

SECTION 15 31 13

SANITARY SEWER MANHOLES, FRAMES AND COVERS

PART 1.00 - GENERAL

1.01 Description

The work in this Section covers the requirements for furnishing, installation of and testing of sanitary sewer manholes and appurtenances.

1.02 Quality Assurance

- A. The Contractor shall use sufficient workmen and competent supervisors in the execution of this portion of the work to ensure adequate and proper installation throughout.
- B. Manholes shall comply with all pertinent codes and regulations, and with these specifications. Where the provisions of the codes and standards conflict with these specifications, the more stringent provisions shall apply
- C. Handling: unload and handle materials with crane, backhoe, or equipment of adequate capacity, equipped with appropriate slings or padding to protect materials from damage.
- D. Workmanship: Manholes, frames and covers shall be free from visible cracks, holes, foreign inclusions or other injurious defects.

1.03 Submittal

Before any materials covered in this section are delivered to the job site, the Contractor shall submit in five (5) copies, shop drawings for these items to the Engineer for review and approval. Shop drawings shall include all manhole materials, precast manhole units, invert and critical elevations, steps, ring and cover units, gaskets and flexible manhole sleeves.

PART 2.00 - PRODUCTS

2.01 Precast Reinforced Concrete Manhole Sections

A. Design

- 1. Design of precast sections shall be in strict accordance with ASTM C 478 (latest) and H-20 loading standards.
- 2. Wall thickness shall be in accordance shall be a minimum of five inches (5") for four foot (4') inside diameter manholes and six inches (6") for five foot (5') inside diameter manholes.
- 3. Bases of all manholes shall have a minimum thickness of six inches (6") over an eight inch (8") stone base for leveling. and cast top section shall have eccentric cone, unless shown otherwise on drawings.
- 4. Risers and grade rings shall all be of one type.

5. Joints shall be formed with male and female ends and sealed with a flexible joint material meeting Federal Specifications SS-5-00210 "Sealing Compound, Preformed Plastic for Pipe Joints," Type I, rope form, or Type II, flat type.
6. Manholes for use on pipelines eighteen inches (18") and larger, over fifteen feet (15') deep (top rim to lowest point) and/or manholes with inside drops shall be 5'-0" in diameter. Either an approved reinforced concrete slab or pre-cast reducer section will be acceptable. The reinforced concrete slab shall have the following minimum design:
 - i. 1'-0" thick minimum (3,000 psi) plus the depth of the riser groove;
 - ii. Reinforced at the top with No. 4 bars at 12" o.c. EW;
 - iii. Reinforced at the bottom with No. 5 bars at 6" o.c. EW for manhole depths from 22' to 32', and No. 7 bars at 6" o.c. EW for manhole depths greater than 32'; and
 - iv. Bottom half of this slab shall have the equivalent of 6 extra No. 6 bars as beam reinforcement around opening for the 4' riser section.
7. In the case where total base to 4' riser section reductions greater than 2' are desired or necessary, a minimum of 36" of vertical riser section shall be used between successive reducers, unless otherwise approved. Four-foot base diameters shall not be reduced further except for placement of ring and cover. Both the tongue and groove of joints shall have reinforcing steel equal in area to that of the wall sections.
8. Except where restricted by shallow cuts or otherwise shown on the Contract Drawings, minimum heights for base sections (excluding poured base thickness) shall be as follows:
 - i. 46" for 4' diameter; and
 - ii. 48" for 5' diameter
9. The base section shall not have a monolithic pre-cast base slab. The pre-cast base riser section shall be placed in a reinforced concrete (3,000 psi) slab to a depth equal to the length of the groove of the riser section. The slab shall have a diameter or side of at least 1' greater than the manhole base section outside diameter. The slab shall be a minimum of 1'-0" thick plus the depth of the riser groove and shall be reinforced top and bottom with a minimum of No. 4 bars at 12" o.c. EWEF for 4' and 5' diameter sections.

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B. Steps

The pre-cast manholes shall have cast in place nonskid manhole steps of press set plastic or other approved material. Step irons shall be generally located at 90 degrees from the direction of flow on the vertical wall. The steps shall be set in the wall a maximum of 12" and/or 16" maximum on centers vertically as required by OSHA standards. All steps shall have a minimum vertical load resistance of 750 pounds with no permanent deflection and pullout resistance of 1,000 pounds. Steps shall be imbedded in the wall a minimum of 4" and project from the wall a minimum of 6" and shall be a minimum of 12" in width with lateral foot stops.

C. Flexible Manhole Sleeves

1. Sleeves shall be used at each entry hole of all sewer manholes. The sleeve flange shall be integrally cast into the manhole wall forming a waterstop and the sleeve portion shall extend through the base at right angles to the wall into which the pipe is inserted.
2. Physical properties of the material for this sleeve are: (1) Minimum tensile strength - 1500 psi, (2) Elongation at rupture, min. - 450%, (3) Compression set, max. 25% ASTM D-396, Method B, and (4) Durometer 50 5, ASTM D 2240.
3. A stainless steel sealing clamp shall secure the sleeve to the pipe.

2.02 Manhole Frame and Cover

A. General

1. The frames and covers shall be constructed of tough, gray cast iron and must meet the requirements of ASTM Specification A-48 latest revision, Class Thirty (30). The covers shall be machined, lie flat on the frame seat, and shall not rattle under the impact of traffic. Covers shall be solid with no holes. Frames and covers shall be thoroughly cleaned and then hot-dipped in asphaltum or coal-tar varnish. Frame and cover shall weigh not less than three hundred (300) lbs. Manhole covers for sanitary sewers shall indicate "Sanitary Sewer" on the cover. Sealed manhole covers shall be furnished with four (4) brass flat head machine screws at 90° and a single polyvinyl gasket between cover and frame seat.
2. For standard applications, manhole frame and cover shall be manufactured by East Jordan Iron Works, Neenah Foundry or approved equal

B. Special Applications

1. Manhole frames and covers that are below the required base flood elevation + two (2) feet shall be watertight. Rings/Frames shall be bolted down into the concrete manhole tops and have at three bolts and a gasket to sit the cover to the frame. Frame and Cover shall be the V-2384 Watertite Frame and Cover manufactured in the United States by East Jordan Iron Works, Inc. or approved equal.
2. For manholes with rim elevation three feet (3') above grade all castings shall be revolution type frames and covers manufactured in the United States of America by East Jordan Iron Works, Inc., or approved equal. The cover shall rotate horizontally away from the frame, allowing access to the manhole.

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2.03 Vent Pipes

Vent pipes, when called for on the Contract Drawings or in the Proposal shall be made of 4-inch diameter, Schedule 40 steel pipe. They shall be furnished and installed with 3/8 inch mesh galvanized screen to cover outside opening.

2.04 Drop Manholes

Drops shall be constructed as shown on the Drawings and/or Standard Details at the location(s) where the invert elevation of a main entering a manhole is two feet (2') or more above the lowest invert of the manhole. Inside drops will not be allowed unless authorized by the engineer. Inside drops shall be RELINER, as manufactured by Duran, or approved equal.

PART 3.00 - EXECUTION

3.01 General

All outfall manholes shall be placed with a minimum of two (2) feet reveal from the top of rim to the existing surface grade with no more than four (4) feet of reveal. It is at the contractor's discretion for raising the manhole above the minimum requirement amount though compensation will only be made for the first two feet. For any manholes within the flood hazard areas, they must be vented or raised to the base flood elevation (BFE) + two (2) feet as identified on the Construction Drawings.

3.02 Excavation and Backfill

Undercut below all manhole footings and/or precast bases to a depth not less than six (6) inches nor greater than twelve (12) inches. Backfill this area with stone bedding material as specified in Section 15 05 01 of these specifications.

Where concrete footings are to be poured, the area in which the concrete is to be placed must be kept dry until concrete has set-up.

3.03 Inverts

The invert channels shall be smooth and semi-circular in shape conforming to the inside of the adequate sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full-section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot.

3.04 Walls

Mortar for jointing and plastering shall consist of one part portland cement and two parts fine sand. For brickwork, lime may be added to the mortar in the amount of not more than 25 percent of the volume of cement. The joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Brick manholes shall be plastered with 1/2 inch of mortar over the entire outside surface of the walls.

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Brick shall be laid radially with every sixth course laid as a stretcher course.

3.05 Rings and Covers

The rings and covers shall be set so that the top of the cover will be flush with or higher than finish grade, as per the Plans or as directed by the Engineer.

All manhole rings in roadways shall be encased in a concrete collar 18" x 6" of 3,000 psi concrete beneath the asphalt, with the cover flush with the top of the pavement.

3.06 Pipe to Manhole Connections (for new and existing manholes)

- A. Cut pipe square before installation. Place so springline edges of pipe are flush with inside wall or extend a maximum of 2.5" in accordance with manufacturer's recommended installation procedures.
- B. Where pipe is extended into manhole, coordinate slope of pipe and slope of notch in invert to ensure smooth transition.
- C. Fit flexible gasket connector between pipe and manhole described herein except for the following connections:
 - i. Where the pipe enters manhole at slope greater than 10%
 - ii. Where pipe enters the manhole at an angle
 - iii. Where manhole is built over existing sewer pipe, except when existing sewer is PVC
 - iv. When either DIP or RCP is connected to existing brick manhole
 - v. Parallel connection
- D. Insert pipe was pipe following connector manufacturer's written recommendations.
 - i. Ensure that pipe is centered in connector, that full barrel portion of pipe is fully inserted, and that pipe is properly bedded immediately to the manhole.
 - ii. When flexible gasket connector is not used for reasons stated herein, use quick-non shrink grouted pipe to manhole connections and bentonite collar.
 - iii. Keep excavation dry and do not backfill until 2 hours have elapsed to permit grout to cure.
- E. When AWWA C900 and C905 is to be grouted using solvent cement:
 - i. Apply solvent cement following manufacturer's instructions to entire exterior portion of pipe to be grouted into wall
 - ii. Coat softened pipe exterior with concrete sand and allow pipe exterior to harden,.
 - iii. Grout sand-coated pipe into wall.

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- F. New connections to existing manholes shall be made by core drilling through the walls. Flexible seals as described herein shall be used for the pipe penetration. Apply a protective epoxy coating to the cored concrete and the ends of any exposed reinforcement.

3.06 Backfilling

After the bedding has been prepared and the manhole installed, selected material from excavation or borrow, at a moisture content which will facilitate compaction, shall be placed alongside the manhole in layers not exceeding 6 inches in depth. Care shall be taken to insure thorough compaction of the fill under the haunches of the pipe lines. Each layer shall be thoroughly compacted by rolling, tamping and mechanical rammers, or by hand tamping with heavy iron tampers, the tamping face area of which shall not exceed 25 square inches. The method of filling and compacting shall be continued until the fill has reached an elevation 12 inches above the top of the pipes. The remainder of the hole shall be backfilled and thoroughly compacted in layers not exceeding 12 inches.

Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material.

All local backfill materials shall be compacted at a moisture content satisfactory to the Engineer, which shall be approximately that required to produce the maximum density. The Contractor shall dry or add moisture to the local material when required to provide a uniformly compacted and stable embankment.

When other than local material is used for backfilling above the foundation, such material will be classified as select backfill material as specified in Part 2.03 of these specifications. Use of this select backfill material shall be only when directed by the Engineer or his representative.

3.07 Manhole Sealing

All manholes shall be sealed with plastic cement putty meeting Federal Specifications SS-C-53. O-ring joints shall conform to the requirements of ASTM C443. A rubber water stop shall be supplied with the manholes to tie the pipe to the barrel section. These gaskets and clamps shall meet the requirements of ASTM C923.

3.08 Manhole Testing

All manholes shall be tested after assembly and prior to backfilling using a vacuum tester manufactured by P.A. Glazier or MMVT, Inc.. Tester shall be provided by the Contractor.

A. Procedure for Vacuum Test

1. All lift holes shall be plugged with a non-shrink grout. All pipes entering the manhole shall be plugged. All plugs must be braced to keep plug form being drawn into the manhole. The inside of the manhole shall be wet down with visibly indicate areas of leakage (if any) after the test is performed. Test head shall be placed on or in the cone section and the seal inflated as per the

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manufacturer's specifications. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valve closed, the time it takes for the vacuum to drop to 9 inches shall be measured. The manhole shall pass if the time is greater than the values in the table below:

<u>Manhole Depth</u>	<u>Manhole Diameter</u>		
	<u>48"</u>	<u>60"</u>	<u>72"</u>
10' or less	60 Sec	75 Sec	90 Sec
10' – 15'	75 Sec	90 Sec	105 Sec
Over 15'	90 Sec	105 Sec	120 Sec

2. If the manhole fails, necessary repairs shall be made using a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until the manhole is acceptable.

PART 4.00 – MEASUREMENT AND PAYMENT

4.01 Sanitary Sewer Manholes

- A. Measurement: By linear foot of various sizes and types provided at the measured depth. The installed pipe shall be measured horizontally along the centerline of the installed pipe from manhole to manhole as part of the completed and accepted work. Depth shall be measured from the invert of the pipe to the top of the ditch bank along the completed and accepted alignment.
- B. Payment: At unit price for each size and type of pipe installed at the measured depth as listed in the Bid Schedule.
 1. Payment includes work for location of utilities, excavation, trenching, backfilling, removal and replacement of driveway pipes, guardrails and other obstructions, connecting to new and existing mains, abandonment of mains and services, installation of stone bedding, and pressure and mandrel testing of mains, and disinfecting and testing of mains.

4.02 Sewer Services

- A. Measurement: By linear foot of height of various sizes, measured to the nearest tenth vertically from the inside bottom (invert) to the to the final finished top of the manhole ring (not to exceed two (2) feet above grade) as part of the completed and accepted work.
- B. Payment: At unit price for each diameter size and depth of manhole installed as listed in the Bid Schedule as part of the completed and accepted work.
 1. Payment includes work for location of utilities, excavation, trenching, backfilling, removal and replacement of driveway pipes, guardrails and other obstructions, connecting to pipes, base construction, incidental concrete and grout used for sealing and invert construction, bedding stone, furnishing and installing appropriate manhole frame and covers and vacuum testing of manholes.

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END OF SECTION