



WASTEWATER DEPARTMENT
STANDARD SPECIFICATIONS

SECTION 405
MANHOLE REHABILITATION

JANUARY 1, 2018

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405.01 GENERAL**A. Description**

1. Provide all materials, equipment, labor and incidentals for the installation and testing of the manhole rehabilitation lining product.
2. The manhole shall consist of spray applying a cement-based material to the walls, inverts, and benches of the existing sanitary sewer manhole.
3. The manhole rehabilitation product shall cure to a water tight system and a minimum thickness as described herein.

B. References

Standards referenced in this Section are listed below:

1. ASTM C-109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
2. ASTM C-293 - Standard Test Method for Flexural Strength of Concrete.

C. Qualifications

The CONTRACTOR shall have a minimum of three years of continuous experience installing the product proposed for this project. Additionally, the CONTRACTOR shall have successfully completed rehabilitation of 250 manholes using the proposed product on manholes of similar installation conditions as this project. The CONTRACTOR shall provide experienced crews using the product proposed and installed under the same installation conditions as this project.

D. Delivery, Storage, and Handling

1. Store materials to prevent physical damage and in accordance with manufacturer's recommendations.
2. Protect materials during transportation and installation to avoid physical damage and in accordance with manufacturer's recommendations.

E. Quality Control

1. No change of material, design values, or procedures may be made during the course of the Work without the prior written approval of the ENGINEER.

2. All test results shall be provided by an independent, certified ISO 17025 testing facility.

F. Warranty

1. All lining work shall be fully guaranteed by the CONTRACTOR for a period of 5 years from the date of Final Acceptance unless otherwise stipulated in writing by the OWNER. During this period, all defects discovered by the OWNER or ENGINEER shall be addressed by the CONTRACTOR in a satisfactory manner at no cost to the OWNER. The OWNER may conduct independent inspections, at its own expense, of the lining Work at any time prior to the completion of the guarantee period.
2. The five (5) year warranty shall be backed by a two (2) year warranty bond and a five (5) year Manufacturer's warranty letter. The five (5) year Manufacturer's warranty letter shall be supplied on the Manufacturer's letterhead and specifically state the project name and OWNER's name and shall not contain any exclusion of activities in the manhole or sanitary sewer system.

G. Submittals

1. Submit manufacturer's product data for design mix with installation instructions for proprietary materials including reinforcement and forming accessories, admixtures, joint materials, hardeners, curing materials and others as requested by ENGINEER.
2. Submit 2 copies of laboratory test or evaluation reports for concrete materials and mix designs as requested by ENGINEER.
3. Submit 2 copies of CONTRACTOR Certification and Material Certification as requested by ENGINEER.
4. Submit documentation of post construction testing as requested by ENGINEER.

405.02 PRODUCT

A. Design Requirements

1. Cement-Based Rehabilitation
 - a. The work consists of rehabilitation of sanitary sewer manholes by spray applying a proprietary pre-blended mixture of acid-resistant calcium

aluminate cement-based material to the walls, inverts, and benches of sanitary sewer manholes, resulting in a monolithic liner with a minimum thickness of 1/2-inch (500 mils).

- b. The thickness shall be increased in accordance with the manufacturer's recommendations to account for the dimensions and existing condition of the manhole and to withstand the forces arising from the manhole's specific depth and service conditions including groundwater hydrostatic pressures and traffic loading.
- c. Where the level of the water table is not known, it shall be assumed that the water table level is equal to the grade elevation surrounding the manhole being rehabilitated.
- d. The water used for the rehabilitation process shall be clean and potable.
- e. No other material shall be used or added to mixture without prior approval by the OWNER.
- f. The applicator, approved and trained, shall furnish all labor, equipment and materials for installing the lining over brick, tile, pre-cast concrete, or concrete block manholes, new or used, using approved equipment.
- g. The installation shall be in accordance with the Contract Specifications along with manufacturer's recommendations.
- h. Where the manufacturer's installation and testing recommendations are more stringent than the following Contract Specifications, the manufacturer's recommendations shall control.
- i. The material shall be a proprietary pre-blended mixture of acid-resistant calcium aluminate cement, chemically-active aggregates, and other additives specifically selected for special properties specifically designed for sanitary sewer applications.
- j. Physical Properties

Minimum Compressive Strength, ASTM C-109	7,000 psi at 28 days
Minimum Flexural Strength, ASTM C-293	1,200 psi at 28 days
Minimum Bond Strength, ASTM C882	2,000 psi
- k. The liner mix shall be made with manufacturer's recommendations for sanitary sewer manhole applications.

2. Approved Products
 - a. STRONG-SEAL HIGH PERFORMANCE MIX
 - b. QUADEX ALUMINALINER
 - c. SEWPERCOAT 2000 HS REGULAR
 - d. PERMAFORM CR-9000

405.03 EXECUTION

A. Preparation

1. Safety

The CONTRACTOR shall perform all Work in strict accordance with all applicable OSHA regulations. Each method of manhole rehabilitation in this section requires some degree of manhole entry by workers. Particular attention is drawn to those safety requirements regarding confined space entry and respiratory protection from airborne particulate materials during cleaning and product mixing and application.

2. The CONTRACTOR shall place covers over invert before prepping. All concrete and masonry surfaces to be rehabilitated shall be cleaned prior to applying any lining system. All grease, oil, laitance, coatings, loose bricks, mortar, unsound brick or concrete and other foreign materials shall be completely removed. Methods such as wet or dry sandblasting, concrete cleaners, degreasers, or mechanical means may be required to properly clean the surface. All surfaces on which these methods are used shall be thoroughly rinsed, scrubbed, and neutralized to remove cleaning agents and their reactant products. Debris resulting from cleaning shall be removed from the manhole and not allowed to be carried downstream.

3. The CONTRACTOR shall be responsible for plugging or diverting the flow of wastewater as needed for manhole rehabilitation. Diverting the sanitary sewage to perform the required rehabilitation shall be incidental to the manhole rehabilitation.

4. Stopping Infiltration

- a. The CONTRACTOR shall use hydraulic cement to stop infiltration at each identified point of leakage into the manhole. If the flow of water into the manhole is too great for stoppage utilizing hydraulic cement, the CONTRACTOR shall drill holes at each point of leakage that extend through the manhole wall. Chemical sealant injection devices shall be placed into the drilled holes in a manner to provide a watertight seal between the holes and the injection device.

- b. Hoses shall be attached to the injection devices from an injection pump. A mixture of manhole chemical sealants shall then be pumped until material refusal is recorded on the pressure gauge of the pumping unit. The CONTRACTOR shall ensure that excessive pumping pressures do not develop that may cause damage to the manhole walls.
 - c. Once the injection of the chemical sealants have been completed, the injection packers shall be removed and the holes shall be filled and troweled flush with the surface of the manhole wall using a fast-set non-shrinking grout.
 - d. Excessively leaking manholes requiring chemical sealants will be considered additional manhole preparation. The CONTRACTOR must notify and receive approval from the OWNER before additional preparation begins. Additional manhole preparation without approval from the OWNER will be considered incidental to the Work. Payment for this item shall be at unit price bid only after the event that normal leak stoppage methods are not effective and it is approved by the OWNER.
5. Loose material shall be removed from the area to be patched exposing a sound sub-base. Holes or voids around steps, joints or pipes, spilled areas, and cavities caused by missing or broken brick shall be patched and missing mortar repaired using a nonshrink patching mortar conforming to the requirements of this section. Cracks not subject to movement and greater than 1/16 inch in width shall be routed out to a minimum width and depth of ½ inch and patched with nonshrink patching mortar conforming to the requirements of this section. Bench repair and patching of walls is considered incidental to manhole preparation for liner application.
6. All manholes which have exposed cured-in-place or deformed/reformed pipe segments in the manhole invert channel shall require the use of a concrete bonding adhesive prior to the spray application of the cementitious manhole liner. The bonding agent shall be any synthetic emulsion specifically formulated for bonding new concrete to existing surfaces. The bonding agent shall be mixed and applied in accordance with manufacturer's recommendation.
7. All incoming or outgoing pipes shall be plugged or otherwise protected during liner application to prevent clogging.
8. Manhole steps shall be removed prior to the rehabilitation of the manhole. The steps may be removed by cutting with a torch or abrasive saw flush

with the wall of the manhole. No separate measurement or payment will be made for removal of the manhole steps.

B. Spraying

1. The surface prior to spraying shall be damp without noticeable free water droplets or running water. Material shall be spray applied to a minimum uniform thickness to insure that all voids and crevices are filled and a smooth.
2. The application of the liner shall provide a monolithic liner of a minimum of $\frac{1}{2}$ ". The liner shall be applied to the invert, bench and wall and shall all be equal in thickness as determined by the water table and the product manufacturer. The manhole invert and bench shall be smooth and sloped in the direction of the flow. The manhole bench shall have a gradual slope to the invert. The invert transition to the pipe shall be smooth and shall not impair the flow.
3. No application shall be made when ambient temperatures are less than 40°F and when freezing is expected within 24 hours unless specific recommendations are made by the manufacturer.
4. A minimum of 4 hours cure time or more as required by the product manufacturer shall be allowed before returning to active flow. A minimum of an additional two (2) hours of cure time shall be added if the rehabilitated manhole is subject to flows from force mains.

C. Acceptance

1. Two standard samples shall be taken from each day's work with the date, location and job recorded for each sample. The samples shall be sent to an established, local, and reputable commercial testing laboratory that has been approved by the OWNER to determine if lining materials meet minimum requirements specified herein. The cost to perform these tests shall be incidental to the manhole rehabilitation.
2. Vacuum Testing shall be in accordance with Section 400, Inspection and Testing when required by the ENGINEER.