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FACILITY SANITARY SEWERS DOC

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

B. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

D. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe; 2018 (Reapproved 2022).

E. ASTM B29 - Standard Specification for Refined Lead; 2019.

F. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

G. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures; 2020.

H. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants; 2009 (Reapproved 2019).

I. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials; 2024.

J. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.

K. AWWA M41 - Ductile-Iron Pipe and Fittings; 2009.

L. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024, with Errata (2025).

M. SSPC-Paint 16 - Coal-Tar Epoxy Polyamide (Black or Dark Red) Coating; 2023.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 SUMMARY

A. This Section includes gravity-flow, sanitary sewerage outside the building, with the following components:
   1. Precast concrete manholes.
   2. Piping

1.04 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene-monomer rubber.

C. FRP: Fiberglass-reinforced plastic.

D. LLDPE: Linear low-density, polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

H. RTRF: Glass-fiber-reinforced, thermosetting-resin fitting.

I. RTRP: Glass-fiber-reinforced, thermosetting-resin pipe.

J. TPE: Thermoplastic elastomer.

1.05 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water 4 psi.

1.06 SUBMITTALS

A. Product Data: For the following:
   1. Special pipe fittings.
   2. Backwater valves.

B. Shop Drawings: For the following:
   1. Manholes: Include plans, elevations, sections, details, and frames and covers.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Field quality-control test reports.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle manholes according to manufacturer's written rigging instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A74, Service class.

B. Gaskets: ASTM C564, rubber.

C. Calking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.04 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A746, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.05 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Cast-Iron Soil Pipes: ASTM C564, rubber.
   2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.06 SPECIAL PIPE FITTINGS

A. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections, rated for 250-psig (1725-kPa) minimum working pressure and for offset and expansion indicated.
   1. Available Manufacturers:
      a. EBAA Iron Sales, Inc.
      b. Romac Industries, Inc.
      c. Star Pipe Products.

B. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig (1725-kPa) minimum working pressure and for up to 15 degrees of deflection.
   1. Available Manufacturers:
      a. EBAA Iron Sales, Inc.

C. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig (1725-kPa) minimum working pressure and for expansion indicated.
   1. Available Manufacturers:
      a. Dresser, Inc.; DMD Div.
      b. EBAA Iron Sales, Inc.
      c. JCM Industries.
      d. Smith-Blair, Inc.

2.07 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   1. Available Manufacturers:
      a. Carolo Industries
      b. Leonard
      c. OMEGA Concrete Products Inc.
   2. Diameter: 48 inches minimum, unless otherwise indicated.
   3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
   4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
   5. Riser Sections: 4-inch (100-mm) minimum thickness, and of length to provide depth indicated.

6. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C 990M), bitumen or butyl rubber.
8. Steps: Individual FRP steps, FRP ladder, or ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than [60 inches.
9. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
    a. Material: ASTM A48/A48M, Class 35 gray iron, unless otherwise indicated.

B. Manhole Cover Inserts: Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.
1. Available Manufacturers:
    a. FRW Industries; a Syneco Systems, Inc. company.
    b. Knutson Enterprises.
    c. L.F. Manufacturing, Inc.
    d. Parson Environmental Products, Inc.
2. Type: Solid.

2.08 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A615/A615M, Grade 60 60958 psi, deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
    a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A615/A615M, Grade 60 60958 psi, deformed steel.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
   1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
      a. Unshielded flexible or rigid couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range:
   1. NPS 4 (DN 100): Hub-and-spigot, Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. NPS 5 and NPS 6 (DN 125 and DN 150): Hub-and-spigot, Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.

F. Install gravity-flow, nonpressure, drainage piping according to the following:
   1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
   2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
   3. Install piping with 48-inch (1220-mm) minimum cover.
   4. Install piping below frost line.
   5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
   6. Install ductile-iron, gravity sewer piping according to ASTM A746.
   7. Install ductile-iron and special fittings according to AWWA C600 or AWWA M41.

G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.04 PIPE JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 22 Section "Common Work Results for Plumbing" Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure, drainage piping according to the following:
   1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
   2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
   3. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
   4. Join ductile-iron and special fittings according to AWWA C600 or AWWA M41.
   5. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

3.05 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C891.

C. Construct cast-in-place manholes as indicated.

D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.

E. Form continuous concrete channels and benches between inlets and outlet.

F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

G. Install manhole cover inserts in frame and immediately below cover.

3.06 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.07 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping where indicated.

3.08 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."

B. Connect pressure, force-main piping to building's sanitary force mains specified in Division 22 Section "Sanitary Waste and Vent Piping." Terminate piping where indicated.

3.09 PAINTING

A. Prepare ferrous frame and cover surfaces according to SSPC-PA 1 and paint according to SSPC-PA 1 and SSPC-Paint 16. Do not paint surfaces with foundry-applied corrosion-resistant coating.

3.10 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
   1. Use warning tape or detectable warning tape over ferrous piping.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
      a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile (4.6 L/millimeter of nominal pipe size per kilometer) of pipe, during 24-hour period.
      b. Close openings in system and fill with water.
      c. Purge air and refill with water.
      d. Disconnect water supply.
      e. Test and inspect joints for leaks.
      f. Option: Test ductile-iron piping according to AWWA C600,"Hydrostatic Testing" Section. Use test pressure of at least 10 psig.
   6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Option: Test concrete gravity sewer piping according to ASTM C 924 (ASTM C 924M).
   7. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous material.

B.

END OF SECTION 22 13 13 22 13 13