

SECTION 02764

MANHOLE REHABILITATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Repair, rehabilitation, or replacement of deteriorated, leaking, or structurally unsound manholes.
- B. All physically deteriorated, leaking or structurally unsound sanitary sewer manholes, and cleanouts shall be rehabilitated per the provisions of this item. Such manholes shall be rehabilitated by one (1) of the following methods:
 - 1. New manholes constructed of cast-in-place concrete or precast concrete as shown on the plans and stated in the specifications.
 - 2. Rehabilitation by use of a liner. (A liner is defined as an applied or inserted product that improves the structural integrity of the manhole).
 - 3. Rehabilitation by use of a corrosion resistant material. A cementitious liner can be may be applied to the manhole prior to the installation of the corrosion resistant material if stated in the plans.
 - 4. Other rehabilitation work.

1.02 PERFORMANCE REQUIREMENTS

- A. Perform work needed to make manholes structurally sound, improve flow, prevent entrance of inflow or groundwater, prevent entrance of soil or debris, and provide protection against hydrogen sulfide gas attack.
- B. Manufacturer's Product Support.
 - 1. Through the Contractor, manufacturers of wall sealing or lining systems shall submit to Owner's Representative for review and approval a detailed description of the proposed rehabilitation process. Describe surface preparation, independent laboratory test results, mix design procedures and method of controlling uniform thickness.
 - 2. A representative employed by the manufacturer and having technical training in admixture and concrete mix design shall be named and available for consultation by telephone during business hours and on site upon 48 hours notices.
 - 3. Manufacturer's representative on concrete lining systems shall provide technical assistance to concrete batch plant operators to ensure proper usage of dispensing equipment and accurate proportions of admixtures.

1.03 SUBMITTALS

- A. Submittals shall conform to requirements of all sections and provisions of these specifications.
- B. Product Data: Submit product data, including surface preparation instructions and application instructions, from manufacturer of wall repair materials, hydraulic cements, quickset mortars, specialized sealants, and grouts.
- C. Installer Qualifications. Installers of liners and wall repair systems shall submit qualifications to Owner's Representative at least 14 days prior to start of any material application. Submittal shall consist of:
 - 1. Manufacturer's approved equipment list, by name and model number for application of product and contractor's equipment list showing approved equipment available for use in product application.
 - 2. List of contractor's personnel who have satisfactorily completed manufacturer's training in product application within previous two years. Include date of certification for each person.
- D. Progress Photographs:
 - 1. After cleaning and sealing each manhole, submit 3" x 5" color photographs of manhole's interior walls for review by Owner's Representative. Owner's Representative may inspect the manhole before giving approval to begin lining.
 - 2. After liner installation of each manhole, submit a minimum of three additional 3" x 5" color photographs to show final condition of rehabilitated manhole.
 - 3. Provide photographs of sufficient quality and clarity so that interior condition can be readily determined by Owner's Representative.
 - 4. Annotate each photograph. Give date, manhole number, material used, and appropriate remarks on the back using permanent ink.

1.04 PROJECT CONDITIONS

- A. Manholes Containing Mechanical or Electrical Equipment:
 - 1. Drawings may not show locations of flow monitoring equipment. If a manhole contains any mechanical hardware or electrical flow monitoring equipment immediately notify Owner's Representative.
 - 2. Reschedule work in such manholes until equipment has been removed by Owner and further instructions are given.
 - 3. Do not subject manholes with mechanical hardware or electrical equipment to diversion/bypass pumping.
 - 4. Damage to installed equipment, due to negligence of Contractor, will be repaired by Owner and cost of repairs charged to Contractor.

- B. Field Location of Manholes, Cleanouts and Inlets:
 - 1. Contractor is responsible for locating and uncovering all manholes and cleanouts in lines being rehabilitated. If difficulty is encountered in locating a manhole or cleanout covered by ground or pavement, notify Owner's Representative and await instructions.
 - 2. Manholes may be located within project limits which are not part of the system being rehabilitated. Properly identify manholes before starting cleaning and sealing operations.

1.05 SALVAGE

- A. Manhole covers and frames, inlet grates and frames, and adjusting rings from abandoned manholes and inlets remain the property of the Owner. Deliver salvaged items to locations designated by Owner's Representative.

PART 2 PRODUCTS

2.01 WALL CLEANING MATERIAL

- A. High Pressure Water: 3500-psi minimum force.
- B. Cleaners: Detergent or muriatic acid capable of removing dirt, grease, oil and other matter which would prevent a good bond of sealing material to wall. Refer to sealing material manufacturer's recommendations.

2.02 WALL REPAIR MATERIALS

- A. Hydraulic Cements: Use a blend of cement powders or hydraulic cement to stop active leaks in the manhole structure.
- B. Quickset Mortar: Use a quickset mortar to repair wide cracks, holes or disintegrated mortar.

2.03 MANHOLE CEMENTITIOUS LINER

- A. This method consists of spray applying a cementitious mix to the manhole walls and benches on the existing manholes resulting in a monolithic liner having a minimum thickness of 1-inch. The mix(es) shall be batches in accordance with manufacturer's recommendations. Adding water to facilitate application at the nozzle will not be allowed.
- B. Provide preapproved cementitious structural rehabilitation liner material for use as a liner for manhole and to repair and reform manhole benches and inverts. Use a pre-approved cementitious structural manhole rehabilitation material which developed a minimum compressive strength of 3000 psi at 14 days as, tested per the provisions of ASTM C1140. Follow manufacturer's recommended batching and mixing instructions.

C. Select manhole wall liner material from the following list of preapproved products:

1. Permacast CR-9000 (AP/M Permaform)
2. QM-1S (Quadex)
3. Strong Seal-MS-2C
4. Reliner MSP
5. Permacast-MS-10,000 (AP/M Permaform)
6. Emaco S88C

2.04 CORROSION RESISTANT MANHOLE MATERIALS

A. The materials to be utilized in the lining of manholes shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment. Manufacturer of corrosion protection products shall have long proven experience in the production of the lining products utilized and shall have satisfactory installation record

B. The materials shall be applied by an approved certified applicator and must meet the manufacturer's recommendations. Equipment for installation of lining materials shall be high quality grade and be as recommended by the manufacturer.

C. Acceptable 100% Solids Epoxy products are:

1. Raven 405 (RLS Solutions)
2. Mainstay DS-5 (Madewell Products Corporation)
3. Standard Epoxy 4553 (Standard Cement Materials, Inc.)
4. or approved equal.

D. The Contractor shall have manufacturer's representative present on site during the installation of corrosion resistant barrier.

2.05 BENCH FORMING/REPAIR MATERIALS

A. Use corrosion resistant concrete containing microsilica admixtures to repair and reform manhole benches and inverts, as specified in Section 03305.

2.06 MANHOLE COVER, FRAME AND INSERTS

A. See Details on Plan Drawings.

B. Provide manhole inserts including new dish, gasket and relief valves. Select appropriate watertight inserts to fit walls and frames of manholes.

1. Supply inserts as manufactured by Southwestern Packing and Seals, or an approved equal.
2. Inserts shall be stamped with the words, "Property of (Owner's Name)".
3. Provide a frame-to-manhole seal as manufactured by Cretex, or approved equal.

PART 3 EXECUTION**3.01 PROTECTION**

- A. Provide barricades and warning lights and signs for excavations created by manhole or cleanout removal.
- B. Do not allow sand, debris or runoff to enter sewer system.

3.02 EXCAVATION

- A. Excavate in accordance with Section 02227.
- B. Perform work in accordance with OSHA standards. Employ a Trench Safety System as specified in Section 01526 for excavations over 5 feet deep.
- C. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01563.

3.03 BYPASS PUMPING

- A. Install and operate diversion pumping equipment to maintain sewage flow and to prevent backup or overflow in accordance with requirements of the appropriate Section. Obtain approval for diversion pumping equipment and procedures from Owner's Representative.
- B. Design all piping, joints and accessories to withstand twice the maximum system pressure or 50 psi, whichever is greater.
- C. In the event of accidental spill or overflow, immediately stop the overflow and take action to clean up and disinfect spillage. Promptly notify Owner's Representative so that required reporting can be made to the TCEQ and Environmental Protection Agency.

3.04 ABANDONMENT OF CLEANOUTS AND MANHOLES

- A. Abandon cleanouts or manholes designated on Drawing or as directed by the Owner's Representative.
- B. If a manhole is to be abandoned on a rehabilitated line, install a carrier pipe through the structure and fill manhole with cement stabilized sand, compacted to a level 2 feet above top of carrier pipe.
- C. Fill remainder of manhole with selected backfill material to 2 feet below ground level.
- D. Dismantle manhole including frame, to 2 feet below ground level. Fill void to existing ground level with select backfill material compacted to 95% Proctor Density.

- E. If manhole to be abandoned is in a paved street, backfill manhole as described above with cement stabilized sand in lieu of select backfill material.

3.05 MANHOLE WALL CLEANING

- A. The floor and interior walls of the manhole shall be thoroughly cleaned and made free of all foreign materials including dirt, grit, roots, oils, grease, sludge, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the coating to the substrate.
 - 1. High pressure water blasting with a minimum of 3500 psi shall be used to clean free all foreign material within the manhole.
 - 2. When grease and oil are present within the manhole, an approved detergent or muriatic acid shall be used integrally with the high pressure cleaning water.
 - 3. All materials resulting from the cleaning of the manhole shall be removed prior to application of the cement based coating.
 - 4. All loose or defective brick, grout, ledges, steps and protruding ledges shall be removed to provide an even surface prior to application of coating.
- B. Prevent any foreign material from entering the adjoining pipes. Remove droppings of foreign and wall sealant materials before they harden on the bottom of the manhole.
- C. No separate pay shall be made for this item. Include cost for sealing in the unit price for manhole liner.
- D. Manufacturer's representative shall be available at all times on site to answer questions and approve manhole preparation work prior to lining.

3.06 MANHOLE WALL SEALING

- A. Seal active leaks in the manhole structure by using a blend of cement powder or hydraulic cement.
- B. Remove loose or defective wall material. Wipe or brush surface clean prior to the application of hydraulic cements.
- C. Drill weep holes at bottom of manhole walls to relieve hydrostatic pressure to stop leaks. Plug pressure relief holes after leaks are stopped using hydraulic cement materials. Lead wool may also be used to plug large leaks.
- D. Repair wide cracks, holes, or disintegrated mortar with quickset mortars. Follow manufacturer's application procedures.
- E. Reshape manhole inverts before wall sealing work. Apply concrete to cleaned manhole benches as specified in Section 03305.

- F. After all active leaks have been stopped, clean and prepare walls for application of selected liner material.
- G. Properly apply the sealing compound to provide the minimum required uniform coating to the wall surface.
- H. Prevent any foreign material from entering the adjoining pipes. Remove droppings of foreign and wall sealant materials before they harden on the bottom of the manhole.
- I. Strictly follow product manufacturer's published technical specifications and recommendations for surface preparation, application and proportioning.

3.07 CEMENTITIOUS LINER

- A. Apply cementitious liner to a thickness of 1-inch using a steel trowel to provide a smooth, even surface. Finish and cure concrete as specified in Section 03305.
- B. Cementitious liner material may be applied using spray application methods. Use steel trowel to provide a smooth, even surface before final set.

3.08 CORROSION RESISTANT LINER (100% EPOXY)

- A. The corrosion resistant barrier shall be spray applied as per the manufacturer's recommendation and shall have an average minimum finished thickness of 80 mils if applied in conjunction with cementitious liner.
- B. Where corrosion resistant barrier is applied directly to manhole wall, upon cleaning and surface preparation, the average minimum finished thickness of 125 mils.
- C. The Contractor shall have manufacturer's representative present on site at all times during the installation of corrosion resistant barrier.
- D. The Contractor shall make provisions in his unit price bid for each structure to maintain dry conditions for the corrosion resistant liner application and subsequent curing as per manufacturer's recommendations.

3.09 FIBERGLASS LINER

- A. A manhole may be rehabilitated using a fiberglass liner if existing manhole has a minimum 45-inch inside diameter and a depth of at least 4-feet.
- B. Clean manhole and remove corbel section until a 45-inch diameter opening is formed. Owner's Representative may direct Contractor as to amount of corbel or wall to be removed. Do not allow debris to fall into sewer lines.
- C. When calculating depth of a fiberglass manhole, allow for a minimum of 18-inches of adjustment rings to be placed between casting bottom and the manhole top. Set adjustment rings in approved grout or mortar.

- D. Cut the bottom of rehabilitation manhole to fit evenly on benches or chip benches out to evenly support base.
- E. Determine exact location of incoming and outgoing service lines in existing manhole and cut accurate openings for a close fit into manhole.
- F. Place the fiberglass liner manhole concentrically into the existing manhole with the openings aligned with existing sewers. Use spacer guides in annular space between existing and rehabilitation manhole. Seal openings with Oakum soaked in sealing gel.
- G. Use quick-set hydraulic cement around inside base of the fiberglass manhole and inside the annular space for a depth of 6-inches.
- H. Fill the remaining annular space with grout after the hydraulic cement at the bottom has dried. Consolidate grout using a method approved by the Owner's Representative.
- I. After the grout has set, install adjustment rings, FRP liner, frame and cover.
- J. Line rings using a one-piece fiberglass reinforced pipe (FRP). Seal pipe to casting and manhole with sealing compound. Grout annular space between the FRP and adjustment ring.

3.10 MANHOLE BENCHES/INVERTS

- A. Remove obstructions and loose materials from benches prior to shaping the invert. Form a smooth, U-shaped invert having a minimum depth of one-half pipe diameter and channel it across the floor of the manhole using a quickset mortar. Control flow to allow sufficient setting time for material used.
- B. Make finished benches smooth and without defects which would allow for accumulation of debris.

3.11 MANHOLE COVERS AND FRAMES

- A. Adjust manhole frames and covers found above or below grade and reset loose frames. Make adjustments with concrete rings or approved materials. Set frames in a full bed of non-shrink grout and adjust to surrounding grade as specified in the pertinent section. Protect bottoms of manhole from debris or soil during adjustment.
- B. Install watertight manhole covers and frames at locations shown on the Drawings or as instructed by Owner's Representative. Use new frames and covers.
- C. For new sanitary sewer manholes subject to loading or differential movement at manhole frames, and for all rehabilitated manholes, install manhole chimney seals to prevent inflow between manhole frames and masonry chimneys. Refer to Section 02603.

3.12 FIELD QUALITY CONTROL

- A. Inform Owner's Representative immediately if materials being used are not producing required results or need modification. Owner's Representative has the right to stop use of any material at any time.

3.13 INSPECTION

- A. After manhole wall sealing or manhole rehabilitation has been completed, visually inspect the manhole in the presence of Owner's Representative. Check for cleanliness and for elimination of active leaks.
- B. At completion of manhole rehabilitation assist Owner's Representative in verifying installation of minimum coating thickness of concrete liner. Test several points on the manhole wall. Repair verification points prior to final acceptance for payment.
- C. During application of corrosion resistant liner, a wet film thickness gauge, meeting ASTM D4414, shall be used. Measurements shall be taken, documented and attested by the Contractor for submission to the Owner.
- D. At completion of manhole rehabilitation, assist Owner's Representative in inspection of installation, sealing and grouting of fiberglass liner.

3.14 TESTING

- A. Refer to Section 02732 for manhole testing requirements.
- B. A vacuum Manhole Tester, in lieu of infiltration test, may be used if criteria and equipment are approved by Owner's Representative.
- C. After the coating product(s) have set in accordance with manufacturer instructions, all surfaces shall be inspected for holidays with high-voltage holiday detection equipment. Reference NACE RPO 188-99 for performing holiday detection. All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional coating can be hand applied to the repair area. All touch-up/repair procedures shall follow the coating manufacturer's recommendations. Documentation on areas tested, results and repairs made shall be provided to Owner by Contractor.
- D. Visual inspection shall be made by the Owner's Representative. Any deficiencies in the finished coating shall be marked and repaired according to the procedures set forth herein by Contractor.

3.15 BACKFILL

- A. Backfill and compact soil in area of excavation surrounding manholes in accordance with Section 02227.

- B. In unpaved areas, grade surface at a uniform slop of 1 to 5 from the manhole frame to natural grade. Provide a minimum of 4 inches of topsoil conforming to requirements of Section 02920 and either seed according to Section 02932 or sod according to Section 02935, as required.

END OF SECTION