

**SECTION 02562
SANITARY SEWER MANHOLES**

1.0 GENERAL

A. Description

Sanitary sewer manhole installation shall include, but not necessarily be limited to, furnishing and installing sanitary sewer manholes, interior lining and miscellaneous structures of concrete or brick masonry built to the shapes and dimensions shown and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Aggregate Backfill: Section 02240
2. Trench Excavation, Backfill, and Compaction: Section 02250
3. Sanitary Sewers: Section 02561
4. Cast-in-Place Concrete: Section 03300
5. Precast Concrete Utility Structures: Section 03400
6. Mortar: Section 04100
7. Brick Masonry: Section 04200

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents.

B. Materials Furnished by the Commission

The Commission will not furnish any materials for sanitary sewer manholes.

C. Contractor's Options

1. The Contractor may furnish polypropylene, or plastic-coated steel for manhole steps.
2. Standard sanitary manholes shall be precast construction; however, the Contractor may furnish cast-in-place, or masonry construction for miscellaneous sanitary sewer structures with the approval of the Commission.
3. Contractor may furnish Manhole interior lining sheets or applied coating.

D. Detailed Material Requirements

1. Granular bedding beneath manhole bases shall meet the gradation requirements of AASHTO M43, Size Number 57, as specified in Section 02240.
2. Portland cement concrete for cast-in-place structures shall be as specified in Section 03300, mix number as indicated on the Standard Details or the Plans.

3. Precast manhole bases, risers, cone sections, grade rings, and precast utility structures shall be as specified in Section 03400.
4. Joints shall be "O" ring compression type meeting the requirements of ASTM C-443.
5. Non-shrink grout shall be as specified in Section 04100.
6. Mortar for brickwork and grade rings shall be as specified in Section 04100.
7. Manhole flows channels and benches shall be formed with concrete as approved by the Commission in the bottom of manholes
8. Frames and covers shall be as shown in the Standard Details and as specified in Section 05500.
9. Manhole steps shall be plastic coated and shall be manufactured using a minimum ½ - inch diameter steel reinforcing rod meeting the requirements of ASTM A 615, as a core. The plastic coating shall meet the requirements of ASTM 2146, Type II, Grade 4375B.
10. Force main discharge manholes and above grade manholes shall be seal-coated with 16 mils of a coal tar polyamide epoxy.
11. Manhole-to-Pipeline Connectors
 - a. Cast-in-place type connectors shall be:
 - 1) A compression type for sewer grades less than 18%.
 - b. For doghouse type manhole applications a banded-boot type connector shall be used.
 - c. Mechanically wedge-in-place type connectors shall be used for cored openings.
12. Manholes shall have sealant between the manhole and the manhole frame. The sealant shall be mastic rope, type B, 3/4 inch minimum diameter, butyl based, and meeting requirements of AASHTO M 198.
13. The insert dish for manholes shall be manufactured of high density polyethylene resistant to corrosion from atmospheres containing hydrogen sulfide and dilute sulfuric acid. The manufacturer shall furnish a load test verification showing a load test failure in excess of 3,000 lbs. The insert shall contain gas relief valves designed to release a pressure of .5 to 2.0 psi and have a water leak down rate no greater than 5 gallons per 24 hours. The handle shall be able to withstand a pull of 500 lbs. without breakage.
14. Linings for interior of concrete manholes which includes but not limited to the channel, bench, and walls shall be thermoplastic sheets of polyvinyl chloride (PVC) meeting the requirements of ASTM D1784, high density polyethylene (HDPE) meeting the requirements of ASTM D1248, or polypropylene (PP) meeting the requirements of ASTM D4101, 16344C. Thermoplastic sheets shall incorporate an anchoring system which permits the sheets to be placed in concrete forms and cast integrally with the concrete of the structure.
15. Resin based lining system shall be suitable for use as a trowel- or spray-applied monolithic surface in sewer manholes suitable for mild to severe hydrogen sulfide environments. The material shall be high strength, high build, corrosion resistant, resin based with no VOC's.
 - a. Epoxy resin based material shall be used to form the sprayed on/structural enhanced monolithic liner covering all interior surfaces of the structure

including benches and inverts of manholes. Must conform to the minimum physical requirements listed below.

Compressive Strength	ASTM D695	10,500 psi
Tensile Strength	ASTM D638	7,000 psi (min)
Flexural Strength	ASTM D790	12,000 psi
Bond	shall exceed tensile strength of substrate	
300,000 (min)		
Flexural Modulus (initial)		735,000 psi
Density		87 pcf

Chemical Resistance: The corrosion resistance of the epoxy coating shall be tested by the coating manufacturer in accordance with ASTM D543. The result of exposure to the chemical solutions listed below shall produce loss of not more than 20 percent of the initial physical properties when tested in accordance with ASTM D543 for a period of not less than 1 year at a temperature of 73.4 °F plus or minus 3.6 °F. The finished structure shall be corrosion resistant to: hydrogen sulfide, sulfuric acid, nitric acid, sodium hydroxide as well as other common ingredients of the sanitary sewage environment with the following compositions:

CONCENTRATIONS OF CHEMICAL SOLUTIONS FOR CHEMICAL RESISTANCE TEST	
Chemical Solution	Concentration, %
Tap Water (pH 6-9)	100
Nitric Acid	5
Phosphoric Acid	10
Sulfuric Acid	10
Petroleum Hydrocarbon Based Fuels (e.g. Gasoline, diesel, etc.)	100
Vegetable Oil ¹	100
Detergent ²	0.1
Soap ²	0.1
Domestic Sewage	100

¹ Cotton seed, corn, or mineral oil

² As per ASTM D543

The wall of the resin based liner will be structurally designed to withstand the hydraulic load generated by the groundwater table & restore structural integrity. The long term, 50 year, value of the flexural modulus of elasticity will be a minimum of 500,000 psi and is an integral part of the engineering equation used to design the wall thickness of the structural liner.

This flexural modulus will be certified by an independent third party testing lab and submitted with design calculations for each structure.

The monolithic high-build epoxy coating shall consist of a 100% solids epoxy formulated with exceptionally high physical strengths and broad range chemical resistance. The coating system coverage shall be a minimum of 100 mils and shall be determined by the manufacturer. The manufacturer

shall provide documentation for the recommended thickness.

The epoxy coating shall have a one-year labor and materials, non-prorated warranty to stop infiltration and further deterioration of the structure.

Other Materials: No other material shall be used with the above mixes without prior approval or recommendation from the manufacturer and the Engineer.

Epoxy coating shall be Mainstay DS-5 manufactured by Madewell; SEL-80HB by Parson Environmental; Raven 405 by Raven Lining Systems or approved equal.”

- b. Polyurethane resin based material shall be used to form the sprayed on/structural enhanced monolithic liner covering all interior surfaces of the structure including benches and inverts of manholes. Must conform to the minimum physical requirements listed below.

Compressive Strength	ASTM D695	18,000 psi
Tensile Strength	ASTM D638	7,000 psi (min)
Flexural Strength	ASTM D790	14,000 psi
Bond	shall exceed tensile strength of substrate	
300,000 (min)		
Flexural Modulus (initial)		735,000 psi
Density		87 pcf

The monolithic high-build polyurethane coating shall consist of a 100% solids formulated with exceptionally high physical strengths and broad range chemical resistance. The manufacturer shall provide documentation for the recommended thickness.

Other Materials: No other material shall be used with the above mixes without prior approval or recommendation from the manufacturer and the Engineer.

The polyurethane coating shall have a 3 year warranty against defects on materials and workmanship.

- 16. Coating shall be Spraywall by Sprayroq, Inc. or approved equal.

- E. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

- 1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
- 2. Manholes and drop connections shall be installed in accordance with the Standard Details and as specified herein.

3. Miscellaneous structures shall be constructed where shown and as indicated on the Plans or as directed by the Commission.
 - a. Cast-in-place concrete construction shall be as specified in Section 03300.
 - b. Brick construction shall be as specified in Section 04200.
4. Pipelines connected to manholes and other structures shall have a pipe joint between 3 and 7 feet from the exterior wall of the structure.
5. All new openings in existing manholes shall be core drilled in a manner acceptable to the manhole manufacturer and the Commission.
6. A high density polyethylene insert dish shall be installed within all manhole covers.

B. Manhole Installation

1. Manholes, frames and covers shall be installed as pipeline installation progresses. The manhole vertical axis shall be plumb and directly over the centerline of the pipeline unless otherwise shown or directed.
2. Manhole joints shall be watertight. Exteriors shall be coated with waterproofing in accordance with the Standard Details.
3. Channels for receiving and passing water shall be formed in the bottom of manholes as shown or directed. Channels shall slope smoothly and evenly and a channel bench constructed to the height of the crown of the highest pipe. Channels and a watertight plug shall be installed in the manhole for future extensions where shown on the Plans or directed by the Commission.
4. Pipes shall be cut flush with the inside wall of the manhole.
5. The frame and cover shall be installed in accordance with the Standard Details.
6. Parging of the interior brick surfaces will not be permitted.

C. Curing

1. Manhole channels and benches shall receive a minimum twenty-four (24) hour cure time prior to being subjected to sewage flow. The Commission reserves the right to adjust this curing period if deemed necessary.

D. Tests

Manholes and other structures shall be visually inspected by the Commission for leakage. Any visible leak shall be sealed or resealed until all leakage into the unit is eliminated. Infiltration testing shall be conducted only when the sewers attached to the manholes or other structures are tested in that manner. Testing shall be in accordance with Section 02561.

E. Manhole Lining

1. Interior Lining

Prior to entering structures, the Contractor shall conduct an evaluation of the atmosphere to determine the presence of toxic, flammable vapors or possible lack of oxygen. The evaluation shall be in accordance with local, state or federal safety regulations.

Place covers over all pipe openings to prevent extraneous material from entering the manhole during repair operations.

All foreign material shall be removed from the structure's wall and bench/floor using a pressure water spray (minimum 3,000 psi). All surfaces shall be clean, free of dirt, grease, and loose particles and shall be prepared according to manufacturer's requirements. The use of acid for cleaning purposes, no matter how dilute, will not be allowed. Loose or protruding concrete shall be removed. The surface to be repaired shall be clean and free of any loose materials.

All repairs to the manhole shall be completed prior to resin interior coating. All infiltration shall be stopped using material compatible with topcoating.

After all preparations and repairs have been completed, remove all loose material and power wash the manhole interior again. The surface to receive the coating shall be clean and sound with adequate profile and porosity to provide strong bond between coating and substrate. All repair materials shall be permitted to cure according to manufacturer's recommendations.

The substrate surface to be coated shall be dry to the touch and meet the manufacturer's requirements for the topcoating.

Cover the steps to prevent adhesion of spray coating or remove all manhole steps prior to coating application if directed by the Engineer.

2. Installation

The Contractor shall furnish and place the resin coating in each manhole as and where directed by the Engineer. The installation of the coating shall be in complete accordance with the manufacturers' specifications.

The resin based coating shall be manually sprayed on or hand troweled on to all surfaces by a trained technician who is experienced in the application of a spray applied resin and has been certified by the manufacturer. Appropriate personal protection equipment shall be utilized but in every case when applying the liner, the sprayer and personnel in direct contact with the spray atmosphere, will always be protected by supplied air.

Application of the spray applied material must be completed in one (1) setup in order to minimize the disruption and cost of traffic control and all other support services. The Contractor shall take precautions to keep overspray or excess material from entering the newly installed pipe and any other pipes in the manhole.

Recoat as needed and in accordance with manufacturer's recommendations until design thickness is achieved.

The structure should be allowed to fully cure and return to ambient temperature prior to any physical testing, including vacuum testing.

The benches shall have the base coat material applied to the required thickness by hand troweling or spray-on methods. Coatings that are spray-applied shall be troweled smooth after application.

Uncover the manhole steps. Do not reinstall steps that were removed unless directed by the Engineer.

4.0 METHOD OF MEASUREMENT

A. Sanitary Sewer Manholes

Measurement for furnishing and installing sanitary sewer manholes will be made per vertical foot for the number of each type constructed, as shown on the Standard Details. Measurement will be made from the lowest point in the manhole invert to the highest external point on the top of the manhole frame and cover.

B. Drop Connections

Measurement for drop connections will be made for the number and type constructed. The manhole on which the drop structure is constructed will be measured and paid for separately as described above.

C. Miscellaneous Structures

Measurement for miscellaneous structures will be made for the number of each type of unit constructed in accordance with the Contract Documents or as directed.

5.0 BASIS OF PAYMENT

A. General

1. Payments will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown, specified, and in strict accordance with the Contract Documents.
2. The price(s) bid for furnishing and installing sanitary sewer manholes shall include the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.
 - b. Furnishing and installing granular bedding for manhole foundation as shown on the Standard Details and as required elsewhere in the Contract Documents.
3. Payment will be made for contingent items when approved by the Commission.

B. Sanitary Sewer Manholes

Payment for sanitary sewer manholes will be made per each type and size (diameter) of manhole installed. The price(s) bid shall include traffic control, furnishing and installing all precast, masonry, or cast-in-place concrete units, waterproofing, reinforcing bars, ladder rungs, metal frames and covers; all testing; providing an approved spoil site, and disposing of all spoil and excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, and incidental items to complete the manholes.

C. Manhole Drop Connections

Payment for drop connections will be made per type and size constructed as shown, specified, and directed. The price(s) bid shall include furnishing and installing all pipe, fittings, precast concrete, concrete encasement, aggregate and incidental items to complete the drop connection.

D. Miscellaneous Structures

Payment for miscellaneous structures will be made for each structure constructed to limits shown on the Contract Documents and shall be full compensation for furnishing all items necessary to satisfactorily complete the work.

E. Waterproofing

No separate payment will be made for waterproofing, but will be considered incidental to unit prices bid.

F. Interior Lining

No separate payment will be made for interior lining, but will be considered incidental to unit bid price.

****END OF SECTION 02562****