SECTION 02601

MANHOLES

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Precast Concrete Manholes

2. Concrete Manhole Bases

3. Manhole Steps

4. Manhole Covers and Frames

B. Related Work Specified Elsewhere

1. Trenching, Backfilling & Compacting: Section 02221

2. Sanitary Sewer Pipe: Section 02610

3. Concrete For Utility Construction: Section 03300

1.02 QUALITY ASSURANCE

A. Reference Standards

1. Pennsylvania Department of Transportation Pub. 408 Specifications, Latest Edition.

2. American Society for Testing and Materials (ASTM):

A48 Specification for Gray Iron Castings

C32 Specification for Sewer and Manhole Brick

C139 Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes

C270 Specifications for Mortar for Unit Masonry

C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using RubberGaskets

C478 Specifications for Precast Reinforced Concrete Manhole Sections

C923 Specification for Resilient Connections Between Reinforced Concrete Manhole Structures and Pipes

1.03 SUBMITTALS

A. Certificates

1. Submit certification from material suppliers attesting that materials meet or exceed specification requirements.

B. Shop Drawings

1. Submit detail shop drawings of manhole sections, precast bases if used, and protective coatings.

2. Submit detail shop drawings of manhole frames and covers.

3. Submit detail shop drawings of manhole steps.

4. Submit manufacturers' descriptive literature for the pipe to manhole flexible connections, for new and existing manholes.

5. Submit buoyancy calculations for manholes which are to be installed at depths exceeding eight (8) feet).

PART 2 PRODUCTS

2.01 BASIC MATERIALS

A. Crushed Stone Subbase

1. 2A Aggregate, Table C, Section 703.2, Publication 408 Specifications, Latest Edition.

B. Manhole Brick: ASTM C32, grade MS, solid

C. Concrete Masonry Units: ASTM C139

D. Masonry Mortar: ASTM C270, Type N

E. Cement Concrete: Section 03300 Entitled "Concrete for Utility Construction"

F. Joint Sealant Compound: FS SS-S-00210, preformed, flexible, self-adhering, cold-applied.

G. Rubber Gaskets: ASTM C443

H. Resilient Pipe-to-Manhole Connection: ASTM C923

I. Grout: ASTM C827, Non-shrink Grout, Masterflow 713 Grout, Non-shrink 5 Star Grout, or equal.

2.02 FABRICATED PRODUCTS

A. Precast Concrete Manhole Sections: ASTM C478

1. 5.5% +/- 1% air-entrained cement concrete.

2. Eccentric cone or flat slab top sections; minimum 24" access opening unless otherwise indicated.

3. Precast riser sections of length to suit.

4. Precast bases of a design similar to the precast riser sections.

5. The sections shall be a minimum of four feet in diameter.

6. Joints shall be sealed with a preformed flexible plastic gasket.

B. Anchor Bolts

1. Anchor bolts for bolting manhole frame to the precast or brick manholes shall be made of 3/4 inch diameter all-thread steel rods with a minimum 2-inch projection through the frame. The all-thread steel rods shall have a 5-inch hook for embedment when brick manholes are used. The all-thread steel rod, washer and nuts shall be galvanized.

2. The concrete inserts for use in pre-cast manholes shall be in accordance with Federal Spec. WW-H-171C (Type 18).

C. Manhole Steps

1. Aluminum: Alloy 6061-T6, ALCOA 16027B or 15785

2. Plastic Coated Steel: Deformed steel reinforcing bar encapsulated with injection molded polypropylene. Serrated tread and end lugs to prevent feet from slipping off.

3. Manhole step shall be formed from Aluminum of Steel stock ½ " square minimum and provide a tread of 12" wide and 7" deep.

4. Steps shall be located within 24" from the manhole cover and bench landing surface.

D. Manhole Frames and Covers

1. Domestic cast iron castings: ASTM A48, Class 30 or better; free of bubbles, sand and air holes, and other imperfections, designated for H-20 loadings as designated by ASSHTO.

2. Contact surfaces machined and matched. Provide "O-Ring" Rubber gasket to seal cover to frame.

3. Cast cover inscription with pipeline service "SANITARY SEWER" or as specified by Owner.

4. Manholes shall be equipped with cast iron manhole frames and self sealing covers unless otherwise indicated on the Contract Drawings. All manhole frames and covers shall be East Jordan Iron Works. Pattern Number 1040APT, or equal. The manhole cover shall be a solid lid with two (2) non-penetrating 5/8" diameter galvanized steel lifting rings cast in them. All manhole frames and covers shall be coated with an asphalt base metal coating. Minimum combined weight of manhole frame and cover shall be 365 pounds.

5. Manholes at specific locations as designated on the Contract Drawings shall be equipped with a watertight frame and cover. Watertight frames and covers shall be East Jordan Iron Works Pattern Number 1040APT, or equal. The manhole cover shall be a solid lid with two (2) non-penetrating 5/8" diameter galvanized steel lifting rings cast in them. All manhole frames and covers shall be coated with an asphalt base metal coating. Minimum combined weight of manhole frame and cover shall be 365 pounds.

E. Watertight Manhole Insert

1. Manholes at specific locations indicated on the Plans shall each be equipped with a Deep Bowl Watertight Manhole Insert with ventilation holes as manufactured by Parson Environmental Products, Reading, PA 19606 (1-800-356-9023 or 610-582-6060), or approved equal.

F. Precast Manhole Bases

1. The bases shall be integrally cast reinforced concrete and shall consist of a manhole bottom and a wall which shall extend a minimum of 6 inches above the top of the highest inflowing sewer. The top of the base section shall be carefully formed to receive the tongue of the barrel section. There shall be a minimum distance of 4 inches between the invert of the lowest outflowing sewer and floor of the precast base to provide for the construction of a formed invert and bench wall within the manhole. There shall be a drop of 0.2 feet between the invert of the primary inlet pipe and the invert of the outlet pipe. No more than two lift holes shall be cast in the bases.

a. Manholes 4 feet in diameter shall have a bottom at least 8 inches thick and a wall at least 5 inches thick.

b. Manholes 5 feet in diameter shall have a bottom at least 8 inches thick and a wall at least 6 inches thick.

c. Steel reinforcement used in the manufacture of precast concrete manhole bases and precast concrete riser and top sections shall conform to the requirements specified in Section 6 of ASTM C478.

G. Joint Material

1. Joint Sealant Compound shall be manufactured of high quality butyl rubber containing 98% solids which shall not harden, shrink or oxidize, meeting the requirements of ASTM C990 as manufactured by Press-Seal Gasket Corporation, Fort Wayne, Indiana, or approved equal.

H. Pipe Connections to Precast Manhole Bases and/or Sections

1. The type and method of the pipe connection to the manhole base or section shall be in accordance with one of the following methods.

a. When DIP or PVC pipe with smooth end is used, a rubber gasket joint manufactured in accordance with ASTM C-443 and meeting ASTM test C-425 shall be installed at the time of casting of new manholes (e.g. Dura Seal, Econo Seal, Dual Seal).

b. Annular space between sewer pipe and manhole wall, for connections to existing manholes, shall be sealed with modular mechanical type seal, consisting of interlocking synthetic rubber links, two pressure plates and stainless steel nuts and bolts. In order to assure a watertight joint between manhole wall and pipe, the installation and tightening shall be per manufacturer's recommendations. The modular mechanical type seal shall be "Linkseal" as manufactured by Thunderline Corporation, Belleville, Michigan, or approved equal.

PART 3 EXECUTION

3.01 EXCAVATION

A. Perform excavation to the line and grade shown on the Contract Drawings and as specified in Section entitled "Trenching, Backfilling & Compaction".

B. Location and depth of manholes as shown on the drawings.

3.02 CONSTRUCTION

A. Construct watertight manholes of precast concrete sections and of the type shown on the Contract Drawings.

B. Construct drop connections of the required type as shown on the Contract Drawings. Encase drop connection in 2000 psi concrete.

C. Construct connection of pipe to an existing manhole by core drilling manhole wall to the sufficient diameter to permit pipe and modular mechanical seal installation. The invert of the additional inlet shall provide a minimum 0.2 feet drop into the outlet. Modify existing bench to provide a smooth concrete channel which directs sewage to existing channel.

D. Install a minimum of 6" of 2A coarse aggregate subbase.

E. Provide cast-in-place concrete or precast concrete bases.

1. Construct cast-in-place bases as shown on the Contract Drawings.

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 shown on the Contract Drawings.

a. Set the precast base on a 2A coarse aggregate subbase.

b. Provide a sealed, flexible resilient connection between pipe and precast base section.

F. Form flow channels in manhole bases. Slope channels uniformly from influent invert to effluent invert; minimum 1 inch drop. Construct bends of the largest possible radius. Form channel sides and invert smooth and uniform; free of cracks, holes or protrusions. Pre-cast concrete manhole bases with pre-formed channels shall be provided unless approved by the Engineer.

1. The minimum depth of flow channel shall be equal to 3/4 the diameter of the largest sewer in the manhole to which it connects. The channel shall be graded to give a smooth, uninterrupted flow through the manhole.

2. Bench walls shall be pitched a minimum of 1 inch per foot from the inside periphery of the manhole to the edge of the flow channel.

G. Do not permit pipe to project more than 2" into the manhole.

H. Seal joints between precast concrete manhole sections with two (2) rows of preformed butyl rubber sealant.

1. Place joint sealant compound on lower section to be squeezed by the weight of the upper section. Dual gaskets shall be used at each section.

2. Place rubber gasket in groove formed in spigot end. Equalize gasket tension. Gasket shall remain in groove for the entire circumference of the section upon assembly.

I. Protective Coatings

1. Prior to setting the precast sections in place each section shall have concrete surfaces blown free of all dirt and debris and brushed clean and then coated in accordance with manufacturers specifications.

2. The Contractor shall provide a certification to the Owner stating that he has installed the manhole coatings in accordance with the manufacturer's recommendations. Coating may be applied by the manhole supplier.

3. Exterior

   a. The coating shall be Bitumastic Super Service Black as manufactured by Carboline, Inc. or Coopers Creek equivalent of Mobil Chemical Co., or approved equal. At least two (2) coats shall be applied giving a total dry film thickness of a minimum of 24.0 mils. After installation, damaged surfaces shall be recoated in accordance with the coating manufacturer's recommendation to give the required 24 mils dry film thickness.

   b. As an alternate, the coating shall include 2 coats of epoxy-amine adduct, multi-mill, two component, catalyzed epoxy, with total solids volume of 49-51%, which is resistant to alkali, salt and ground water immersion, petroleum products and acids. Coating shall meet AWWA D102-78, paint system No. 1 standards and a minimum 12 mils dry film thickness.

4. Interior

   a. The coating shall include 2 coats of epoxy-amine adduct, multi-mill, two component, catalyzed epoxy, with total solids volume of 49-51%, which is resistant to alkali, salt and ground water immersion, petroleum products and acids. Coating shall meet AWWA D102-78, paint system No. 1 standards and a minimum 12 mils dry film thickness.

J. Install manhole sections with steps in proper vertical alignment.

K. Use masonry or precast solid manhole rings to achieve elevation shown for frame and cover. Do not adjust elevation more than 1 ft. with masonry or precast rings.

L. Install manhole frames, covers and steps.

1. Set top of frames at finished grade elevation or other elevation shown on the drawings.

2. Manhole frames and covers shall be brought to proper grade as previously noted, set in 1/4 inch bed of mastic, and anchored in place with the four (4) 3/4 inch diameter anchor bolts which shall be securely embedded in the top of the manhole. Where concrete spacer rings are used, holes shall be carefully drilled to facilitate bolting. The intent is to have as completely solid manhole assembly. Bolts should only be used on 3 ½" frames unless specifically required by the Engineer.

3. Seal joint between manhole frame and manhole with joint sealant compound.

4. All lids which "rock" must be replaced by alternative lids.

5. Build manhole steps into the precast concrete risers and brick masonry of the manholes. Build the uppermost step into the masonry not over 24 inches below the cast iron manhole frame and continue these steps downward along the interior vertical side of the manhole to a point no lower than the crown of the largest sewer. Build all steps into the precast concrete risers and brick masonry in a manner satisfactory to the Owner, and spaced not more than 12 inches apart.

M. Where new manholes are to be constructed on existing pipelines, carefully excavate around existing pipeline for placement of the new manhole base. Take all measures necessary to control flow through the existing pipeline and to prevent leakage into the new base. After completion of the manhole, carefully remove the top portion of the existing pipeline. The "Doghouse" type manhole shall only be used with approval of the Authority Engineer.

N. The excavation to connect a pipe to an existing manhole shall extend around the manhole to a depth sufficient to prevent dislocation of the cone or barrel sections. At a minimum, the excavation around the manhole shall extend to the first barrel section above the manhole base section or 6 feet above invert. Damage to the existing manhole is the responsibility of the contractor to repair or replace to the satisfaction of the Owner.

O. Design precast units for all dead loads and live loads as indicated and as required for compliance with applicable Building Code requirements. Walls shall be designed for water and soil pressure using water height at the grade elevation shown on the Plans. If hydrostatic uplift forces exist, the Designer (Fabricator) shall provide for necessary hold-down items. The Contractor shall furnish and install hold-down items, if they are required.

3.03 BACKFILLING

A. Backfill and compact suitable backfill material only after examination of the manhole by the Owner.

B. Perform backfilling as specified in Section 02221 entitled "Trenching, Backfilling & Compacting" and in accordance with the Contract Drawings.

3.04 TESTS

A. General

1. After the gravity sewers and manholes have been installed and backfield. The manholes shall be tested for leakage.

B. Test Procedure (Vacuum Test)

1. The testing shall be done after assembly of the manhole and frame, after base coarse has been placed.

2. All lift holes shall be plugged with a non-shrinking mortar, as approved by the Owner.

3. The seal between the manhole sections shall be in accordance with ASTM C923.

4. The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe.

5. With the vacuum tester set in place:

a. Inflate the compression band to effect a seal between the vacuum base and the frame.

b. Connect the vacuum pump to the outlet port with the valve open.

c. Draw a vacuum to 10" of Hg. and close the valve.

6. The test shall pass if the vacuum remains at 10" Hg. or drops to 9" Hg. in a time specified for the particular size manholes listed.

VACUUM TEST TABLE

Manhole Diameter	Test Period
48"	60 sec
60"	75 sec
72"	90 sec
Junction Box	120 sec

If the manhole fails the initial test, the Contractor shall locate the leak and make proper repairs. Testing shall continue until the manhole passes the aforementioned criteria.

7. Testing of manholes by the Contractor shall be performed in the presence of the OWNER.

3.05 LOCATION, SIZE AND SPACING

A. General

1. Manholes shall be located at the junction of two sanitary sewer pipes, at any change in grade, alignment or size of pipe or at the terminus of the sewer main.

2. The maximum spacing between manholes shall be three hundred (300) feet unless preapproved by the Engineer.

3. Manholes with depths greater than ten feet in depth shall be a minimum of 6 feet in diameter.

4. The maximum depth of manholes shall be fifteen feet or as approved by the Board.

*** END OF SECTION ***