.

2) Doors and Trim: Flush with front of cabinet, constructed of not lighter than number 2.7 mm thick (12 gauge) steel. Doors shall open through 180 degrees and be provided with two butt hinges or continuous hinge. Latch shall be provided by manufacture of cabinet.

3) Painting: Prime and finish painting is specified under Section 09 91 00, PAINTING.

B. Type T: Funnel Type Chemical Resistant Floor Drain and "P" Trap: Double drainage pattern with integral seepage pan for embedding in floor and weep holes to provide adequate drainage from pan to drain pipe. Floor drain shall be polypropylene, flame retardant, Schedule 40 or 80.

Provide outlet of floor drain suitable for properly jointing perforated or slotted floor level grate and funnel extension. Minimum dimensions as follows:

1. Height of funnel - 95 mm (3-3/4 inches).
2. Diameter of lower portion of funnel - 50 mm (2 inches).
3. Diameter of top portion of funnel - 100 mm (4 inches).

C. Type X: Chemical resistant floor drain and p-trap. Double drainage pattern with integral seepage pan for embedding in floor and weep holes to provide adequate drainage from pan to drain pipe. Floor drain shall be polypropylene, flame retardant, Schedule 40 or 80. Provide outlet of floor drain suitable for properly joining a perforated or slotted floor level grate.

## **2.5 WATERPROOFING**

A. A sleeve flashing device shall be provide at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproofed caulked joint shall be provided at the top hub.

B. Walls: See detail shown on drawings.

## **PART 3 - EXECUTION**

### **3.1 PIPE INSTALLATION**

- A. The pipe installation shall comply with the requirements of the International plumbing code and these specifications.
- B. Branch piping for chemical waste piping system shall be installed and connected to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

- C. Piping shall be installed for reagent racks. The piping shall be arranged neatly and located as required by the equipment.
- D. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
- E. All pipe runs shall be laid out to avoid interference with other work.
- F. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.
- G. The piping shall be installed to permit valve servicing or operation.
- H. The piping shall be installed at the indicated slopes or according to the International plumbing code.
- I. The piping shall be installed free of sags and bends.
- J. Seismic restraint shall be installed where required by code.
- K. Changes in direction for chemical waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- L. Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.
- M. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"
- N. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

### **3.2 JOINT CONSTRUCTION**

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- C. Hubless, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
  - 2. Pipe sections with damaged threads shall be replaced with new sections of pipe.
- E. for PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

### **3.3 SPECIALTY PIPE FITTINGS**

- A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.
- B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

### **3.4 PIPE HANGERS, SUPPORTS, AND ACCESSORIES**

- A. All piping shall be supported according to the International plumbing code, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications.
- B. Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with zinc Chromate primer paint.
- C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.



- D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 to NPS 2): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
  2. 80 mm or DN 80 (NPS 3): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.
  3. 100 mm or DN 100 to 125 mm or DN125 (NPS 4 to NPS 5): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
  4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 to NPS 8): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.
  5. 250 mm or DN250 to 300 mm or DN300 (NPS 10 to NPS 12): 1500 mm (60 inches) with 22 mm (7/8 inch) rod.
- E. Vinyl coated hangers shall be installed for glass piping. The maximum horizontal spacing and minimum rod diameters shall be:
1. For 25 mm or DN25 to 32 mm DN32 (NPS 1 and NPS 1-1/4), the maximum spacing shall be 1.22 meters (48 inches) with 10 mm (3/8 inch).
  2. For 40 mm or DN40 and 50 mm or DN50 (NPS 1-1/2 and NPS 2), the maximum spacing shall be 1.83 meters (72 inches) with 10 mm (3/8 inch).
  3. For 80 mm or DN80 (NPS 3 inch), the maximum spacing shall be 1.83 meters (72 inches) with 13 mm (1/2 inch).
  4. For 100 mm (DN100) (NPS 4 inch), the maximum spacing shall be 1.83 meters (72 inches) with 16 mm (5/8 inch).
- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 meters (15 feet). In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING,
- G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PUMBING, floor, Wall and Ceiling Plates, Supports, and Hangers shall have the following characteristics:
1. Solid or split unplated cast iron.
  2. All plates shall be provided with set screws.
  3. Height adjustable clevis type pipe hangers.
  4. Adjustable Floor Rests and Base Flanges shall be steel.
  5. Hanger Rods shall be carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.

6. Riser Clamps shall be malleable iron or steel.
  7. Rollers shall be Cast iron.
  8. Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 100 mm (4 inches) in length and be 16 gauge steel. The shield shall be sized for the insulation.
- H. Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
- I. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- J. Penetrations:
1. Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop system that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
  2. At floor penetrations, Clearances around the pipe shall be completely sealed and made watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- K. Chemical waste and vent piping shall conform to the following:
1. Where waste lines from fixtures are shown on plans to be chemical resistant, vents from those fixtures shall also be chemical resistant.
  2. Storage and installation for PVC chemical resistant pipe shall comply with ASTM D2665.
  3. Glass Pipe installation shall be as recommended by the manufacturer. Glass pipe pitch shall be 1 : 50 (1/4 inch per foot), minimum.
  4. Silver recovery pipe pitch shall be 1 : 200 (0.5 percent), minimum.
  5. Mechanically Joined Polypropylene Pipe requires a pre-grooved pipe or cutting of a groove in each pipe section using a rotation cutting tool. Polypropylene chemical resistant pipe pitch shall be 6 mm

- minimum (1/4 inch per foot) minimum. Mechanically joined pipe shall not be installed below grade.
6. Plastic chemical waste pipe shall not be installed within 23 m (75 feet) of hot water appliances (autoclaves, dishwashers, sterilizers) and similar equipment.
  7. High silicon content cast iron pipe with bell and spigot joints and heat fusion plastic pipe may be used below grade under building.
  8. Stainless steel, mechanical joints shall not be installed below grade.
  9. Stainless Steel Piping system shall be Joined and supported per manufacturer's recommendations.

### **3.5 TESTS**

- A. The chemical resistant pipe system shall be tested either in its entirety or in sections.
- B. Tests for Chemical Resistant Waste, vent, and Silver Recovery Systems shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted as directed.
  1. If entire system is tested using a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
  2. Air pressure test of 35 kPa (5 psi) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the test.
  3. Final Tests: Either one of the following tests may be used.
    - a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.

Department of Veteran Affairs  
Renovate Research Lab Phase 3  
Nashville, TN  
V.A. Project Number: 626-11-101

- b. Peppermint Test: Introduce (two ounces) of peppermint into each line or stack.

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