

SECTION 043
SPECIFICATIONS - MANHOLES

Manholes shall be constructed on sewers at changes in size, slope or direction and at other necessary points as shown on the plans or as directed by GPSD.

1.0 Pre-Cast Manholes

Pre-cast manhole sections shall meet the requirements of the latest version of ASTM C478 except where otherwise directed by this Section. Any wall sections or joints of questionable quality shall be replaced. Construction of manhole barrel reducing sections shall not be allowed. The minimum compressive strength of concrete manhole products shall be 5,000 psi in seven (7) days unless specified otherwise on project plans. Concrete compressive strength tests using cores taken from manhole products shall not be allowed; rather, concrete compressive strength tests shall be performed using compression test cylinders a set of which shall be constructed no less than daily per concrete mix. Furthermore, in contrast to that allowable within the text of ASTM C478, in no case shall any cylinder tested fall below one-hundred percent (100%) of the specified strength of the concrete. All test results shall be the property of GPSD and provided by the Contractor immediately after the completion of testing. If compression test results are less than allowable, GPSD shall determine necessary measures to be taken including potential rejection of constructed precast, manhole components.

Manhole bottoms shall be pre-cast with cast-in fillets (Moorbase), except where saddle-type manholes are specified by GPSD.

2.0 Joints

Joints between concrete manhole components shall be constructed using butyl rubber. Butyl rubber sealants shall be the CS-202 Butyl Rubber Sealant as manufactured by ConSeal Concrete Sealants, Inc. The ends of each butyl rubber sealant shall overlap to ensure closure. For all wet wells or where the groundwater elevation is above the manhole invert the exterior side of the manhole joints shall be sealed with CS-212 Polyolefin Backed Exterior Joint Wrap as manufactured by ConSeal Concrete Sealants, Inc.

3.0 Manhole Connectors

Manhole connectors to seal the connection between pipes and the manholes shall be constructed using the following connector systems.

- Approved boot connectors shall include the following:
 - G3 Boot System as manufactured by A-Lok Products, Inc.
 - PSX Direct Drive system as manufactured by the Press-Seal Gasket Corporation
 - PSX Positive Seal system as manufactured by the Press-Seal Gasket Corporation.
- Approved compression connectors shall include the following:
 - Econoseal system as manufactured by the Press-Seal Gasket Corporation
 - A-Lok Premium system as manufactured by A-Lok Products, Inc.
 - X-Cel system as manufactured by A-Lok Products, Inc.

4.0 Top Barrel & Adjusting Rings

The height of the barrel shall be suitable to fit the various depths of the manholes as shown on the plans and as directed in the field by GPSD. The top of manhole castings and lids shall be flush and consistent with the existing surface surrounding the manhole or with a proposed elevation as directed by GPSD. A twelve-inch (12") or sixteen-inch (16") barrel section shall be required immediately beneath a flat-top lid.

The maximum height of adjusting rings to be allowed for use under the manhole frame shall be eight (8) inches. Rubber adjusting rings shall be used for adjustments where the raise is less than or equal to three (3) inches; for all adjustments, at least two (2) inches of rubber adjusting rings shall be used immediately below the manhole frame. Manhole casting adjusting rings may be used for minor height adjustments not exceeding eight (8) inches; however, concrete adjusting rings of thickness two (2) inches or less shall not be allowed. If the surface surrounding the manhole is uneven, tapered rubber adjusting rings as provided by the manufacturer may be used. Adjusting rings shall be concentric to the manhole access opening with a deviation no greater than one eighth of an inch (1/8").

Rubber adjusting rings shall be either Infra-Riser Multi-Purpose Rubber Composite Adjustment Risers as manufactured by East Jordan Iron Works, Inc. or rubber adjusting rings as manufactured by American Highway Products, Ltd.

5.0 Frames

Manholes shall carry a cast iron frame and cover, equal to Neenah Foundry R-1530, Type B or East Jordan Iron Works, Inc., 1920 Frame and Lid with modifications as shown on the Sanitary District's Detail Drawing for castings, included in Section 095 of the specifications. A waterproof frame and cover equal to Neenah Number R-1915-H2, Neenah Number R-1916-C or East Jordan Iron Works, Inc., 1058 Frame and Lid shall be used where shown on the Plans. Where waterproof frames and covers are constructed, bolts used to secure covers to frames shall be completely coated with anti-seize compound. Anti-Seize compound shall be a pure nickel-based anti-seize compound rated for hostile environments and meet MIL-PRF-907F requirements. Anti-Seize compound shall be acid resistant and have a strong resistance to water wash off. Compound may not contain copper, lead, chlorides or other halogens, phosphorus, or silicones. Approved materials are Nikal Jet-Lube as manufactured by Whitmore Manufacturing, LLC, Loctite LB 771 Nickel Anti-Seize as manufactured by the Henkel Corporation, or CRC Nickel Anti-Seize as manufactured by CRC Industries.

All castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion or other defects. They shall be smooth and well-cleaned by shot blasting and shall be coated with asphalt paint. Castings shall be sealed to the top of the manhole with butyl rubber sealant.

6.0 Steps & Ramps

Steps in the manhole shall be equal to M.A. Industries, Inc. molded step PS-1-PF and shall be placed as specified on the applicable Detail Drawing as provided in Section 095 of these Specifications. Manhole steps shall be centered over the outlet pipe on eight (8) inch to and including twelve (12) inch diameter sewers. Steps shall be installed at ninety (90) degrees to the outlet pipe on sewers larger than twelve (12) inches.

Manhole Safety Ramps as manufactured by American Highway Products, Ltd. May be used as directed.

7.0 Coring

Coring into an existing manhole shall be performed only when and as directed by GPSD personnel. The size of core holes shall be minimal relative to the size of hole necessary for the introduction of the specified pipe size into the joint type specified. Coring into a manhole shall be performed with great care to minimize the number of anchor holes necessary to execute the core. Joints between cored holes and specified piping shall be made using a press seal boot. Coring shall not be performed within four inches of a joint.

8.0 Anchoring Systems

Concrete anchoring systems shall be either Trubolt Wedge Anchors, Type 316 stainless steel, part of the Red Head Concrete Anchoring Systems manufactured by Illinois Tool Works (ITW), Inc or Type 316 Stainless Steel threaded rod bedded by an adhesive anchoring system in boreholes. Where utilized boreholes shall be freshly drilled and cleaned with compressed air prior to installation of the adhesive anchoring system. If precast or previously drilled boreholes are to be utilized they shall also be cleaned with a non-residue degreasing agent and allowed to completely dry prior to installation of the adhesive anchoring system. Boreholes shall have a diameter of not less than 1.25 times nor more than 1.5 times the diameter of the threaded rod. Boreholes shall have a minimum embedment depth of not less than three inches or five times the diameter of the threaded rod, whichever is greater.

The type of anchor used as well as the thread length and anchor diameter shall be as specified on the project plans. Where indicated on the project plans, concrete anchoring shall be coupled with an adhesive anchoring system. Adhesive anchoring systems shall be EPCON, two-part epoxy, Adhesive Anchoring Systems as manufactured by ITW, Inc.

Capsule anchors shall be of the size and length required as outlined on the Plans and Specifications and shown on the Shop Drawings unless otherwise stated. Anchors shall be Molly Parabolt type M24-1, Ramset Chemset CTR10. Installation shall be per manufacturer's recommendations.

9.0 Manhole, Standard

Standard precast, concrete, and flat top manholes shall be permitted for pipe diameters up to forty-two (42) inches and for depths up to twenty (20) feet. A structural engineer, licensed in Illinois, shall certify the proper design of flat top manholes for pipe diameters greater than forty-two (42) inches or depths greater than twenty (20) feet using the standard GPSD manhole as the basis of design.

10.0 Manhole, Drop

Where a sewer discharges into a manhole, the bottom of which is two (2) feet or more below the invert of the sewer, the connection shall be made through a drop manhole connection.

Manholes shall be a minimum of 60-inches nominal inside diameter and sized to provide a minimum of 48 inches clearance between the pipe and the opposite side of the manhole.

Manhole internal drop connections shall be the Reliner Inside Drop System manufactured by Duran, Inc. or an equal approved via addendum prior to the opening of bids. Products and installation shall be in accordance with the specifications of the manufacturer and project plans and Specifications except as

follows: all brackets, braces and clamps shall be made of stainless steel; all anchors shall be made of Type 316 stainless steel; all anchors shall be secured into bored holes using a fast curing adhesive anchoring system equivalent to ITW Red Head C6 Fast Curing Epoxy for all conditions or an equivalent approved via addendum prior to the opening of bids.

Internal drop connections shall be constructed using the manufacturer's "B" Bowl with an 8" outlet unless otherwise noted. The drop pipe shall be anchored as directed by the manufacturer except that a clamping bracket shall be placed near the top of the drop pipe (just below the flexible external pipe coupler) and another near the bottom of the drop pipe (near the PVC pipe elbow). The turn-out at the base end of the drop pipe shall be either a 45 degree or 90 degree PVC pipe elbow whose invert shall be as directed on the applicable plan sheet.

11.0 Manhole, Drop, Special

Special (external) drop manholes shall be constructed only where allowed by GPSD.

External drop connections shall be constructed by completely encasing in concrete a drop connection "stack" constructed using a PVC, C900, tee, PVC, C900, pipe, Fernco Flexible Couplings, PVC, SDR 35, pipe and PVC, SDR 35, fittings. Joining of the PVC, C900, tee with the vertical portion of the stack shall be made by coupling a piece of PVC, C900, pipe to the vertical portion of the stack, constructed using PVC, SDR 35, pipe, using an appropriately-sized Fernco Flexible Coupling. The nominal diameter of the tee, pipe and fittings used to construct the stack shall be at least two-thirds (2/3) as large as the diameter of the sewer tributary to and upstream of the drop manhole; however, the nominal diameter of the stack shall at no time be less than eight (8) inches.

The stack shall be completely encased in a minimum of six (6) inches of IDOT, Class "SI", concrete as measured from all directions from the outside surface of all components of the stack; however, the upstream, bell, of the PVC, C900, tee shall remain accessible for joining with an appropriately-sized, PVC, C900, pipe. The concrete encasement is to extend to the limits of the excavation and undisturbed earth and shall be anchored to the manhole wall sections.

The first pipe upstream of the drop manhole shall be constructed using Certa-Lok, PVC, C900, pipe with a laying length of twenty-feet (20') and DR as specified by GPSD. The joint between the first pipe upstream of the drop manhole and the next pipe upstream of it shall be constructed using an appropriately-sized, 5000 Series, Strong Back (RC), coupling as manufactured by Fernco. Filling of excavations below and around the first pipe upstream of drop manholes shall be completed in accordance with Subsection 2.0, titled "Backfilling for Structures", of Section 047 of these Specifications except that use of earth removed from the excavation shall not be allowed.

12.0 Manhole, Splash Drop

Where a sewer discharges into a manhole, the bottom of which is less than two (2) feet below the invert of the sewer, the connection shall be made through a splash drop connection. Splash-drop manholes shall be in accordance with the Detail Drawings supplied in these specifications.

13.0 Manhole, Custom, Special

Where specified, manholes shall be constructed based upon actual conditions revealed after field investigation. As much as possible, special-type manholes shall be constructed using precast concrete manhole parts such as wall sections, flat tops, moor bases, etc.; however, as directed by GPSD, portions of

the manholes shall be cast-in-place. Cast-in-place portions shall conform as much as possible to the specifications for standard or drop manholes detailed in these Specifications.

Castings and lids shall conform to these Specifications.

Portland cement concrete used shall be in accordance with Class PV concrete as detailed in Section 1020 of the Illinois Department of Transportation (IDOT) Standard Specifications. Formwork shall be as directed by GPSD. Cast-in-place benches shall have troughs formed within that are smooth and transfer the flow through the manhole without disruption. All cast-in-place concrete shall be smoothly finished, cured and protected. There shall be no materials or concrete debris left in the manhole after construction nor shall any concrete debris or materials be introduced into the existing sewer system.

The crown of existing sewer pipes shall be removed to the spring line of the pipe or to the top of the newly cast bench.

14.0 Manhole, Saddle

Saddle-type manholes shall be constructed only where allowed by GPSD.

Saddle-type manholes shall be constructed using precast concrete manhole components in accordance with these Specifications except that a saddle-type manhole shall be precast to conform to the dimensions and operation of the existing sewer over which it is to be constructed. Field modifications may be allowed by GPSD. Likewise, the existing sewer shall be field modified so that the constructed manhole is fully operational.

A saddle-type manhole shall be constructed to straddle an existing sewer by modifying an appropriately sized precast concrete manhole barrel section. The dimensions of the chosen precast concrete manhole barrel section shall be chosen based upon field conditions including the size of the existing sewer and consideration for the structural integrity of the constructed manhole. The opening cut into the barrel shall be large enough to allow placement over the existing sewer; however, excessive cutting beyond that necessary to place the modified barrel section over the sewer shall not be allowed.

The manhole-base section shall be properly constructed in accordance with these Specifications and the directions of GPSD. Manhole-base sections shall be adequately supported upon concrete blocks and sewer bedding materials. After properly supporting the manhole base, ready-mix, Portland cement Class SI concrete as detailed in the Illinois Department of Transportation (IDOT) Standard Specifications shall be poured around the manhole-base section. No further construction upon or around the constructed base section shall be allowed until the concrete has reached 2,000 psi based on compressive strength tests. The use of early age or high early accelerators is allowed.

Joints between the newly placed and modified manhole barrel section that will serve as the manhole bottom and the existing sewer shall be made using ready-mix concrete in accordance with these Specifications. The joint shall be watertight and constructed to the satisfaction of GPSD.

Manhole benches within saddle-type manholes shall be constructed in accordance with the directions for manhole bench and trough reconstruction provided in Section 075 of these Specifications.

The crown of existing sewer pipes shall be removed to the top of the newly cast bench. The pipe shall be cut true and even with the top of the constructed manhole bench without excessive pipe removed below or remaining above the top of the bench.

15.0 Manhole Testing

Constructed manholes shall be tested. Testing shall conform to ASTM C1244 Standard Test Method for Concrete Sewer Manholes by the negative air pressure (vacuum) test and ASTM C1227 Standard Test Method for Concrete Septic Tanks. All test results shall be the property of GPSD and provided by the Contractor immediately after testing is concluded.

16.0 Manhole Corbel Removal and Replacement

When removing an existing manhole barrel reducing section or corbel, the entire vertical length of the corbel shall be removed. After corbel removal, the remaining manhole barrel shall be of a uniform and consistent diameter.

The replacement of the removed corbel shall be constructed utilizing the existing joint.

If the barrel section to remain does not have a joining system that is able to be utilized the replacement precast concrete barrel sections shall be constructed on top of the remaining barrel. The new circular sections shall be centered and leveled on top of the remaining barrel as well as possible. The remaining barrel section shall provide support for the proposed manhole sections and, where in contact, two rows of butyl-rubber rings shall be used to form the joint between the poured, concrete collar and the replacement barrel sections.

A poured-in-place concrete collar is to be constructed around the joint of the new and remaining barrel sections to both secure the position of the new barrel sections and to provide tapered surfaces. Where the position of the existing barrel deviates from the replacement sections, the concrete collar shall be tapered to promote conveyance of any water and solids down into the manhole bench and trough. Sharp angles and benches created at the location of the joint shall not be allowed. Tapered surfaces shall be made part of the concrete collar and sloped at a grade of no less than one-inch (1") vertical for each twelve-inches (12") horizontal away from the new wall section. The concrete collar is to be constructed using material in accordance with these Specifications.

The concrete collar shall be sufficiently sized to encompass the horizontal cross-sections of both the existing and proposed barrel sections by six-inches (6") beyond the outer-circumference. Additionally, the concrete collar shall vertically extend at least twelve-inches (12") below and above the joint of the remaining and new barrel sections.

Replacement of the removed manhole barrel reducing section or corbel shall be in accordance with these Specifications and the directions of GPSD. Components necessary to reconstruct the manhole shall be chosen based on these Specifications and the existing conditions.

END OF SECTION