

**SECTION 33 05 13**  
**MANHOLES AND STRUCTURES (Manholes)**

**PART 1 GENERAL****1.1 DESCRIPTION**

- A. The work of this section includes, but is not limited to:
1. Precast concrete manhole sections
  2. Precast concrete manhole bases
  3. Cast-in-place concrete manhole bases
  4. Manhole steps
  5. Manhole frames and covers and adjusting rings
- B. Related Work Specified Elsewhere:
1. Earth Moving (Trenching, Backfilling and Compacting): Section 31 20 00.02
  2. Erosion and Sedimentation Controls: Section 31 25 00
  3. Asphalt Paving (Bituminous Paving and Surfacing): Section 32 12 16
  4. Concrete (Plain and Reinforced Cement Concrete): Section 32 13 13.01
  5. Concrete (Cement Concrete for Utility construction): Section 32 13 13.03
  6. Facility Sanitary Sewers (Sanitary Sewer Pipe): Section 33 31 00.00
  7. Facility Sanitary Sewers (Sanitary Sewer Testing): Section 33 31 00.01
  8. Facility Storm Drainage Piping (Storm Drain Pipe): Section 33 41 00
- C. Definitions:
1. Standard Manhole – manhole with vertical height from top of base (invert) to top of rim greater than five feet (5').
  2. Shallow Manhole - manhole with vertical height from top of base to top of rim less than five feet (5').
- D. Applicable Standard Details:  
As shown on the Contract Drawings and in accordance with Publication 408 Specifications.

**1.2 QUALITY ASSURANCE**

- A. Reference Standards:
1. Pennsylvania Department of Transportation (PennDOT), latest revision:  
Publication 408, Specifications  
Publication 213, Temporary Traffic Control Guidelines  
Publication 19, Field Test Manual
    - PTM No. 106 – Moisture-Density Relations of Soils (using 5.5 lb. Rammer and 12 inch drop)
    - PTM No. 402 – Determining In-Place Density and Moisture Content of Construction Materials by Use of Nuclear Gauges
 Publication 72M, Roadway Construction Standards (RC-39)
  2. American Society for Testing and Materials (ASTM):
    - A48 Specification for Gray Iron Castings
    - A185 Specification for Welded Steel Wire Fabric, Plain, for Concrete Reinforcement
    - A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
    - B221 Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes

- C139 Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
  - C270 Specification for Mortar for Unit Masonry
  - M306 Specifications for Drainage, Sewer, Utility and Related Castings
  - C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
  - C478 Specification for Precast Reinforced Concrete Manhole Sections
  - C923 Specifications for Resilient Connectors between Reinforced Concrete Manholes Structures, Pipes and Laterals
  - D1248 Specification for Polyethylene Plastics Molding and Extrusion Materials
3. Federal Specifications (FS):
    - CID A-A-60005 Frame, Covers, Grating, Steps, Sump and Catch Basin Manholes
    - SS-S-00210 Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe
  4. Pennsylvania Code
    - Title 67, Transportation, Chapter 459, Occupancy of Highway by Utilities
- B. Inspections:
1. Inspections of the manholes by the ENGINEER will, at a minimum, be made of materials upon delivery to the job site; of the subgrade, prior to manhole base construction or placement; and of the completed manhole, prior to backfill.
  2. Inspections of the frame and covers by the ENGINEER will be made upon delivery to the job site; and of the completed installation, prior to backfill.
  3. A final inspection of the manhole channels, steps, frames and covers and all joints will be performed upon completion of all testing, roadway restoration, and/or seeding.
  4. Manholes shall be subject to rejection for failure to conform with these specifications or if any one of the following conditions is noted:
    - a. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
    - b. Defects that indicate incorrect proportioning, mixing, and molding.
    - c. Surface defects larger than ½" diameter indicating honey-combed or open texture.
    - d. Damaged or cracked ends, where such damage would prevent making a satisfactory joint.
    - e. Any continuous crack having a surface width of 0.01 inches or more and extending for a length of 6 inches or more, regardless of position in the section wall.
- C. Concrete Testing (For Cast –In-Place Work) – As specified in Section 32 13 13.01.
- 1.3 SUBMITTALS**
- A. Certificates:
1. Submit two copies of certification from material suppliers attesting that materials meet or exceed specification requirements.
- B. Shop Drawings:
1. Submit details of manhole sections, and precast bases if used.
  2. Submit detail for cast-in-place concrete manhole base.
  3. Submit details of manhole frames and covers, including required lettering.
  4. Submit details of adjusting rings.
  5. Submit details of manhole steps.
  6. Submit manufacturer's descriptive literature for the pipe to manhole flexible connections.

7. Submit anti-floatation (buoyancy) calculations assuming a groundwater table to the existing surface and without accounting for any structure skin resistance. Assumed (dry) unit weight of backfill shall be 90 LBS/CF.
8. Submit manufacturer's descriptive literature for joint sealant compounds.

#### **1.4 JOB CONDITIONS**

- A. As specified in Section 31 20 00.02.

#### **1.5 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Precast Concrete Units:
  1. After fabrication and curing, transport the manhole and components to the job site. Protect until required for installation.
  2. Handle to avoid damage to surfaces, edges and corners and to avoid creation of stresses within the units.

### **PART 2 PRODUCTS**

#### **2.1 CRUSHED STONE BASE**

- A. AASHTO No. 57 or AASHTO No. 8 crushed aggregate, Section 703.2, Publication 408, Section 703.2.

#### **2.2 MANHOLE BRICK: Not Permitted**

#### **2.3 CONCRETE MASONRY UNITS: Not Permitted**

#### **2.4 CEMENT MORTAR: ASTM C270, Type S**

#### **2.5 CEMENT CONCRETE: Section 321313.03**

#### **2.6 RUBBER GASKETS: ASTM C443**

#### **2.7 RESILIENT PIPE-TO-MANHOLE CONNECTION: ASTM C923**

- A. PSX gaskets as manufactured by Press-Seal Gasket Corporation, Fort Wayne, Indiana or approved equal.

#### **2.8 NON-SHRINK GROUT: Fast-setting, cement-based mortar such as MasterSeal 590 (formerly Waterplug), manufactured by Master Builders Solutions a Brand of MBCC Group, Shakopee, MN, or approved equal.**

#### **2.9 PRECAST CONCRETE MANHOLE SECTIONS: ASTM C478**

- A. 5.5% ± 1.5% air-entrained cement concrete.
- B. Eccentric cone or flat slab top sections; minimum 24" access opening.
- C. Precast riser sections of length to suit.
- D. Precast drop connections, and precast lampholes are not permitted, unless approved by the ENGINEER.
- E. Manholes shall have a 4' inside diameter unless otherwise noted on the Contract Drawings.

#### **2.10 CASTING MATERIALS**

- A. Gray Iron Castings shall conform to the requirements of AASHTO M105 Class 35B or ASTM A 48 Class 35B.
- B. Castings shall be manufactured true to pattern and component parts shall fit together in a satisfactory manner. They shall be smooth and well cleaned by shot blasting. Circular manhole frames, covers and grates shall be furnished with machined horizontal bearing surfaces.
- C. All shipments shall include appropriate certification from the producing foundry. The certification shall state that the castings have been produced in facilities operating in accordance with the applicable laws

and regulations of the United States and the appropriate state, province, or local unit of government. This certification shall also state that all samples representing each lot have been tested, inspected, and have been found to meet the requirements of this specification and the applicable ASTM material specification listed in Section 3. Certification shall also state country of origin of the castings. If specified in the order, a report of the test results shall be furnished.

D. Markings

1. Each individual casting shall be identified by the foundry showing the following:
  1. Name of producing foundry and country of manufacture preceded by the words "Made In", such as "Made in USA".
  2. AASHTO designation or ASTM designation number.
  3. Class by a number followed by a letter indicating the minimum tensile strength and size of test bar.
  4. Heat identification and cast date (MM/DD/YY).
  5. Casting lettering shall read as SEWER.
  6. Any markings as required to meet Federal requirements.

E. Records

1. All test results by this specification shall be maintained by the producing foundry for seven years and shall be made available to the purchaser upon request.
2. Records of casting certifications issued by a producing foundry shall be maintained by the producing foundry for seven years and shall be made available upon request.

**2.11 JOINT SEALANT COMPOUND**

- A. F S SS-S-00210, preformed, flexible, self-adhering, cold-applied. Joints between manhole base and riser, between risers, between riser and cone, between cone and adjusting rings and cast iron frame, shall be made of RUB'R-NEK, a flexible plastic gasket-type sealant manufactured by K. T. Snyder Company, Inc., of Houston, Texas, or approved equal.

**2.12 MANHOLE STEPS**

- A. Manhole steps shall be made of non-corrosive aluminum, or steel reinforced fiberglass or polypropylene materials. Steps in precast walls shall terminate 1" from outer surface and shall be cast in place wherever possible or grouted with a waterproof, non-shrink grout.
1. Aluminum alloy steps (Alloy 6061-T6) shall be model No. F-140 manufactured by Washington Aluminum Company, Inc., of Baltimore, MD, or approved equal and shall have a protective coating consisting of asphalt coating conforming to AASHTO M-190 requirements applied to the portion to be embedded in the concrete.
  2. Steel reinforced fiberglass steps shall be Model No. 115 manufactured by R.J. Manufacturing, Inc. of San Antonio, Texas, or approved equal.
  3. Steel reinforced copolymer polypropylene plastic steps shall be Model No. PS-2-B or PS-2 –PFS manufactured by M. A. Industries, Inc. of Peachtree City, Georgia, or approved equal.

**2.13 MANHOLE FRAMES AND COVERS**

- A. Domestic soft, gray cast iron castings shall be free of bubbles, sand and air holes, and other imperfections. Castings shall be furnished unpainted.

- B. Standard and Heavy Duty frames and covers shall be capable of withstanding an AASHTO HS-25 loading and shall have about a 24" clear opening. Watertight frames and covers shall meet AASHTO HS-20 loading requirements.
- C. Frame and cover shall have machined bearing surfaces and matched to insure against rocking.
- D. Cover shall be lettered or marked in accordance with this section 2.10.D.1.e. Lugs and lettering shall be flush with frame.
- E. Standard frames and covers shall be similar to Model No. 1040, manufactured by East Jordan Iron Works, Inc., East Jordan, Michigan, or approved equal. Solid covers shall be self-sealing, have two (2) concealed watertight pick holes, and shall have two (2) lifting rings or bars, and no openings to permit surface water entry. Covers shall be 1 1/2" thick, and frames shall have a 24" diameter minimum clear opening and a minimum height of 7".

**2.14 REINFORCING STEEL:** Section 32 13 13.01

**2.15 ADJUSTING RINGS**

- A. Precast cement concrete grade adjustment rings shall be cast from 4000 psi concrete (28-day compressive strength). Circumferential reinforcement shall be in conformance with ASTM C478. Split concrete rings are not permitted.
- B. Plastic or High Density Polyethylene (HDPE) rings are not permitted.
- C. Infra-Riser Adjustment rubber rings, manufactured by East Jordan Iron Works, East Jordan Michigan or approved equal, may be substituted for concrete rings, if approved by the ENGINEER.
- D. Poured in place concrete adjustments shall conform with Contract Drawings and Publication 408 Specifications.

**2.16 WALL PENETRATION SEALS**

- A. Concrete wall penetration seals shall be "link-seal", as manufactured by Thunderline Corporation, Houston, TX or approved equal.
- B. Use appropriate wall sleeve type as recommended by manufacturer to provide watertight seal/connection.

**2.17 STRUCTURAL CONCRETE BONDING AGENT**

The epoxy bonding agent shall be Nitrobond EP, as manufactured by Fosroc Limited, Coleshill Road, Tamworth, Staffordshire, UK. The bonding agent shall be a two-component, solvent-free epoxy resin. The two components shall be differentially pigmented in order to ensure visually that correct mixing has taken place prior to the application. The product shall achieve 70 N/mm<sup>2</sup> compressive strength, 36 N/mm<sup>2</sup> tensile strength, 30% elongation, and 14 N/mm<sup>2</sup> bond strength and water absorption of 0.05%, when tested in accordance to ASTM C881: Type I, II, III, IV and V, grade 2 class E & F. Nitrobond shall be installed per manufacturer's recommendation.

**PART 3 EXECUTION**

**3.1 MAINTENANCE AND PROTECTION OF TRAFFIC:** Section 31 20 00.02

**3.2 CUTTING PAVED SURFACE PRIOR TO EXCAVATION:** Section 31 20 00.02

**3.3 BLASTING:** Blasting is prohibited.

**3.4 EXCAVATION**

- A. Excavate at location marked in the field.

- B. Excavate as specified in Section 31 20 00.02.
- C. Excavate to the required depth and grade for the invert of the manhole plus that excavation necessary for placement of base material.
- D. An inspection of the subgrade by the ENGINEER prior to placing base (aggregate bedding) material is required. Over-excavate and install suitable material, if directed by the ENGINEER.
- E. Actively dewater excavation, as required, throughout construction.

### **3.5 MANHOLE CONSTRUCTION**

- A. Install a minimum of 4" thick compacted crushed stone base. Provide cast-in-place concrete or precast concrete bases.
  - 1. Construct cast-in-place bases as shown on Contract Drawings and Publication 408 Specifications.
    - a. Cast-in-place bases may be constructed with a special form for a joint to match the manhole cylinder sections.
  - 2. Install precast bases as detailed in Publication 408 Specifications.
    - a. Set the precast base on the crushed stone base.
    - b. Provide a sealed, flexible resilient connection between pipe and precast base section.
- B. Construct drop connections as shown on Contract Drawings. Drops shall be inside, using RELINER (Duran, Inc.) Drop Bowl product, unless otherwise approved by the ENGINEER.
- C. Form flow channels in manhole bases. Slope channels uniformly from influent invert to effluent invert, minimum 0.1' drop. Construct bends of the largest possible radius. Form channel sides and invert smooth and uniform, free of cracks, holes or protrusions.
- D. Do not permit pipe to project more than 3" into the manhole.
- E. Where special gaskets or water stops are recommended by pipe manufacturers for connections at manhole walls, these facilities shall be provided. All pipe connection joints shall be watertight.
- F. Seal joints between precast concrete manhole sections with preformed rubber gaskets or joint sealant compound.
- G. Place joint sealant compound on lower section to be compressed by the weight of the upper section.
- H. Step placement:
  - 1. Install manhole sections with steps in proper vertical alignment. Distance from top of rim to top step shall not be greater than 30". Distance from floor of manhole to bottom step shall not be greater than 20".
  - 2. Manhole steps shall be placed perpendicular to the mainline channel. Do not locate steps over channels, unless approved by ENGINEER.
- I. Install manhole frames and covers.
  - 1. In all streets and private roadways the top rim elevation or the entire circumference of all manhole frames and covers shall be depressed 1/4" below the elevation of the adjacent street surface.
  - 2. Seal joint between manhole frame and manhole with joint sealant compound.
  - 3. All manholes shall be adjusted to finished street grade utilizing no more than two (4" maximum thickness) adjusting rings. Brick and stone adjustments are not permitted. The use of metal extension rings is not permitted, unless approved by the ENGINEER.
  - 4. If the proper adjustment cannot be achieved by the use of two rings, the cone section shall be removed and the proper barrel section inserted.

5. All concrete adjusting rings shall be parged and plastered on the inside and outside with cement mortar one-half (½") inch in thickness, carefully spread and thoroughly troweled to a smooth surface on the inside only.
  6. Install Infra Riser (E.J. Iron Works) adjusting rings in accordance with manufacturer's recommendations using approved butyl sealant between cone and ring and between rings.
- J. New manholes constructed on existing pipelines:
1. Only cast-in-place manhole bases shall be installed over existing sanitary sewers, unless approved by the ENGINEER.
  2. Carefully excavate around existing pipeline for placement of the new manhole base.
  3. Take all measures necessary to control flow through the existing pipeline and to prevent leakage into the new base.
  4. After completion of the manhole, carefully saw and remove the top portion of the existing pipeline.
  5. No materials, construction debris, or ground and surface water shall enter the existing pipelines.
  6. Upon completion of the connections, a properly sized plumber's stopper shall be placed in the new line and be adequately braced to prevent a "blow-out".
  7. The stopper shall not be removed until written permission is granted by the ENGINEER.
- K. Concrete wall penetration shall be cored at the sizes and locations indicated on the Contract Drawings or as recommended by the seal manufacturer. Place approved water-tight connectors in the concrete walls in accordance with manufactures requirements as approved by the ENGINEER.

**3.6 SUPPORT OF EXCAVATION: Section 31 20 00.02**

**3.7 CONTROL OF EXCAVATED MATERIAL: Section 31 20 00.02**

**3.8 DEWATERING: Section 31 20 00.02**

**3.9 BACKFILLING**

- A. Backfill only after examination of the manhole by the ENGINEER.
- B. Perform backfilling as specified in Section 31 20 00.02

**3.10 DISPOSAL OF EXCAVATED MATERIAL: Section 31 20 00.02**

**3.11 RESTORATION OF SURFACE AREAS**

- A. Restore paved areas as specified in Section 32 13 13.02.
- B. Restore unpaved surfaces as specified in Section 31 20 00.02.

**END OF SECTION**