

**SECTION 33 40 00
STORM SEWER UTILITIES**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Concrete Work, Reinforcing, Placement and Finishing: Section 32 05 23, CONCRETE FOR EXTERIOR IMPROVEMENTS.
- C. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- D. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 ABBREVIATIONS

- A. HDPE: High-density polyethylene
- B. PE: Polyethylene

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle manholes, inlet boxes, and stormwater inlets according to manufacturer's written rigging instructions.

1.5 COORDINATION

- A. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.6 QUALITY ASSURANCE:

- A. Products Criteria:
 - 1. 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. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.7 SUBMITTALS

- A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, valves and other miscellaneous items.

1.8 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 for Testing and Materials (ASTM):
- | | |
|----------------|--|
| A185/A185M-07 | Steel Welded Wire Reinforcement, Plain, for Concrete |
| A615/A615M-09b | Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement |
| C33/C33M-08 | Concrete Aggregates |
| C150/C150M-11 | Portland Cement |
| C443-10 | Joints for Concrete Pipe and Manholes, Using Rubber Gaskets |
| C478-09 | Precast Reinforced Concrete Manhole Sections |
| C891-09 | Installation of Underground Precast Concrete Utility Structures |
| C923-08 | Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals |
| C1173-08 | Flexible Transition Couplings for Underground Piping Systems |
| D3350-10 | Polyethylene Plastics Pipe and Fittings Materials |
| F477-10 | Elastomeric Seals (Gaskets) for Joining Plastic Pipe |
| F1668-08 | Construction Procedures for Buried Plastic Pipe |
- C. American Association of State Highway and Transportation Officials (AASHTO):
- | | |
|---------|---|
| M252-09 | Corrugated Polyethylene Drainage Pipe |
| M294-10 | Corrugated Polyethylene Pipe, 12 to 60 In. Diameter |
- D. Standard Specifications of Pennsylvania State Department of Transportation (PennDOT) Publication 408, latest revision.

1.9 WARRANTY

- A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers' and suppliers' written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

- A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.2 HDPE PIPE AND FITTINGS

- A. Corrugated HDPE drainage pipe and fittings, NPS 3 to NPS 10; AASHTO M252, Type S, with smooth waterway for coupling joints.
 - 1. Silt-tight Couplings conforming to AASHTO M252 or ASTM F2306. Bell and spigot connection shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of AASHTO M252 or ASTM F 2306.
- B. Corrugated HDPE pipe and fittings, NPS 12 to NPS 60; AASHTO M294, Type S with smooth waterway for coupling joints. Pipe shall be produced from HDPE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.
 - 1. Silt-tight Couplings conforming to AASHTO M294 or ASTM F2306. Bell and spigot connection shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of AASHTO M294 or ASTM F 2306.

2.3 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure 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 plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
 - 2. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.4 MANHOLES AND INLET BOXES

- A. Standard Precast Concrete Manholes:
 - 1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 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 minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 - 5. Riser Sections: 4 inch minimum thickness and lengths to provide depth indicated.
 - 6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.

7. Joint Sealant: ASTM C990, bitumen or butyl rubber.
 8. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
 9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches. ASTM A615, deformed, 1/2 inch steel reinforcing rods encased in ASTM D4101, width of 16 inches minimum, spaced at 12 intervals.
 10. Adjusting Rings: Reinforced-concrete rings, 6 to 20 inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.
- B. Standard Precast Concrete Inlet Boxes and Yard Drain:
1. Description: ASTM C913; designed for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints. Precast Standard inlet box, or size as necessary based on required pipe sizes and pipe openings, as shown on PennDOT Standard Drawings RC-46M.
 2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to inlet box as required to prevent flotation.
 3. Joint Sealant: ASTM C990, bitumen or butyl rubber.
 4. Resilient Pipe Connectors: ASTM C923, cast or fitted into inlet box walls, for each pipe connection.
 5. Steps: If total depth from floor of inlet box to finished grade is greater than 60 inches. ASTM A615 deformed, 1/2 inch steel reinforcing rods encased in ASTM D 4101, width of 16 inches minimum, spaced at 12 inch intervals.
 6. Adjusting Rings: Reinforced-concrete rings, 3 to 10 inch total thickness, to match size of inlet box frame and cover, and height as required to adjust inlet box frame and cover to indicated elevation and slope.
- C. Manhole Frames and Covers:
1. Description: Frame and Cover as shown on PennDOT Standard Drawings RC-39M, 30" inside diameter. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
 2. Material: ASTM A48, Class 35 gray iron designated to meet AASHTO M306 loading.
- D. Inlet Box Frames and Grate:
1. Description: AASHTO M306 loading, PennDOT Type M frame or Type C frame when abutting curbing, as shown on Standard Drawings RC-45M, one-piece bicycle safe.
 2. Material: ASTM A48, Class 35 gray iron.

2.5 CONCRETE FOR MANHOLES AND INLET BOXES

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C150, Type II.

2. Fine Aggregate: ASTM C33, sand.
 3. Coarse Aggregate: ASTM C33, crushed gravel.
 4. Water: Potable.
- B. Concrete Design Mix: 4000 psi (27.6 MPa) minimum, compressive strength in 28 days.
1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A615, Grade 60 deformed steel.
- C. Manhole Channels and Benches: Channels shall be the main line pipe material. Include benches in all manholes and catch basins.
1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel. Minimum of 6 inch slope from main line pipe to wall sides.

2.6 WARNING TAPE

- A. Standard, 4-Mil polyethylene 3 inch wide tape detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

PART 3 - EXECUTION

3.1 PIPE BEDDING

- A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class I material.

3.2 PIPING INSTALLATION

- A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping with 24 inch minimum cover as shown on the Drawings.
- C. 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 use of lubricants, cements, and other installation requirements.
 1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
 2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
 3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.

4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
 5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
 6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches over the crown of the pipe.
 7. Warning tape shall be continuously placed 12 inches above storm sewer piping.
- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. 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.
- F. Install gravity-flow, non-pressure drainage piping according to the following:
1. Install piping pitched down in direction of flow.
 2. Install HDPE corrugated sewer piping according to ASTM D2321 with gasketed joints.

3.3 RE-GRADING

- A. Raise or lower existing manholes and structures frames and covers in re-graded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES

- A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

3.5 MANHOLE INSTALLATION

- A. Install manholes, complete with appurtenances and accessories indicated. Install precast concrete manhole sections with sealants according to ASTM C891.
- B. Set tops of frames and covers flush with finished surface.
- C. Circular Structures:
1. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible

gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.

2. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.
3. Structure shall be set on a 12 inch thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb.
4. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic.

3.6 INLET BOX AND YARD DRAIN INSTALLATION

- A. Install inlet boxes and yard drains, complete with appurtenances and accessories indicated. Install precast concrete inlet boxes sections with sealants according to ASTM C891.
- B. Set tops of frames and covers flush with finished surface of inlet boxes that occur in pavements.

3.7 CONNECTIONS

- A. Make connections to existing piping and underground manholes.
 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
 2. Make branch connections from side into existing piping, NPS 4 to NPS 24. Remove section of existing pipe, install wye fitting into existing piping.
 3. Make branch connections from side into underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete.
 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
 1. Use non-pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.
 - a. Unshielded flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible 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.

3.8 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 1. Close open ends of piping with at least 8 inch thick, brick masonry bulkheads.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 1. Remove manhole or structure and close open ends of remaining piping.
 2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Division 31 Section EARTH MOVING.

3.10 IDENTIFICATION

- A. Install green warning tape directly over piping and at outside edge of underground structures.

3.11 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred.
 1. Submit separate reports 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. Damage: 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. Re-inspect and repeat procedure until results are satisfactory.

3.12 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

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