(Revised October 20 ,2021)

# SECTION 02641

# PRECAST CONCRETE MANHOLES

## PART 1 — GENERAL

## 1.01 SECTION INCLUDES

The work covered by this section includes furnishing all labor, equipment, and materials required to install precast concrete manholes complete with frames and covers as described herein and as shown on the Plans. Frames and covers shall be supplied and installed per Section 02608.

## 1.02 REFERENCES

**A.** The following is a list of standards that may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): M198, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

2. ASTM International (ASTM):

   a. A36/A36M, Standard Specification for Carbon Structural Steel.

   b. A48/A48M, Standard Specification for Gray Iron Castings.

   c. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

   d. A536, Standard Specification for Ductile Iron Castings.

   e. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

   f. B139/B139M, Standard Specification for Phosphor Bronze Rod, Bar, and Shapes.

   g. C14, Standard Specification for Non-reinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

   h. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.

   i. C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

   j. C150/C150M, Standard Specification for Portland Cement.

k. C192/C192M, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

l. C270 - Standard Specification for Mortar for Unit Masonry.

m. C387/C387M, Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

n. C443, Standard Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets.

o. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.

p. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

## 1.03 SUBMITTALS

**A.** C990, Standard Specification for Joints in Concrete Pipe, Manholes, and Precast Box Sections using Preformed Flexible Joint Sealants.

**B.** C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (non-shrink).

**C.** C1311, Standard Specification for Solvent Release Sealants.

**D.** C1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

**E.** D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

**F.** D4101, Standard Specification for Propylene Injection and Extrusion Materials.

**G.** F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

**H.** F594, Standard Specification for Stainless Steel Nuts.

**I.** Submittals shall conform to the requirements of Specification 1300, Submittals.

**J.** Action Submittals:

1. Shop Drawings including details of construction, reinforcing and joints, anchors, lifting, external straps, erection inserts, and other items cast into members.

2. Product Data:

a. Concrete mix design. Compressive strength result report for production week.

b. Method of curing proposed.

c. Manhole frame to structure seals.

d. Manhole frame to structure anchor bolt.

e. Rubber gaskets and sealants.

f. External joint wrap.

3. Materials to be used in fabricating drop connections.

4. Materials to be used for pipe connections at manhole walls.

5. Materials to be used for stubs and stub plugs, if required.

6. Materials and procedures for corrosion resistant liner and coatings, if required.

7. Plugs to be used for vacuum testing.

8. Bitumastic coated steel strap and anchors

9. Stack out drawings

10. Non-shrink grout

11. Test equipment complete with current calibration report identifiable to actual equipment being used.

12. Informational Submittals:

13. Experience Record:

    a. Precast concrete production capabilities.

    b. Evidence of current PCI plant certification.

14. Calculations: Proposed details and design calculations for stresses in precast concrete members for loading conditions including earth pressures and transportation, handling, and erection.

    a. Calculations shall be stamped by engineer registered in the same state as the Project.

15. Certificate of Compliance: Certify admixtures and concrete do not contain calcium chloride.

16. Test Reports:

    a. Precast manufacturer’s concrete test cylinders.

b. Core compression test.

17. Manufacturer's recommended installation instructions.

**K.** Field quality control report.

**L.** Safety Plan

**M.** Confined Space Entry Plan

**N.** The Contractor shall provide a complete a daily written record (diary) as required per section 01320 – Progress Reports & Videos

## 1.04 DESIGN CRITERIA

**A.** General

1. Manholes shall be constructed of specified materials to the sizes, shapes, and dimensions and at the locations shown on the Plans or as otherwise directed by the Owner's Representative.

   a. Depth of the manhole will vary with the locations,

   b. Top of the manhole frame will be at the finished grade of the pavement or

   c. Higher than the ground surface as shown on the Plans

   d. Invert will be at the designed elevations.

2. Manholes in wooded or unmaintained easement areas:

   a. Minimum of twenty-four (24) inches above ground level

   b. Minimum of two (2) feet above the one hundred (100) year flood plain;

   c. Whichever is greater.

3. Flood Plain Areas:

   a. Manholes located within the one hundred (100) year flood plain shall contain manhole frames bolted to the eccentric cone in order to stabilize the manhole adjustment rings.

   b. The manhole adjustment rings shall contain pre-drilled holes for the bolts from the pre-cast manufacturer.

   c. Manhole concrete rings shall be secured to each other to protect against slide and tilt of rings due to buoyancy.

## 1.05 QUALITY ASSURANCE

**A.** Manufacturer Qualifications:

1. Precast concrete producer shall have been in the business of producing precast concrete products similar to those specified for a minimum of three (3) years. The precast concrete producer shall maintain a permanent quality control department or retain an independent testing agency on a continuing basis.

2. The agency shall issue a report, certified by a licensed engineer, detailing the ability of the precast concrete producer to produce quality products consistent with industry standards.

**B.** Prior to delivery:

1. Basic materials specified in this section shall be tested and inspected by an approved independent commercial testing laboratory

   a. Certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable if approved by the Owner's Representative.

   b. All materials failing to conform to these Specifications shall be rejected.

**C.** Any materials damaged in transit to the work site or are otherwise unsuitable for use in the Work shall be rejected and removed from the project.

## 1.06 RESPONSIBILITY FOR SANITARY SEWER OVERFLOWS AND DAMAGE TO PROPERTY AND UTILITY

**A.** Reference Specification Section 01030: Special Project Procedures, 3.01, B

## 1.07 SAFETY

**A.** All work shall be performed in accordance with OSHA standards and State and Federal safety regulations.

**B.** No person shall enter a confined space without the documented requisite training, certification, Confined Space Entry Plan and entry permit.

# PART 2 — PRODUCTS

## 2.01 PRECAST CONCRETE MANHOLES

**A.** Unless specified otherwise in the Plans or in the Special Conditions of the Contract, all new manholes will be precast concrete manholes as specified in this section. The minimum wall thickness for a four (4) foot diameter manhole shall be five (5) inches.

**B.** Construct in accordance with the requirements of ASTM C478.

1. Reinforced concrete manholes shall consist of manhole base sections, riser

sections, transition sections, and conical sections as described herein.

2. Configure components to minimize the number of joints required per manhole.

3. Owner's Representative may require any manhole not composed of the minimum number of sections to be replaced.

4. The installation of steps in any manhole or manhole section is prohibited.

**C.** Portland cement concrete used in the precast reinforced concrete manholes:

1. Have a minimum compressive strength of 4,000 psi at twenty-eight (28) days.

2. Contain type II Portland cement with a C3A content of five and one-half (5½) percent or less and meet the requirements of ASTM C478.

3. Newly cast manholes shall be cured in accordance with the requirements of ASTM C478.

   a. The method of curing proposed must be submitted to the Owner's Representative prior to manufacture.

4. Manholes shall be cured for a minimum of seven (7) days prior to shipment to the Work Site unless otherwise instructed in writing by the Owner's Representative. Manufacturer shall test the compressive strength of a minimum of two (2) concrete cylinders per calendar week.

   a. Reports verifying the results of the compression tests shall be maintained at the manufacturer's facility.

   b. Reports shall be made available for inspection and review by the Owner's Representative.

   c. The manhole manufacturer shall permit the Owner's Representative to make unannounced reviews of compression test records and inspection of manufacturing facilities at any time during normal business hours.

   d. The maximum allowable absorption of the concrete used for manhole construction shall not exceed eight (8) percent of the dry weight.

5. Manufacturer shall notify the Owner's Representative of manholes delivered for use that were manufactured during a week when a concrete compressive strength test yielded a result of less than 4,000 psi.

**D.** Reinforcing steel shall be:

1. Bars of intermediate grade,

2. Open hearth, billet steel, conforming to the requirements of ASTM A615,

3. Or Cold-Drawn Steel Wire for Concrete Reinforcement conforming to

the requirements of ASTM A82;

4. Or of wire fabric conforming to the requirements of ASTM A185.

5. The circumferential reinforcement in the riser and conical top sections shall have an area of not less than 0.12 square inches per linear foot.

**E.** The interior and exterior surfaces of the manhole shall have a smooth hard finish, and shall be free from cracks, chips, spalls, and exposed reinforcing.

**F.** Manhole base sections:

1. Circular, wet cast,

2. Supplied in forty-eight (48) inches, sixty (60) inches, seventy-two (72), and ninety-six (96) inches diameters.

3. Heights shall range from forty-eight (48) inches to ninety-six (96) inches depending on availability with diameter and as specified or approved by the Owner's Representative.

4. Supply with Manhole Lift System inserts.

   a. Lifting eye bolts shall be supplied to the Contractor upon request.

   b. Pipe openings shall be furnished in accordance with Section 3.03.B.

**G.** Riser sections:

1. Circular, wet or dry cast,

2. Supplied in forty-eight (48) inches, sixty (60) inches, and seventy-two (72) inches diameters.

3. Heights: range from sixteen (16) inches to forty-eight (48) inches in sixteen (16) inch multiples depending on availability with diameter and as specified or approved by the Owner's Representative.

4. Riser sections shall be supplied with Manhole Lift System inserts.

   a. Lifting eye bolts shall be supplied to the Contractor upon request.

**H.** Transition sections:

1. Conical transition sections shall be supplied for sixty (60) inches to forty-eight (48) inches diameter transitions.

   a. Conical transitions shall be thirty-two (32) inches high.

      1) Sixteen (16) inches high conical transitions may only be used when approved by the Owner's Representative.

b. All conical transition sections shall be supplied with a Manhole Lift.

c. Wet or dry cast, concentric only.

1) Eccentric sections will not be allowed.

2) Transition from forty-eight (48) inches diameter to a twenty-seven (27) inches clear access opening

3) Either twenty-four (24) inches, thirty-six (36) inches, or forty- six (46) inches high.

2. Flat slab transitions:

a. Supplied for base sections seventy-two (72) inches to ninety-six (96) inches in diameter.

b. Flat slab transitions shall be manufactured structurally to meet individual project requirements.

c. Clear access openings shall be provided to accommodate riser sections as shown in the Plans or as detailed in the Detail Drawings.

**I.** Precast manhole riser joints:

1. Offset tongue and groove type,

a. Supplied with Tylox Super Seal pre-lubricated gasket.

b. Each joint shall also be supplied with Conseal CS-231 waterstop sealant,

1) As manufactured by Concrete Sealants,

c. In widths as recommended by the manufacturer.All joints shall be permanently strapped utilizing three (3) stainless steel (SST) strap anchors located one-hundred and twenty (120) degrees apart.

d. Anchored onto the manhole walls with *SST adhesive anchors.*

**J.** The ends of each reinforced concrete manhole riser section and the bottom end of the manhole top section shall be so formed so when assembled, they will form a continuous uniform manhole.

**K.** Precast manholes having entering sewers of twenty-four (24) inches diameter or smaller shall have precast openings in the manhole walls for incoming or outgoing sewers as indicated on the Plans.

**L.** Clearly mark manhole components for each installation site to correctly assemble manhole to suit construction conditions existing at that particular location.

**M.** Set concrete manhole base sections on a foundation of #57 compacted stone aggregate,

1. Twelve (12) inch minimum thickness,

2. Covering the entire bottom of the excavation for the manhole.

3. Aggregate size may be adjusted by the Owner's Representative based on field conditions.

**N.** Manhole riser rings (non-paved areas only) and/or brick and mortar used to adjust manhole frame to grade, shall conform to Section 02607 – Manhole Height Adjustment.

## 2.02 STRUCTURAL MATERIALS AND CASTINGS

**A.** Structural steel shall conform to the requirements of ASTM A283, unless otherwise indicated on the Plans.

**B.** Steel castings shall conform to the requirements of ASTM A27.

1. Grades to be used will be as indicated on the Plans.

**C.** Gray iron castings: Conform to Specification 02608, Manhole Frame and Cover Installation.

**D.** Aluminum castings: Conform to the requirements of ASTM B108.

**E.** Structural aluminum: Conform to the requirements of either ASTM B209, B221, B308, B241, or B211, as applicable.

1. Finished bolts and nuts shall be given an anodic coating of at least 0.0002 inches in thickness.

## 2.03 SPECIALTY ITEMS

**F.** One piece manholes:

1. Manufacture in accordance with the requirements of ASTM C478 and as detailed in the Detail Drawings.
2. Cast utilizing concrete as required above.
3. Manufactured with a minimum eight (8) inches thick base with dowel steel reinforcement and waterstop.
4. Used only in situations which will not accommodate a twenty-four (24) inch base section and twenty-four (24) inch conical section.

**G.** 36" x 48" Manhole Tees shall be manufactured in accordance with the requirements of ASTM C478 and as detailed in the Detail Drawings.

1. Cast utilizing concrete as specified above.

**H.** Saddle manholes shall be manufactured in accordance with the requirements

of ASTM C478 and as shown in the Detail Drawings.

1. Cast utilizing concrete as specified above.

**I.** Drop Manholes (Memphis Tees) shall be manufactured in accordance with the requirements of ASTM C478 and as detailed in the Detail Drawings.

1. Cast utilizing concrete as specified above.

## 2.04 CONCRETE

Concrete shall conform to the requirements of Section 03300 – Cast-In-Place Concrete.

# PART 3 — EXECUTION

## 3.01 GENERAL

**A.** All activities shall be performed in accordance with the manufacturer's recommendations and regulations established by OSHA.

**B.** The Contractor shall verify the lines and grades are as specified in the Plans. Notify the Owner's Representative immediately if discrepancies are discovered.

## 3.02 INSTALLATION

**A.** Reinforced Concrete Sewers Forty-eight (48) inches Diameter and Larger:

1. As specified above, except that they shall be installed on a saddle constructed on the barrel of the sewer.

**B.** Joints for precast manhole stacks:

1. Offset tongue and groove with Tylox Super Seal pre-lubricated gaskets as manufactured by Hamilton Kent.

2. Each joint shall also be sealed with Conseal CS-231 waterstop sealant as manufactured by Concrete Sealants.

3. Width and installation of the joint sealant shall be in accordance with the manufacturer's recommendations.

   a. All joints shall be supplied with 3" x 16" x ½" inch SST strap anchors.

   b. Three (3) strap anchors, one-hundred and twenty (120) degrees apart per joint.

**C.** Where the difference in the invert elevation of

1. Two (2) or more sewers,

2. Eighteen (18) inches in diameter or smaller,

3. Intersecting in one (1) manhole is two (2) feet or more,

4. A drop manhole shall be constructed in the manner shown in the Detail Drawings.

   a. Similar in construction to the standard manhole, except that a drop connection of a pipe and fittings of the proper size and material shall be constructed outside the manhole:

      1) Supported by Class B concrete as indicated on the Plans and in the Detail Drawings.

      2) Manhole and the drop connection shall be placed on twelve (12) inch reinforced concrete base as detailed in the Detail Drawings.

      3) Drop connection piping assembly shall be bolted to the barrel of the manhole riser using a minimum of four 5/8-inch diameter stainless steel (316) bolts adhesive type with suitable washers to prevent failure caused by pulling the bolt head through the manhole wall.

**D.** Base sections shall be precast with the vertical walls of sufficient height to allow entry of the required pipes as shown on the Plans, and as detailed in the Detail Drawings.

**E.** Rebuild Invert and Bench: The flow invert, or channel, straight through a manhole shall be made to conform as closely as possible in shape and slope to that of the connecting sanitary sewers. Rowlock (brick) inverts are required. Crushed stone filler may be utilized under the bench, or table. Earth filler shall not be allowed. The invert walls shall be formed, or shaped, to the full height of the crown of the outlet sanitary sewer in such a manner as to not obstruct maintenance, inspection, or flow in the sanitary sewers. Inverts shall be constructed with the same radius as the outflow pipe. A bench shall be provided on each side of the manhole inverts. The bench shall be sloped to provide a minimum three- (3-) inch fall from the top of the bench to the crown (top inside) of the pipe or one-half (1/2) inch per foot, whichever is greater. No lateral sewer, service connection, or drop connection shall discharge onto the surface of the bench. The bench shall be constructed of aggregate-mix cement with smooth, veneer finish and troweled smooth from manhole wall to invert.

**F.** All water standing in the trench shall be removed before placing of concrete is started, and the foundation maintained in a dry condition per Section 02205, Dewatering.

**G.** Shallow manholes shall be constructed to the sizes, shapes, and dimensions as detailed in the Detail Drawings, and at the locations shown on the Plans.

1. They shall be constructed of precast concrete sections as shown on the Plan or as directed by the Owner’s Representative.

**H.** Top elevation of manhole frames shall be adjusted to grade in areas such as streets, alleys, and parking lots or where indicated on the Plans in accordance with the requirements of this Specification 02607, Manhole Height Adjustment.

## 3.03 PIPE CONNECTIONS AT MANHOLES

**A.** Openings in manhole walls for incoming and outgoing sewers shall be:

1. Precast

2. After pipe installation, seal with an approved non-shrink grout.

3. These manholes shall be installed on compacted stone bedding per Standard Detail, S-001 Standard Precast Manhole.

**B.** Flexible manhole connector may be approved by the Owner's Representative as an alternate method of sealing the space between the manhole wall and the pipe for connections greater than eighteen (18) inches.

1. Flexible manhole sleeves shall be required for all pipes eighteen (18) inches and smaller

   a. Cast into the manhole by the precast Manufacturer.

   b. Flexible connector shall be:

      1) A-Lok,

      2) Z-Lok,

      3) or Kor-N-Seal

      4) Conforming to the requirements of ASTM C923

      5) Made from ethylene propylene rubber (EPDM) designed to be resistant to ozone, weather elements, chemicals, including acids, alkalis, animal and vegetable fats, oils, and petroleum products.

      6) Manhole sleeves shall be secured to pipe by stainless steel clamp and bolt assembly conforming to the requirements of ASTM C923.

**C.** Stainless steel elements of the manhole connector shall be:

1. Non-magnetic Series 304 Stainless,

   a. Excluding the worm screw for tightening the steel band around the pipe which shall be Series 305 Stainless.

      1) Tightening the steel band worm screw shall be torqued by a break-away torque wrench available from the precast manhole supplier,

         a) Set torque for 60-70 inch/lb.

      2) Connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer.

3) Connector shall be of a size specifically designed for the pipe material and size being utilized on the Project.

## 3.04 MANHOLE TESTING

**A.** All manhole inserts, new manholes, and replacement manholes shall be tested by the Contractor using the vacuum test method,

1. Follow manufacturer's recommendations for proper and safe procedures.
2. Perform test after installation of inserts.
3. Repair leakage in the manhole or structure, before, during, or after the test at no additional cost to the Owner.

**B.** Manholes:

1. Prior to testing manholes for water tightness:

   a. Plug lift holes with a non-shrink grout,

   b. Confirm joints between precast sections are properly sealed

   c. Pipe openings are temporarily plugged and properly braced.

2. Vacuum Tests shall be performed in accordance with ASTM C1244-11 prior to backfilling:

   a. If the manhole fails the initial test, make repairs with non-shrink grout on exterior and interior

   b. Retesting shall proceed until a satisfactory test is obtained.

   c. Vacuum testing equipment shall be as manufactured by P.A. Glazier, Inc., or approved equal.

**C.** The Owner's Representative reserves the right to have third party consultants perform construction materials testing and assessments to any new manhole.

**D.** The use of soapy water on the manhole walls to help determine the areas of leakage is permitted.

**E.** Contractor shall provide record of Owner Representative's witnessed test for each manhole.

## 3.05 BACKFILL

The Contractor shall place and compact backfill materials in the area of excavation surrounding manholes in accordance with the requirements Section 02324 – Trenching and Trench Backfilling only after successful leak testing of manholes is complete

## 3.06 CLEANUP

**A.** After the work has been completed and all testing acceptable, the Contractor shall clean up the work area.

1. Work area shall be left in a condition equal to or better than prior condition.

2. Disturbed grassed areas shall be seeded or sod placed per applicable Sections of the Contract and as directed by the Owner's Representative at no additional cost to the Owner.

3. The work site restoration work shall be completed in accordance with the requirements of Section 02276 – Site Restoration and Erosion Control.

**B.** All debris and excess material not incorporated into the permanent installation shall be disposed of by the Contractor.

1. Debris and liquids are to be disposed of properly in accordance with all applicable laws.

   a. Owner's Representative can furnish a letter to the landfill stating the Contractor is authorized to dispose of the non-hazardous materials.

2. Debris and liquids type and quantities are to be tracked in the daily contractor diary.

3. Hauling and disposal costs will be borne by the Contractor.

## 3.07 WARRANTY

**A.** The Contractor shall guarantee the work for a warranty period of one (1) year from the date of final acceptance.

1. If, at any time during the warranty period, any defect is identified the Contractor shall make acceptable repairs at no additional cost to the Owner.

2. In this case, the Contractor shall warrant the work for one (1) year in addition to the warranty required by the Contract.

**B.** If the frequency of similar defects requiring repair increases, then the entire project will be re-evaluated.

**END OF SECTION**