

## **SECTION 02605**

### **MANHOLES**

#### **PART 1 - GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Furnish all labor, material and equipment to construct manholes at such locations as shown on the Drawings or as required by the Authority. In addition to manholes, work in this Section shall include but not be limited to:
  - 1. Manhole Frame Adjustment
  - 2. Drop Manholes
  - 3. Connections to Existing Manholes
  - 4. Connections to Existing Sewer
- B. Manholes shall conform to the design indicated by the Drawings and to the requirements specified herein.

##### **1.02 RELATED SECTIONS**

- A. Section 01010 - Summary of Work
- B. Section 01300 - Submittals
- C. Section 01400 - Quality Control: Testing Fill Compaction
- D. Section 01500 - Construction Facilities and Temporary Controls
- E. Section 01570 - Traffic Regulation
- F. Section 02225 - Excavating, Backfilling and Compacting for Utilities
- G. Section 02600 - Utility Piping for Sanitary Sewers
- H. Section 03300 - Cast-in-Place Concrete
- I. Section 11306 - Pump Stations
- J. Appendix A - Standard and Special Construction Detailed Drawings

##### **1.03 REFERENCES**

- A. American Society for Testing and Materials/Latest Edition
  - 1. ASTM A-48 - Specification for Gray Iron Casting
  - 2. ASTM A-276 – Specification for Stainless and Heat-Resisting Steel Bars and Shapes
  - 3. ASTM A-307 – Specification for Carbon Steel Externally Threaded Standard Fasteners
  - 4. ASTM A-615 – Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - 5. ASTM C-32 – Specification for Sewer and Manhole Brick (Made from Clay or Shale)
  - 6. ASTM C-62 - Specification for Sewer and Manhole Brick

7. ASTM C-139 - Specification for Concrete Masonry Units for Construction of Catch Basins & Manholes
  8. ASTM C-270 – Specification for mortar for Unit Masonry
  9. ASTM C-361 – Specification for Reinforced Concrete Low-Head Pressure Pipe
  10. ASTM C-443 - Specification for Joints for Circular Concrete, Sewer and Culvert Pipe, Using Rubber Gaskets
  11. ASTM C-478 - Specification for Pre-Cast Reinforced Concrete Manhole Sections
  12. ASTM C-923 - Specification for Resilient Connections Between Reinforced Concrete Manhole Structures and Pipes
  13. ASTM D-2240 – Test Method for Rubbery Property-Durometer Hardness
  14. ASTM D-4104 – Specification for Propylene Plastic Injection and Extrusion Materials
- B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these specifications.
- C. American Water Works Association:
1. AWWA C-302, AWWA Standard for Reinforced Concrete Water Pipe-Noncylinder Type, Not Prestressed.
- D. Federal Specifications:
1. Fed. Spec. SS-SS-210A, Sealing Compound, Preformed Plastic, for Expansion joints and Pipe Joints (Type 1 Rope Form).

#### 1.04 SUBMITTALS

- A. Submit Shop Drawing/Product Data from manufacturer's descriptive literature and specifications for all materials used in this Section. Submit in accordance with Section 01300.
- B. Other special detailed drawings as may be required for submittal.

#### 1.05 JOB CONDITIONS

- A. **Dust Control:** Use all means necessary to control dust on and near the Work if such dust is caused by the Contractor's operations during performance of the Work or is a result of the condition in which the Contractor leaves the site.

Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other work on the site.

- B. **Protection:** Use all means necessary to protect all materials of this section before, during, and after installation and to protect all objects designated to remain.

In the event of damage, immediately make all repairs and replacements necessary to the approval of

the Authority at no additional cost to the Authority.

- C. Qualifications of Workmen: Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with the design and application of work described for this Section, and who shall be presented all times during progress of the work of this Section and shall direct all work performed under this Section.
- D. Access and Inspection: All work in this section is subject to Inspection by the Authority or his representative and they shall have full access to the project for same.

#### 1.06 SITE CONDITIONS

##### A. Environmental Requirements:

1. Do not set or construct manhole bases on subgrade containing frost.
2. To improve workability of Preformed Plastic Sealing Compound during cold weather, store such at temperature above 70 degrees F or artificially warm compound in a manner satisfactory to the Authority's Engineer.
3. During warm weather stiffen Preformed Plastic Sealing Compound by placing under cold water or by other means as recommended by the compound manufacturer.

#### PART 2 - PRODUCTS

##### 2.01 PRE-CAST REINFORCED CONCRETE WALL SECTIONS

- A. Walls of manholes shall be constructed of reinforced concrete ring sections with a minimum inside diameter of forty-eight (48) inches. The risers and top sections shall be manufactured in compliance with the requirements of Specifications for Pre-Cast Reinforced Concrete Manhole Risers and Tops, ASTM C-478. Riser sections shall have tongue and groove ends (tongue on top of section) and a minimum wall thickness of five (5) inches. Top sections shall be of eccentric cone or flat slab top design as required by the Drawings. Eccentric cones shall have the same minimum wall thickness and area of circumferential steel reinforcement as the round riser sections. Flat slab tops shall have a minimum thickness of six (6) inches and shall be reinforced with steel in accordance with the design requirements specified in ASTM C-478. Top sections shall have a top width of such design and dimensions as to properly support the required manhole frame and cover and the lower joint shall be of tongue and groove design.
- B. Top sections of eccentric cones or flat tops shall have an opening of twenty-four (24) inches and contain four (4) anchors, equally spaced to receive 3/4 inch frame anchor bolts.
- C. The entire exterior surface of all manholes shall be coated with two (2) coats of an approved bituminous coating, minimum 23 Mil total thickness.
- D. All sections shall contain factory installed lifting keys or lugs.

##### 2.02 REINFORCED CONCRETE MANHOLE BASES

- A. Pre-cast reinforced concrete bases shall normally be used in lieu of cast-in-place concrete bases.

- B. The base, for either type, shall extend six (6) inches beyond the outside face of the manhole wall and shall be at least eight (8) inches thick.
- C. Both pre-cast and cast-in-place bases shall be constructed in accordance with ASTM C-478.
  - 1. Cast-in-Place bases for up to fifteen (15) inch sewers shall have one mat of No. 4 deformed Grade 60 reinforcing steel on twelve (12) inch centers placed midway in minimum eight (8) inch thick base.
- D. Pre-cast bases shall have factory installed pipe seals and must be constructed such that there is a 2% slope across manhole base from invert to invert.
- E. Approved precast manhole section manufacturers:
  - 1. Monarch Concrete Products
  - 2. FI-HOFF, Inc.
  - 3. Equal

2.03 RUBBER EXTENSION RINGS

- A. Rubber extension rings shall be manufactured from a composite of recycled rubber, nylon fiber and polyurethane prepolymer.
- B. Material density shall be a minimum of 64.2 lbs/cubic foot.
- C. Standard thicknesses shall range from ½" to 3".
- D. Bolt holes shall be provided in select bolt hole patterns.
- E. Manufacturer's polyurethane joint sealer/adhesive shall be used between each layer.
- F. Rubber extension ring shall be Infra-Riser as manufactured by EJ Corporation (800-626-4653) or equal.

HDPE MANHOLE ADJUSTMENT RINGS ARE NOT PERMITTED TO BE USED.

2.04 MANHOLE STEPS

- A. Steps shall be Copolymer Polypropelene plastic molded over No. 4, Grade 60 steel reinforcement, model #PS1 -PF as manufactured by M.A. Industries, Inc., Peachtree City, GA.
- B. Place all steps on twelve (12) inch centers.
- C. Portion of steps embedded in concrete shall be given a coat of heavy bodied bituminous paint.
- D. Steps and installation shall meet ASTM C-478 requirements.

2.05 TRENCH BACKFILL MATERIAL

- A. Material shall be as specified in Section 02225, paragraph 2.01.

2.06 PIPE OPENING SEALS

- A. Pipe opening seals shall be cast integrally with manhole section, sized to fit pipe specified, and set at correct elevation and location.
- B. Seals shall meet the requirements of ASTM C-923.
- C. Approved pipe seal manufacturers:
  - 1. Dura Tech, Inc. - DUAL SEAL II-III
  - 2. Press Seal Gasket Corporation - PRES SEAL
  - 3. A-Lok Products Corporation - A-Lok Manhole Pipe Seal
  - 4. Scales Manufacturing Corporation - RES-SEAL
  - 5. Equal

2.07 PREFORMED PLASTIC SEALING COMPOUND

- A. Sealing compound shall be of either bituminous or butyl rubber base and conform to Federal Specification SS-S-210 A, Type I.
- B. Material shall be in rope form, supplied with a two-piece cover to preclude adhesion until use.
- C. Material shall be of a minimum size of 7/8 inch by 1-3/8 inches or equivalent to 1-1/4 inches round.
- D. Approved sealing compound manufacturers:
  - 1. K.T. Snyder Company, Inc. - RUB R-NEK
  - 2. Concrete Products Supply Company - CPS-210
  - 3. Equal

2.08 CONCRETE MANHOLE ADAPTERS (WATERSTOPS)

- A. Waterstops shall be composed of virgin Polyvinylchloride (PVC) sized for respective pipe.
- B. Approved manufacturer:
  - 1. Fernco Joint Sealer Company - CMA Series
  - 2. Equal

2.09 BITUMINOUS COATING

- A. Coating shall be a coal-tar epoxy type or other approved composition.
- B. Approved manufacturers:
  - 1. Koppers Co., Inc. - Bituminous Super Service Black
  - 2. Rayston Laboratories - Roskote 201/Raypex 309
  - 3. Equal

2.10 CONCRETE MASONRY UNITS FOR MANHOLES

- A. Masonry units shall be manufactured in solid pre-cast segmented units and meet the requirements of ASTM C-139.

2.11 WATERPROOFED MORTAR

- A. Mortar shall meet the requirements of ASTM C-270, Type M, 2500 psi.
- B. Mix shall consist of 1 part cement, 1/4 part lime and 2 1/2 parts sand. Two (2) pounds of Medusa (or equal) integral waterproofing powder shall be used per bag of cement.

2.12 MANHOLE FRAMES AND COVERS

- A. Castings for frames and covers for manholes shall be composed of best quality, tough, gray iron, free from cold shuts, blow holes, and other imperfections, and shall meet the requirements of ASTM A-48 for Class No. 30, designed for AASHTO Highway Loading Class HS-20.
- B. All bearing surfaces shall be machined flat, sandblasted clean and the entire unit shall receive one coat of asphaltum paint.
- C. Frame shall contain four (4) one inch holes equally spaced to match manhole inserts for fastening.
- D. All manhole covers shall bear the words DANGER "SANITARY SEWER" DO NOT REMOVE and contain two non-penetrating pick holes and two lifting rings.

2.13 WATERTIGHT MANHOLE FRAMES AND COVERS

- A. This item shall be same as specified in Sub-Section 2.13 except cover shall have a neoprene gasket contained in a factory machined dovetail or rectangular groove in the bearing side of cover.
- B. Cover shall be of the design with two lids an inner and an outer lid. The inner lid is secured by a cross bar with a stainless steel screw.

2.14 APPROVED MANUFACTURERS FOR FRAMES AND COVERS

- A. Allegheny Foundry Co., Frame Pattern No. 105, Cover Pattern No. 106
- B. Neenah Foundry Co.

2.15 MANHOLES FOR LARGE DIAMETER SEWERS

- A. Manholes in this classification are where sewer lines have eighteen (18) to twenty-seven (27) inch inside diameters.
- B. These manholes shall meet the Specifications of Sub-Section 2.01 and 2.02 except base wall sections shall be doghoused at pipe openings.
- C. Bases for these manholes shall contain two (2) mats of No. 4 deformed, Grade 60 reinforcement steel, on twelve (12) inch centers in a minimum thickness slab of twelve (12) inches. Place mats three (3) inches from bottom and two (2) inches from top of base.

- D. Manholes containing eighteen (18) to twenty-seven (27) inch inside diameter sewer lines shall have an inside diameter of sixty (60) inches.
- E. When sewers are over twenty-seven (27) inches in diameter, the design of the manhole shall be as specified and approved by the Authority.

2.16 CONCRETE

- A. Concrete for cast-in-place bases with monolithic flow channels shall meet the specification for Class A concrete.
- B. Concrete for flow channels in precast bases shall meet the specification for Class A concrete, Section 03300.

2.17 AGGREGATE

- A. Aggregate for base bedding shall meet the Specifications of PDT Pub. 408, Section 703 for AASHTO No. 57, coarse aggregate.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILL

- A. Excavation and backfill shall conform to the applicable requirements of Section 02225 - Excavating, Backfilling and Compacting for Utilities.
- B. Excavate manhole area to allow minimum of six (6) inches of bedding of AASHTO No. 57 aggregate properly leveled and compacted.

3.02 BASES

A. Cast-in-Place

1. Base shall be to the design and dimensions indicated on the Drawings.
2. Bases shall be reinforced as specified in Sub-Section 2.02(C)1 or 2.15(C). Use Class A concrete. Set pre-cast wall section into fresh concrete for integral joint.
3. When using wall sections which contain no integral pipe seals, use length of pipe which extends only to outside of base dimension. Place approved waterstop on pipe at center point of wall thickness.
4. Flow channels shall be formed directly in the concrete of the manhole base and shall be smooth and accurately shaped to a semi-circular bottom conforming to the inside of the adjacent sewer sections. Changes in the direction of the sewer and entering branches shall have a true curve of as large a radius as the size of the manhole will permit.
  - a. Complete concrete placement around pipe openings, working well into waterstop. Finish flush on outside.

- b. All slopes (benches) outside flow channels shall be sloped gradual toward invert.

B. Pre-Cast

1. Pre-cast bases shall be set on aggregate bed as Sub-Section 3.01(B).
2. Flow channels shall be placed after pipe placement. Forming shall be as Sub-Section 3.02 A.4.(a)(b) using Class A concrete.
3. Flow channels, same size as pipe, may be constructed directly with the pre-cast base at time of manufacture. Submit manufacturer's product data to Authority for approval before placing order.

3.03 MANHOLE SECTIONS

- A. All pre-cast concrete ring sections and top sections shall fit together readily to permit effective jointing. Joints between adjacent sections of all manholes shall be made with two (2) strips of approved preformed joint sealing compound. All material squeezed out on inside shall be cut off.
- B. Adjoining riser and conical top sections shall be fitted together in such a manner as to assure true vertical alignment of manhole steps.

3.04 MANHOLE FRAMES AND COVERS

- A. Set manhole frame to proper elevation and to cross section slope where required. Bring mortar up over frame if exposed above finished grade.
- B. Where adjustment is required [maximum one (1) foot], use rubber grade rings. Set in two (2) strips of preformed plastic sealing compound, taking care to align bolt holes. Use two strips of plastic sealing compound between frame and top rubber ring. Approved sealant must be used between each rubber ring. Recheck elevation due to possible sealant compression.
- C. When using rubber rings for adjustment a maximum of 4 inches in new construction may be used.
- D. Tighten down manhole frame using bolts long enough to reach insert in cone or flat top section.
- E. Refer to Standard Drawing No. 6.
- F. Contractor shall be responsible to see that all such items as mentioned under this Section are adjusted to the new paving elevation to provide a smooth even transition from pavement to manhole cover.

3.05 MANHOLE COVER ADJUSTMENT

A. Raising

1. Adjustment of existing (old) work requiring raising shall be performed in accordance with Sub-Section 3.04.
2. Adjustments in excess of 1-1/2 inches shall be made with approved grade rings. (See Section 2.03 )
3. Rises in excess of twelve (12) inches shall be made by removing the top section of the manhole and inserting precast sections required to meet elevation called for. Each increment



of one (1) foot shall contain an approved step set in alignment with the existing.

4. When elevation changes require removal of an existing manhole section(s), the Authority shall be consulted in advance of the work to determine the best method to accomplish the work. All work will be inspected by the Authority.

**B. Lowering**

1. Methods and materials for lowering manhole frames shall comply with specifications listed in Sub-Sections 3.04 and 3.05A.
2. All new materials meeting Authority's Specifications shall be used in this work.
3. Determine list of material required and have on site to expedite work, especially if in a roadway.
4. If Contractor desires to use an alternate method which deviates from these specifications, the Contractor shall review this method with the Authority for their decision.

**3.06 CONNECTIONS TO EXISTING MANHOLE**

- A. Contractor shall cut an opening in the existing manhole to a size to allow the pipe with a waterstop attached plus one (1) inch clearance on all sides. Cut out existing concrete channel fill, allowing room to form satisfactory new flow channel.
- B. Place length of pipe (5' minimum) to provide joint at outside edge of manhole base or wall. Center pipe in wall, fill opening with link seal, volclay and waterproof mortar and form new flow channel. Cradle half of pipe to second joint with Class B concrete.
- C. Paint waterproof mortar when dry with an approved bituminous coating.
- D. Slew channels shall not be constructed in any manhole.

**3.07 CONNECTIONS TO EXISTING SEWERS**

- A. The Contractor shall construct the new sewer at a uniform grade to meet the existing sewer at a slightly higher invert elevation than the invert of the existing sewer at the point of proposed connection.
- B. For proposed sewers of a diameter equal to the existing sewer, a new manhole shall be constructed over the existing sewer, with the new sewer invert 0.10 ft. to 0.25 ft. higher than the existing upstream invert.
  1. Manhole bases may be either cast-in-place or precast as heretofore specified.
- C. Existing sewer service shall be maintained during base and flow channel work.
- D. When broken or damaged pipe results from this operation, replace with new pipe of the same material and type. Saw any piping to be removed to preclude cracking or irregular edges caused by breaking out with a hammer or using other methods.

- E. When replacing pipe, use pipe length to have a joint at edge of manhole base with second joint five (5) feet ahead/back. Cradle half of pipe to second joint with Class A concrete. (SEE SECTION 03300)
- F. Refer to Sub-Section 3.06 for construction details when "doghousing" and completion of this type of installation.
- G. For proposed sewers of six (6) inch diameter or less, a direct connection to an existing sewer may be permitted by the Authority by using a cutting-in saddle or wye. This method would generally apply to single family dwelling units. For industrial, commercial, or multifamily residences, the Authority may require that a manhole be constructed on the property to be served and over an existing sewer should one exist. All connections to existing sewers are subject to review by the Authority on an individual basis.
- H. Proposed sewers of a diameter larger than the existing sewer to which it is to be connected will not be normally permitted without providing additional capacity to the existing sewer.

### 3.08 DROP MANHOLES

- A. Drop connection shall be made where the invert of any inlet pipe is two (2) feet or more higher than the invert out of the manhole.
- B. Pre-cast manhole sections shall have openings with integrally cast pipe seals to fit design elevations for new installations.
- C. When using "doghouse" sections or connecting to existing manholes refer to Sub-Section 3.06 for construction details of pipe through wall section.
- D. Connection configuration to manhole shall be made in accordance with Standard Detail Drawing No. 3.
- E. Entire configuration of piping shall be encased in Class B concrete to a minimum thickness of six (6) inches.
- F. Paint entire surface of encasement, when dry, with an approved bituminous coating.

### 3.09 LIFTING RECESS SEALING

- A. Seal with tapered rubber plug designed to fit recess.
- B. Drive plug home to ensure water and air tightness.
- C. Straight through lifting holes of exposed concrete (no hole forming material in place) shall be tightly filled with waterproof mortar and, when dry, painted with an approved bituminous coating.

### 3.10 PLANNED PIPE OPENINGS

- A. When future pipe connection has been planned for manholes, they shall be plugged to preclude exfiltration and infiltration.
  - 1. With integral pipe seals, place a pipe stopper/plug of the size required, properly secured, for any thrust caused by testing, etc.

2. Where a "doghouse" opening may occur, lay up cement masonry units with waterproof mortar, parge, and, when dry, paint with an approved bituminous coating.