
TECHNICAL SPECIFICATIONS
SEWER MANHOLE REHABILITATION SYSTEM
WITH A PROTECTIVE CEMENT LINER AND
HIGH BUILD EPOXY COATING
(As Provided by Standard Cement Materials)

FOREWORD

The following specification describes the work, materials and equipment for restoring structural integrity, eliminating water infiltration and exfiltration and the application of a monolithic, cement liner and high build epoxy coating system to provide corrosion protection in a sewer manhole. This system is applicable to lift station wet well chambers, concrete pipe, sumps and junction boxes.

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements for cleaning, surface preparation, applying structural cement and applying an epoxy coating system to the sewer manhole wall surfaces.

1.02 RELATED SECTIONS

- A. Concrete repair.

1.03 REFERENCES

- A. ASTM C 150 Standard Specification for Portland Cement.
- B. ASTM C 595 Standard Specification for Blended Hydraulic Cements.
- C. ASTM C 39-86 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- D. ASTM C 496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
- E. ASTM C 78 Standard Test Method for Flexural Strength of Concrete; Using Simple Beam with Third Point Loading.
- F. ASTM C 267 Standard Test Method for Determining the Chemical Resistance of Grouts and Mortars.
- G. AASHTO T277 Rapid Determination of the Chloride Permeability of Concrete.
- H. ASTM D 4541-89 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- K. ASTM C 33-86 Standard Specification for Concrete Aggregates.
- L. ASTM C 494-86 Standard Specification for Chemical Admixtures for Concrete.

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M. ASTM C 260-86 Specification for Air-Entraining Admixtures for Concrete.

N. ACI 201.2R-93 Guide for Durable Concrete.

1.04 SUBMITTALS

A. Submit the following information to the engineer:

1. Technical product data, including brand name and manufacturer for each product. Provide laboratory test results verifying the cements 28-day compressive strength in accordance with ASTM C-39 or ACI 318.
2. The manufacturer shall provide satisfactory test results that demonstrate conformance to ASTM C 267, Chemical Resistance of Mortars, Grouts and Monolithic Surfacing.
3. Product Certification stating the chloride ion content of the cement material.
4. Provide a list of similar sewer manhole rehabilitation projects with five years of history. Include the Owner and Engineer's name and the project date.
5. The contractor shall furnish all of the labor, equipment and materials. The application equipment shall be capable of spraying the cement and epoxy materials as required by the manufacturers printed recommendations.

1.05 QUALITY CONTROL

A. Provide a procedure that meets applicable ASTM, NACE and SSPC inspection standards and quality assurance control that meet the manufacturers procedure. The engineer shall approve the procedure before start up.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store the materials in a dry area and protect from weather. Protect the cement and epoxy coating materials, store between 50° F and 90° F. Keep open flame away.

1.07 WARRANTY

A. The applicator shall guaranteed the work to be free of defects in materials and workmanship for one-year period, unless otherwise stated, after completion and acceptance of the work. The applicator shall repair defects in materials or workmanship, which may develop during the one-year period; and any damage to other work caused by such defects or discovered within the same period at no additional cost to the owner will.

PART 2 - PRODUCTS

2.01 CONCRETE SUBSTRATE

A. Remove all existing coatings before applying the new protective epoxy coating. The applicator shall maintain a strict surface preparation procedure that is suitable for top coatings and provide the greatest compatibility with the epoxy coating. The applicator will adhere to all applicable ASTM, NACE and SSPC guidelines for proper surface preparation.

- B. Generally, the protective epoxy coating manufacturer shall make all recommendations for accelerated epoxy coating application, use LG 68 Heavy Duty Concrete Cleaner to etch the concrete or new cement liner in this case.

2.02 MANUFACTURER

- A. Standard Cement Materials, Inc., Houston Texas. 1. 888. 278.1337 or Fax 713. 680-1017.
- B. A manufacturers representative shall be available for consultation by telephone or on site upon 48-hour notice.

2.03 MATERIALS

- A. Use the monolithic cement liner and high build epoxy coating system to repair, fill voids, and provide structural restoration and integrity, eliminating water infiltration and exfiltration and corrosion protection. The repair materials must be compatible with the specified epoxy coating.
- B. The following products are approved for use as specified:

- 1. Use the Reliner MSP™ Cement. A high strength, factory blend of finely divided cementitious and pozzolanic materials, a microsilica-based admixture ingredient, polypropylene fibers and other admixtures that enhance workability during placement.

Physical Properties:

Portland cement, Type I or II		ASTM C-150, C-595
Compressive Strength:		
1 day	2000	ASTM C-39
28 day	6000	ASTM C-495
Split-Tensile	500	ASTM C-496
Flexural	650	ASTM C-78
Bond	150	ASTM D- 4551*
Adhesion	150	ACI 503R
Sulfate Resistance:		
90 day	+0.26	ASTM C-267
Water to cement ratio		0.36

- 2. Use the Standard Epoxy Coating 4553™, 100% solids, solvent-less two-component epoxy coating system with increased bond strength and board range chemical resistance. Use it to protect concrete, steel, masonry and Fiberglass structures in moist and damp environments. Apply a maximum of 40 mils in two applications over a smooth horizontal, vertical or overhead surface. The recommended coverage's will vary from 30 to 60 mils depending on the application. Contact Standard Cement Materials Inc, Houston, Texas for information.

Adhesion to:		<u>psi</u>
Concrete	ASTM D 4541-02	Substrate failure
Steel	ASTM D 4541-02	1000

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2.04 PROTECTIVE COATING APPLICATION EQUIPMENT

- A. Use a plural component spray pump designed specifically for this purpose. Spray apply the mixed Standard Epoxy Coating 4553™ to the specified thickness.

PART 3 - EXECUTION

3.01 REPAIR PROCEDURE

- A. The applicator shall bear complete responsibility for cleaning the structure, stopping all minor water infiltration, mixing of the materials, applying and finishing of the repair system. The work activity and material storage shall be limited to the repair area. All additional work in the adjacent streets and material installation and removal of line plugs shall be performed as shown on the drawings.

- 1. The applicator shall comply with all local; state and OSHA confined space entry requirements.

- B. The Contractor will take the appropriate action to lower the water flow below the surface to be coated, provide all large diameter line plugs, blocks, restraints and discharge lines for controlling and diverting the water flow into the influent line.

3.02 CLEAN THE SEWER MANHOLE

- A. Clean the sewer manhole to a clean sound surface. Use a high-pressure water washing or wet abrasive sand blasting, use 3500-psi water pressure, minimum. Use an acceptable cleaning procedure to achieve a sound profile. Remove dirt, oil, loose concrete, any previously applied coatings or other deleterious materials. The manhole structure may require cleaning, inspection, proper replacement or preparation of the steel reinforcement, structural crack repair, stopping water leaks and joint treatment. Remove all of the corroded cement mortar that has a light white tint color or which has experienced excessive erosion and deterioration greater than 1 inch. The cleaned surface profile shall be restored using the Reliner MSP™ Cement, as specified in this specification. Contact Standard Cement Materials, Inc. for more help with repair materials, selecting cleaning equipment or inspection services.

- B. After all the preparations have been completed, repair or fill any damaged areas or large voids in the concrete.

3.03 REPAIR MATERIALS

- A. Fill or repair all voids and irregularities at least one hour prior to applying the Reliner MSP™ Cement. Use the Fast Set Bench Repair Cement patcher, FSR, a non-metallic shrink compensating grout. A cement patcher that sets in about fifteen minutes and reaches final set in thirty minutes.

- 1. Hand mix and apply the Fast Set Bench Repair Cement patcher for filling voids and making repairs in concrete and masonry walls. Mix a small amount of the Fast Set

Bench Repair Cement patcher with cold water to the consistency of pancake batter. Brush the neat mixture over the area as a "primer". Carefully work the primer into the surface pores and voids. Then mix additional FSR Cement patcher to the consistency of soft putty to fill the void. Mix thoroughly for one minute, work quickly, the FSR Cement patcher begins to stiffen in about six to eight minutes. Apply by hand or with a trowel, level and smooth the patch. Keep the patch damp by spraying lightly with water or by covering with a damp cloth for at least one hour. Protect the mortar from wind changes, freezing and temperature extremes.

B. Hydraulic Cement

1. Use CUSTOM PLUG Hydraulic Cement to stop all active water leaks. Use a rapid setting hydraulic cement product specifically designed for that purpose. If the water leak continues, contact your Standard Cement Materials representative for help in selecting the right product to stop the leak.

C. Chemical grout

If the leak persist and is difficult to stop, use an acceptable chemical grout to stop the water infiltration. Contact your Standard Cement Materials representative for more help in selecting the correct grout to stop difficult leaks.

3.04 MIXING THE CEMENT MORTAR

- A. Mix the Reliner MSP™ Cement in accordance with the manufacturers printed data. The manufacturer shall provide a source for consultation throughout the application of the manhole liner system.

B. Follow the manufacturers mixing, sampling and testing procedures as described in ASTM C 94 specification for Ready Mixed Concrete.

3.05 MIXING THE EPOXY CORROSION BARRIER

- A. Charge the epoxy coating spray pump.

1. Fill the spray pumps storage bins with the epoxy components. The liquid Standard Epoxy Coating 4553™ is a 2:1 component, Activator Compound at 1-gallon and Base Compound at 2-gallons. Use a plural component spray pump designed specifically for this purpose.

3.06 APPLICATION OF CEMENT LINER

- A. Dampen the repair areas, but allow no running water. Spray apply the Reliner MSP™ Cement liner to a minimum ½ to 5-inch thickness. Compact the cement into all of the remaining voids and crevices. Measure the cement liner depth to insure that the desired thickness has been applied. Finish with a stainless steel trowel to a smooth or brush finish surface. Apply the cement liner down from the top, along the walls to the floor. Spray apply in such a manner so as to produce an even surface. Produce a cove finish at the wall to the ceiling and floor interface. Contact the manufacturer for recommendations when more than 24 hours have passed between starting and finishing the application.

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- B. No application shall be made when ambient temperatures are less than 40 degrees F and when freezing temperature is expected within 24 hours. If the ambient temperature is in excess of 90 degrees F; precautions shall be taken to keep mixing water below 85 degrees F. Use ice if necessary.

3.07 APPLICATION OF PROTECTIVE EPOXY COATING SYSTEM

- A. The protective epoxy coating shall be applied by a trained certified applicator. The applicator shall furnish all of the labor, equipment, materials and application as required by the manufacturer.
- B. Coat the specified surface with a moisture tolerant, solvent-less, 100% solids, self-priming epoxy protective coating as described herein. Spray apply the mixed Standard Epoxy Coating 4553™ material to a nominal wet film thickness range of 40 mils, DFT. Apply the epoxy coating over the Reliner MSP Cement as soon as possible. Contact your Standard Cement Materials representative for details about spray equipment. Use a systolic piston pump designed specifically for this purpose.
 - 1. To avoid damage to the uncured epoxy coating, keep all pipe penetrations plugged for a minimum of 4 to 8 hours after the coating installation.
 - 2. Allow the finished process to cure 8 to 24 hours before being subjected to active flow. Follow the manufacturers recommendations.

3.08 CURING

The ambient temperature and condition in the sewer lift station wet well is usually adequate for curing the wet cement. However, for the best curing, place wet damp curing blanket, lid, wind shade, an impervious cover or use a high molecular weight curing compound over the mortar to protect it from the heat, wind changes or extremes. Keep the epoxy corrosion barrier coating system dry and clean up to 8 hours.

A. Hot Weather Placement

- 1. Avoid any potential problems due to shrinkage cracking. Follow ACI 302 "Guide for Concrete Floors and Slab Construction" and ACI 308 "Standard Practice for Curing Concrete" to minimize decreased bleeding problems. Protect the cement liner material from dry, hot, severe weather extremes and freezing. If the ambient temperature is equal to 70 degrees F, or in excess of 90 degrees F, then take precautions to keep the mixing water cool. Cool the water to a temperature equal to or below 70 degrees F. Use an auxiliary ASTM C 494, Type A, D or F and G cement admixture, block ice or other means if necessary. Follow the manufacturers recommendation for placement and the use of any auxiliary admixtures.

No application shall be made when the ambient temperature is less than 40 degrees F and when freezing temperature is expected within 24 hours. Protect the finished cement. Wet cure immediately, cover with plastic sheets or use an acceptable liquid membrane-forming curing compound, ASTM C 309. The curing compound shall contain minimum 25% solids and prevent a maximum loss of water up to 0.4-kg/ cubic meters in 72 hours. Spray apply, roll or brush the curing compound while the cement is still in a soft workable state. Apply in accordance with the manufacturer's recommendation.

This repair process can be stopped and restarted as job conditions allow. All washed out areas should be allowed to cure 24 hours, clean and coat again with the Reliner MSP™ Cement liner material. The Sewer Manhole Rehabilitation System® is acceptable for day, nighttime or continuous 24-hour work schedules.

3.09 TESTING AND INSPECTION SECTION

A. SAMPLING

1. Use a shotcrete panel as per ASTM C-1140 or as specified by the contractors document for testing compressive strength. Make one panel from each day's work. Label the panel with the date, location, project and product batch numbers on each one. The product batch numbers are located on each cement bag. Testing shall be according to ASTM C 39. Send the panel to a third party laboratory or the manufacturer for verification. Test in accordance with Test Method C-1140. Test the cement material for 7 and 28-day periods. Retain one sample for further instructions should the others fail to meet the 28-day test requirement.

B. INSPECTION

1. Each structure will be visually inspected the same day following the application of the repair liner and epoxy coating.
2. The Contractor will be required to use an Engineer approved third party inspector to inspect the completed lining system the next day. Use a NACE accredited inspector or the manufacturer's representative. Check for holidays and voids. Up on final completion of the work, the manufacturer will provide a written certification to the Engineer. The certification will confirm that the repair materials were applied per the manufacturer's recommendations. Contact your Standard Cement Materials representative for more help with the inspection services.
3. All remaining water leaks, which are detected, will be chipped back, plugged, lined with cement and coated immediately with the protective epoxy coating. Allow any areas that have been repaired to cure for 24 hours.

PART 4 - BASIS OF PAYMENT

- A. Payment shall be based on the Contract Unit Price per structure coated as indicated in the Rehabilitation Section Schedule. The Contract Unit Price shall be payment in full for performing the work and for furnishing all labor, supervision, materials, equipment and all the testing necessary to complete the work.

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END OF SECTION