

**SECTION 22 13 00
SANITARY SEWARGE FACILITIES**

PART 1 - GENERAL**1.1 DESCRIPTION**

This section pertains to sanitary sewer facilities for the pumping station, 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: Pipe Hangers and Supports, Materials Identification.
- D. Section 22 05 23, General Duty Valves for Plumbing Piping: Plug Valves and Check Valve
- E. Section 22 13 36, Packaged Wastewater Pump Units: Base Mounted Duplex Pumping Package
- F. Electrical, Division 26.
- G. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Pipe Insulation.
- H. Underground piping, plug valves, and manhole: Section 33 30 00, Sanitary Sewerage Utilities.
- I. Section 07 92 00 Joint Sealants: Sealant products.

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 and Fitting.
 - 2. Floor Drains.
 - 3. Air Release Valve.
 - 4. Flexible Connectors
 - 5. Pipe Supports
 - 6. Flow Meter
 - 7. Davit Crane
 - 8. All items listed in Part 2 - Products.
- C. Shop Drawings:
 - 1. Pipe Supports

2. Piping layout within the pump station, including, but not limited to, all valves, fittings, and meter. Layout shall included dimensions.

3. Davit Crane Foundation

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 Society of Mechanical Engineers (ASME): (Copyrighted Society)
- A112.6.3-01 (R 2007)....Standard for Floor and Trench Drains
 - A13.1-07.....Scheme for Identification of Piping Systems
 - B16.3-06.....Malleable Iron Threaded Fittings, Classes 150 and 300.
 - B16.4-06.....Standard for Grey Iron Threaded Fittings
Classes 125 and 250
 - B16.12-98 (R 2006).....Cast Iron Threaded Drainage Fittings
 - B16.15-06.....Cast Bronze Threaded Fittings, Classes 125 and 250
- C. American Society for Testing and Materials (ASTM):
- A47/A47M-99 (R 2004)....Standard Specification for Steel Sheet,
Aluminum Coated, by the Hot Dip Process
 - A53/A53M-07.....Standard Specification for Pipe, Steel, Black
And Hot-Dipped, Zinc-coated, Welded and
Seamless
 - A74-06.....Standard Specification for Cast Iron Soil Pipe
and Fittings
 - A183-03.....Standard Specification for Carbon Steel Track
Bolts and Nuts
 - A536-84(R 2004).....Standard Specification for Ductile Iron
Castings
 - B32-08.....Standard Specification for Solder Metal
 - B75-02.....Standard Specification for Seamless Copper Tube
 - B306-02.....*Standard Specification for Copper Drainage Tube
(DWV)*
 - B584-06a.....Standard Specification for Copper Alloy Sand
Castings for General Applications
 - C564-03a.....Standard Specification for Rubber Gaskets for
Cast Iron Soil Pipe and Fittings

- D2000-08.....Standard Classification System for Rubber
Products in Automotive Applications
- D2564-04E1.....Standard Specification for Solvent Cements for
Poly (Vinyl Chloride) (PVC) Plastic Pipe and
Fittings
- D2665-08.....*Standard Specification for Poly (Vinyl
Chloride) (PVC) Plastic Drain, Waste, and Vent
Pipe and Fittings*
- 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
- F. American Society of Sanitary Engineers (ASSE):
1018-01.....Trap Seal Primer Valves - Potable, Water
Supplied
- G. Plumbing and Drainage Institute (PDI):
PDI WH-201.....Water Hammer Arrestor

1.5 QUALITY ASSURANCE:

- A. Products Criteria:
1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 2. Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, including model number, securely affixed in a conspicuous place on equipment, or name or trademark, including model number cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

PART 2 - PRODUCTS

2.1 DRAIN AND VENT PIPING

- A. Cast iron waste, drain, and vent pipe and fittings
1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:

- a. pipe buried in or in contact with earth
 - b. sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.
 - c. interior waste and vent piping above grade.
2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).
 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 A-888, or ASTM A-74.
 4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. 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 Standard C-564 or be installed with lead and oakum.
- B. Copper Tube, (DWV):
1. Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground..
 2. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
 3. The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.
 4. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.
- C. Polyvinyl Chloride (PVC)
1. Polyvinyl chloride (PVC) pipe and fittings are permitted where the waste temperature is below 60°C (140°F).
 2. PVC piping and fittings shall NOT be used for the following applications:
 - a. Waste collected from steam condensate drains
 - b. spaces such as mechanical equipment rooms, kitchens, SPD, and sterilizer areas.
 - b. Vertical waste and soil stacks serving more than two floors
 - c. Exposed in mechanical equipment rooms.
 - d. Exposed inside of ceiling return plenums
 3. Polyvinyl chloride sanitary waste, drain, and vent pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D

1785 and ASTM D2665, sewer and drain series with ends for solvent cemented joints.

4. Fittings:

- a. PVC fittings shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

2.2 ABOVE GROUND PRESSURE (FORCE) AND SUCTION LINES (PIPE AND FITTINGS)

- A. All pipe and fittings used in the construction of pressure and suction lines shall be rated for a minimum of 1035 kPa (150 psi).
- B. Ductile Iron: Flanged pipe shall conform to AWWA C115 with polyethylene lining. Lining shall be heat-fused mechanical bond polyethylene having a dielectric strength of 250 volts per mil when fully cured. Lining shall be holiday tested in accordance with AWWA C116. The lining shall be a minimum of 1 mm (40 mil) in the barrel of the pipe, and a minimum of 0.25 mm (10 mil) on the bell and spigot area of the pipe. The lining shall be repaired at all field cuts per the manufacturer's recommendations. Joints shall be conformed to AWWA C116.
- C. Ductile iron fittings shall comply with AWWA C110. Fittings shall be flanged. Fittings shall be polyethylene line, as specified for ductile iron pipe.

2.3 SPECIALTY PIPE FITTINGS (GRAVITY SYSTEM)

- A. Transition pipe couplings shall join piping with small differences in outside diameters or 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 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. For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.
 - 3. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.
- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.

- C. Dielectric flange insulating kits shall be of non conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- D. The di-electric nipples shall be electroplated steel nipple complying with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.4 FLOOR DRAINS

- A. Floor drains shall be a round nickel bronze top floor drains.
- B. Floor drain shall be the type that prevents the emission of sewer gases into the pump station without the use of a trap and trap primer.
- C. The floor drain shall also prevent the raw sewage from entering the pump station.
- D. Floor drains shall be ProSet Trap Guard Floor Drain Model T45630-F-P or approved equal.

2.5 FLEXIBLE CONNECTORS

- A. Shall be adequate for wastewater applications.
- B. Flexible connectors for the pressure piping system discharge line shall be Cablesphere by Metraflex or approved equal.
- C. Flexible connectors for the pressure piping system suction line(s) shall be a stainless steel pump connector Model SLP by Metraflex or approved equal. Connector shall be adequate for full vacuum.

2.6 PLUG VALVE AND CHECK VALVE

- A. Plug valves and check valves shall be specified within Section 22 05 23.

2.7 PIPE SUPPORTS (PRESSURE SYSTEM)

- A. Pipe supports shall be galvanized steel with a base plate that can be anchored to the floor/wall. The support shall be an adjustable saddle type support and U-bolts shall be provided when required.
- B. The supports that sit on a nut supported by a vertical pipe to adjust the height shall not be permitted. The support must form a rigid unit.

2.8 FLOW METER

- A. Furnishing an electromagnetic flow meter suitable for fixed-site measurement of bi-directional flow in a full pipe. The flow meter shall consist of a flow tube and flow transmitter, which shall transmit flow. The flow tube shall use a spool piece configuration.

- B. The electromagnetic flow meter shall be adequate for wastewater applications.
- C. The meter shall support bi-directional flow and display flow rate, forward and reverse total flow, and internal error messages.
- D. Flow meter shall contain an empty pipe detection feature that can drive the output to 0 flow (4 mA) when the pipe is empty. The pipe will be empty except when the pumps are operating.
- E. The nominal diameter of the flow tube shall be as shown. The flow tube shall contain flange connections and be completely open. Flanges shall comply/be compatible with ANSI B16.5 Class 150 RF.
- F. The micro-processor shall be contained within a NEMA 4X enclosure mounted to the flow tube. The micro-processor shall contain AMR and SCADA ready outputs.
- G. The flow meter shall be provided with all components required for a complete installation including gaskets.
- H. One day of start-up and training shall be provided by a manufactures representative.
- I. The electromagnetic flow meter (detector and amplifier) shall be the M-2000 by Badger or approved equal.

2.9 BASE MOUNTED DUPLEX PUMPING PACKAGE

- A. Shall be as specified within Section 22 13 36.

2.10 AIR RELEASE VALVE:

- A. Valves shall be combination air release and vacuum valve with a single body. The valves shall be rated for 1025 kPa (150 Psi) working pressure, and conform to AWWA C512. Valve shall be provided with threaded connections, and be mounted on a full opening ball valve which shall isolate the valve from the system.
- B. Valve shall be adequate for wastewater applications.
- C. Valve body shall be cast iron.
- D. Interior and exterior of valve shall be coated with fusion bonded epoxy.
- E. Floats and operating mechanism shall be 316 stainless steel.
- F. Non-clog design, Val-Matic or approved equal.

2.11 DAVIT CRANE:

- A. Davit crane shall be as indicated on the drawing.
- B. Davit crane manufacturer shall provide recommended foundation depth and reinforcement required for crane supplied.

- C. Crane height shall be fixed and adequate for operation within the pump station building without hitting light fixtures.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION (GRAVITY)

- A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.
- B. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- C. All pipe runs shall be laid out to avoid interference with other work.
- D. The piping shall be installed to permit valve servicing or operation.
- E. Unless specifically indicated on the drawings, the minimum slope shall be 2% slope.
- F. The piping shall be installed free of sags and bends.
- G. Seismic restraint shall be installed where required by code.
- H. Changes in direction for soil and 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.
- I. 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.
- 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"
- K. Aboveground copper tubing shall be installed according to CDA's "Copper Tube Handbook".
- L. Underground PVC piping shall be installed according to ASTM D2321.

3.2 PIPE INSTALLATION (PRESSURE)

- A. Lay pipes as indicated on drawings.
- B. Contractor is responsible to ensure that bolt circles properly align.
- C. Support all pipe with pipe supports as indicated on the drawings.
- D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site.
- E. Clean interior of all pipe thoroughly before installation.
- F. Install pressure (force) mains in accordance with AWWA C111 and C600.

3.3 JOINT CONSTRUCTION (GRAVITY)

- 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 or No-hub, 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. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.
- F. 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.

3.4 SPECIALTY PIPE FITTINGS (GRAVITY)

- 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.

3.5 PIPE HANGERS, SUPPORTS AND ACCESSORIES

- A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, these specifications, and as indicated on the drawings. Where conflicts arise between these the code and Section 22 05 11, the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.
- B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- 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 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
 - 2. 80 mm or DN 80 (NPS 3 inch): 1500 mm (60 inches) with 13 mm (½ inch) rod.
 - 3. 100 mm or DN100 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 inch to NPS 8 inch): 1500 mm (60 inches) with 19 mm (¾ inch) rod.
 - 5. 250 mm or DN250 to 300 mm or DN 300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 22 mm (7/8 inch) rod.
- E. The maximum spacing for plastic pipe shall be 1.22 m (4 feet).
- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).
- G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates, Supports, 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 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.
 7. Riser clamps shall be malleable iron or steel.
 8. Rollers shall be cast iron.
 9. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.
- H. 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.
- I. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- J. 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 shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- K. Piping shall conform to the following:
1. Waste and Vent Drain to main stacks:

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

2. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.6 SETTING OF AIR RELEASE VALVES

- A. Set valves at location indicated on drawing with adequate space for maintenance of the valve.
- B. Valves shall be set plumb.
- C. Install the valve after the completion of testing of the pressure (force) main.
- D. Valve outlet shall be connected to a vent and drain pipe as indicated on the drawing. A coupling should be provided to disconnect valve from vent and drain piping for maintenance of valve.

3.7 FLOOR DRAINS

- A. Floor drains shall be cast into the concrete pump station floor and installed as recommended by the manufacturer.

3.8 FLEXIBLE CONNECTORS

- A. Shall be installed as recommended by the manufacturer.

3.9 PLUG VALVE AND CHECK VALVE

- A. Plug valves and check valves shall be installed as specified within Section 22 05 23.

3.10 FLOW METER

- A. Prior to assembly, all meter components shall be inspected for quality and tested for proper function and freedom from defects. Any deficiencies or irregularities shall be corrected at no additional cost to the owner.
- B. Once installed and the forcemain main activated, the meter shall be tested for proper functionality. Any deficiencies or irregularities shall be corrected at no additional cost to the owner.
- C. Meter shall be stored in such a manner as to protect them from damage due to freezing of trapped water. The interior shall be kept free from dirt and other foreign matter at all times. Meters shall be handled with care to avoid damage and shall not be dropped or bumped.
- D. Damaged to meters that cannot be repaired to the COR's satisfaction shall be replaced at no cost to the Owner.
- F. Install meter as recommend by the manufacturer.

3.11 BASE MOUNTED DUPLEX PUMPING PACKAGE

- A. Shall be installed as specified within Section 22 13 36.

3.12 TESTS

- A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.

B. Waste System tests 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 for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste 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 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.
3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.
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 (2 ounces) of peppermint into each line or stack.

B. Pressure (Force) Mains: Test at 690 kPa (100 psi) for two hours. Leakage shall be per the following:

$$L=J*D*\sqrt{P}/4500$$

Where:

L = Maximum Allowable Leakage in Gallons per Hour

J = Number of Joints in Test Area

D = Diameter of Pipe in Inches

P = Average Test Pressure (Psi)

3.13 DAVIT CRANE:

- A. Davit crane shall be anchored to concrete foundation as recommended by the manufacturer.

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