

**SECTION 22 14 00
FACILITY STORM DRAINAGE**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the requirements for storm drainage systems, including piping 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: Pipe Hangers and Supports, Materials Identification.
- D. Section 22 07 11, PLUMBING INSULATION: Pipe Insulation.

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. Roof Drains.
 - 3. Cleanouts.
 - 4. All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.

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).
- C. American Society of Mechanical Engineers (ASME):
 - A13.1-07.....Scheme for Identification of Piping Systems
 - A112.36.2M-91 (R2008)...Cleanouts
 - B1.20.1-1983 (R2006)....Pipe Threads, General Purpose (Inch)
 - B16.3-11.....Malleable Iron Threaded Fittings, Classes 150
and 300
 - B16.9-12.....Factory Made Wrought Buttwelding Fittings
 - B16.11-11.....Forged Fittings, Socket-Welding and Threaded
 - B16.12-09.....Cast Iron Threaded Drainage Fittings

- B16.15-06.....Cast Copper Alloy Threaded Fittings: Classes
125 and 250
- B16.18-12.....Cast Copper Alloy Solder Joint Pressure
Fittings
- B16.22-13.....Wrought Copper and Copper Alloy Solder Joint
Pressure Fittings
- B16.23-11.....Cast Copper Alloy Solder Joint Drainage
Fittings - DWV
- B16.29-12.....Wrought Copper and Wrought Copper Alloy
Solder-Joint Drainage Fittings - DWV
- D. American Society for Testing and Materials (ASTM):
- A47/A47M-99 (R 2009)....Standard Specification for Steel Sheet,
Aluminum Coated, by the Hot-Dip Process
- A53/A53M-12.....Standard Specification for Pipe, Steel, Black
and Hot-Dipped, Zinc-Coated, Welded and
Seamless
- A74-13a.....Standard Specification for Cast Iron Soil Pipe
and Fittings
- A183-03 (R 2009).....Standard Specification for Carbon Steel Track
Bolts and Nuts
- A312/A312M-09.....Standard Specification for Seamless, Welded,
and Heavily Cold Worked Austenitic Stainless
Steel Pipes
- A536-84 (R 2009).....Standard Specification for Ductile Iron
Castings
- A733-03 (R 2009).....Standard Specification for Welded and Seamless
Carbon Steel and Austenitic Stainless Steel
Pipe Nipples
- A888-09.....Standard Specification for Hubless Cast Iron
Soil Pipe and Fittings for Sanitary and Storm
Drain, Waste, and Vent Piping Applications
- B32-08.....Standard Specification for Solder Metal
- B61-08.....Standard Specification for Steam or Valve
Bronze Castings
- B62-09.....Standard Specification for Composition Bronze
or Ounce Metal Castings
- B75/B75M-11.....Standard Specification for Seamless Copper Tube

- B88-09.....Standard Specification for Seamless Copper
Water Tube
- B306-13.....Standard Specification for Copper Drainage Tube
(DWV)
- B584-09a.....Standard Specification for Copper Alloy Sand
Castings for General Applications
- B687-99 (2005).....Standard Specification for Brass, Copper, and
Chromium-Plated Pipe Nipples
- C564-12.....Standard Specification for Rubber Gaskets for
Cast Iron Soil Pipe and Fittings
- D1785-12.....Standard Specification for Poly(Vinyl Chloride)
(PVC) Plastic Pipe, Schedules 40, 80, and 120.
- D2000-12.....Standard Classification System for Rubber
Products in Automotive Applications
- D2447-03.....Standard Specification for Polyethylene (PE)
Plastic Pipe, Schedule 40 and 80, Based on
Outside Diameter
- D2564-12.....Standard Specification for Solvent Cements for
Poly (Vinyl Chloride) (PVC) Plastic Pipe and
Fittings
- D2665-12.....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
- E. American Welding Society (AWS):
- A5.8/A5.8M-11.....Specification for Filler Metals for Brazing and
Braze Welding
- F. Cast Iron Soil Pipe Institute (CISPI):
- 301-12.....Standard Specification for Hubless Cast Iron
Soil Pipe and Fittings for Sanitary and Storm
Drain, Waste, and Vent Piping Applications.
- 310-12.....Standard Specification for Coupling for Use in
Connection with Hubless Cast Iron Soil Pipe and
Fittings for Sanitary and Storm Drain, Waste,
and Vent Piping Applications
- G. International Code Council (ICC):
- IPC-2012.....International Plumbing Code

H. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-72-10a.....Ball Valves with Flanged or Butt-Welding for General Service

SP-110-10.....Ball Valves Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

PART 2 - PRODUCTS

2.1 STORM WATER DRAIN PIPING

A. Cast Iron Storm Pipe and Fittings:

1. Cast iron storm pipe and fittings shall be used for the following applications:
 - a. Pipe buried in or in contact with earth.
 - b. Extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls.
 - c. Interior storm piping above grade.
 - d. All mechanical equipment rooms or other areas containing mechanical air handling equipment.
2. The cast iron storm Pipe shall be bell and spigot, or hubless (plain end or no-hub) as required by selected jointing method.
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A888, or ASTM A74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Heavy duty couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564 or be installed with leak and oakum.

B. Roof drain piping in locations where the outdoor conditions are subject to freezing shall be insulated.

2.2 SPECIALTY PIPE FITTINGS

A. Transition pipe couplings shall join piping with small differences in outside diameters or be of different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear erring and corrosion resistant metal tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.

2.3 CLEANOUTS

- A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger 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 storm sewer line.
- B. 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. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover with minimum opening of 150 mm by 150 mm (6 inch by 6 inch) shall be provided at each wall cleanout.
- C. 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 ROOF DRAINS AND CONNECTIONS

- A. Roof Drains: Roof Drains (RD) shall be cast iron with clamping device for making watertight connection. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof membrane, a soft copper membrane shall be provided 300 mm (12 inches) in diameter greater than outside diameter of drain collar. An integral gravel stop shall be provided for drains installed on roofs having built up roofing covered with gravel or slag. Integral no-hub, soil pipe gasket or threaded outlet connection shall be provided.
 1. Flat Roofs: The roof drain shall have a beehive or dome shaped strainer with integral flange not less than 300 mm (12 inches) in diameter. For an insulated roof, a roof drain with an adjustable drainage collar shall be provided, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp. The Bottom section shall serve as roof drain during construction before insulation is installed.
 2. Portico Roofs and Gutters: Roof drains shall be horizontal angle type drain with flat bottom and horizontal outlet at the same

elevation as the pipe to which it is connected. Strainer shall be removable angle grate type.

3. Protective Roof Membrane Insulation Assembly: The roof drain shall have a perforated stainless steel extension filter, non puncturing clamp ring, large sump with extra wide roof flange and deck clamp.
 - a. Non pedestrian Roofs: The roof drain shall have large polypropylene or aluminum locking dome.
 - b. Pedestrian Roof: The roof drain shall have a bronze promenade top 350 mm (14 inches) square, set in square secured frame support collar.
4. Roof Drains, Overflow: Roof Drains identified as overflow drains shall have a 50 mm (2 inch) water dam integral to the drain body.
5. Roof drains in areas subject to freezing shall have heat tape and shall be insulated.
- B. Expansion Joints: Expansions joints shall be heavy cast iron with cast brass or copper expansion sleeve having smooth bearing surface working freely against a packing ring held in place and under pressure of a bolted gland ring, forming a water and air tight flexible joint. Asbestos packing is prohibited.
- C. Interior Downspouts: An expansion joint shall be provided, specified above, at top of run on straight, vertical runs of downspout piping 12 m (40 feet) long or more.
- D. Downspout Nozzle: The downspout nozzle fitting shall be of brass, unfinished, with internal pipe thread for connection to downspout.

2.5 WATERPROOFING

- A. A sleeve flashing device shall be provided 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 shall be installed from the piping system and connect to all drains and outlets.
- C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- D. All pipe runs shall be laid out to avoid interference with other work.
- E. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.
- F. Unless otherwise stated on the documents, minimum horizontal slope shall be one inch for every 1.22 m (4 feet) of pipe length.
- G. The piping shall be installed free of sags and bends.
- H. Seismic restraint shall be installed where required by code.
- I. Changes in direction for storm drainage piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep $\frac{1}{4}$ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and $\frac{1}{8}$ bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. 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.
- J. 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"

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.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

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. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
2. NPS 3 (DN 80): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.
3. NPS 4 to NPS 5 (DN 100 to DN 125): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
4. NPS 6 to NPS 8 (DN 150 to DN 200): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.
5. NPS 10 to NPS 12 (DN 250 to DN 300): 1500 mm (60 inches) with 22 mm (7/8 inch) rod.

E. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).

F. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates 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 low 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. Roller 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 4 inches in length and be 16 gage steel. The shield shall be sized for the insulation.
- G. Miscellaneous Materials shall be provided 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. All necessary auxiliary steel shall be provided to provide that support.
- H. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- I. Penetrations:
1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed 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. Water proofing: 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.
- J. Piping shall conform to the following:
1. Storm Water Drain and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm (3 inches) and smaller	2%
100 mm (4 inches) (4 inches) and larger	1%

3.5 TESTS

- A. Storm sewer system shall be tested either in its entirety or in sections.
- B. Storm Water Drain tests shall be conducted before trenches are backfilled or wall coverings are installed. A water test or air test shall be conducted, as directed.
 - 1. If entire system is tested with water, tightly close all openings in pipes except the 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 the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
 - 2. For an air test, an air pressure 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.
 - b. Peppermint Test: Introduce .06 liters (2 ounces) of peppermint into each line or stack.

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