Specification for Applying A Protective High Build Epoxy Coating to a Concrete Sewer Manhole

FOREWORD

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

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Requirements for cleaning, surface preparation 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 638	Tensile Strength of Plastics.
I. ASTM D 695	Compressive Strength of Rigid Plastics.
J. ASTM D 790	Flexural Strength Properties of Un-reinforced and Reinforced Plastics.
K. ASTM D 2240	Standard Test Method for Durometer Hardness, Type D.
L. ASTM D 4060	Standard Test Method for abrasion Resistance of Organic Coatings by the Taber Abraser.

M. ASTM D 4541-89	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
N. ASTM D 543	Standard Practice for Evaluating the Resistance of Plastics to Reagents.
O. ASTM G 20	Standard Test Method for Chemical Resistance of Pipeline Coatings.
P. ASTM C 33-86	Standard Specification for Concrete Aggregates.
Q. ASTM C 494-86	Standard Specification for Chemical Admixtures for Concrete.
U. ASTM C 260-86	Specification for Air-Entraining Admixtures for Concrete.
R. ACI 201.2R-93	Guide for Durable Concrete.
S. NACE	National Association of Corrosion Engineers (NACE International) Published Standards.
T. NACE	Steel Structure Painting Council Published Standards.

1.04 SUBMITTALS

A. Submit the following information to the engineer:

1. Technical data for each product, including brand name and product manufacturer.

2. Provide a reference list of similar sewer manhole rehabilitation projects with five years of history. Include the Owner and Engineer's name and the project date.

3. Provide a certification that demonstrates the applicator is trained and approved by the manufacturer to apply the epoxy materials. The applicator shall furnish all of the labor, equipment and materials. The application equipment shall be used as specified.

1.05 QUALITY CONTROL

A. Use a procedure that meets applicable ASTM, NACE and SSPC inspection standards and provide quality assurance controls that meet the manufacturers printed recommendations.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store the materials in a dry area and protect from weather. Protect the epoxy coating materials, store between 50° F and 90° F. Handle each product according to the material safety data sheets, MSDS. Keep open flame away.

1.07 WARRANTY

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

PART 2 - PRODUCTS

2.01 CONCRETE SUBSTRATE

A. Cure the concrete prior to applying the epoxy coating system.

1. Use a factory blended, rapid set (system compatible) cement based patching mortar that is suitable for making repairs with the specific epoxy coating system. Apply the trowel grade or spray applied patching mortar according to the manufacturers' recommendation.

B. Remove all of the old existing coatings before applying the new epoxy coating. The applicator shall provide a strict surface preparation procedure that is suitable for the new epoxy coating. The applicator will adhere to all applicable surface preparation guidelines.

2.02 MANUFACTURER

A. Standard Cement Materials, Inc., Houston Texas. 1. 888. 278.1337 or Fax 713. 680-1017.

B. The manufacturer shall provide a written certification that exhibits the applicator is approved to apply system. A manufacturers representative shall be available for two-days of on-site consultation or by telephone upon 48-hour notice.

2.03 REPAIR MATERIALS

A. Use the Fast Set Bench Repair Cement patcher to repair, fill bug-holes and voids, and provide structural restoration before applying the high build epoxy coating system.

B. Use the Protective Coating Material as specified:

1. Standard Epoxy Coating 4553™, a 100% solids, solvent-less two-component epoxy resin-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.

Property		psi
Product type		Amine cured epoxy
Mix ratio		2:1
Compressive	ASTM D 695	9,200
Flexural	ASTM D 790	8,700
Tensile:	ASTM D 638	5,400
Tensile Elongation		5.9 %
Hardness, Shore D	ASTM D 2240	85
Taber Abrasion:		
CS 17 Wheel	ASTM D 4060	< 30.3 mg loss
Adhesion to:		
Concrete	ASTM D 4541	Concrete substrate failure
Steel (SSPC-10)	ASTM D 4541	> 1,250 psi

Corrosion Resistance	
Suitable = .5 pH:	
30% sulfuric acid	No effect
50% sulfuric acid	No effect
Temperature Resistance	200 degrees F

2.04 PROTECTIVE COATING APPLICATION EQUIPMENT

A. Use a heated plural component spray pump equipment 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 epoxy coating 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 applicator will take the appropriate action to lower the water flow level below the surface to be coated, provide all of the line plugs, blocks, restraints and discharge lines for controlling or diverting the water flow into the influent line.

3.02 CLEAN THE SEWER MANHOLE

A. Clean the Existing Concrete Wall:

Clean and prepare each surface to be coated as specified or according to the manufacturer's instruction. Use a non-diluted, bio-degradable heavy duty concrete cleaner to clean the concrete surface, high pressure washing technique or an abrasive sand blast process to clean and remove any previously applied cement paste, concrete patches, epoxy coatings or special paints. Remove all efflorescence, chalk, loose or dry cement laitance, discolored cement mortar, and dust, grease, oils or release agents. Continue the cleaning process to produce an exposed aggregate profile. Clean the surface as recommended by the epoxy coating system manufacturer. Contact Standard Cement Materials, Inc, Houston Texas for technical assistance with the installation procedure for the coating system.

Use 3,500-psi minimum water pressure to clean the surface. Remove all the deleterious materials. Collect and remove all of the debris and foreign materials.

The cleaned surface profile shall be repaired, leveled and smoothed using the FSR™ Cement patcher. Contact Standard Cement Materials, Inc. for more help with repair materials, selecting cleaning equipment or inspection services.

1. Use an approved Heavy Duty Concrete Cleaner to clean and the surface.

2. Clean Steel Items:

Blast clean all the exposed or embedded steel surfaces and items in such a manner as to produce a near white condition conforming to NACE International

Surface Preparation Standard No. 2. Verify the clean surface, by comparison, with the NACE Visual Standard for the blast media and equipment used. Remove all laminations, protrusions and steel splinters in the steel, weld pits and pockets.

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 with 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. Repair any cracks and water leaks in the wall:

Hand mix and apply the Fast Set Bench Repair Cement, FSR, 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 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.

2. Chemical grout

If the leaks persist, 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 APPLICATION OF PROTECTIVE EPOXY COATING SYSTEM

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 pump designed specifically for this purpose.

a. Spray apply the mixed Standard Epoxy Coating 4553™ material to a nominal wet film thickness range of 40 mils, DFT. in a single pass. Employ a spray pattern of multiple thin passes applied at a right angle to the previous one. Check frequently to achieve a wet film thickness of 20 to 25 mils, or until a repeatable, cross hatched pattern of application is established.

Safety precautions related to the use of an airless sprayer shall be fully observed at all times. Be careful to include the use of a plastic tip guard on

the spray gun. Use only suitable high-pressure hoses and fittings. Remember to depressurize the spray pump and hoses whenever unattended.

Keep all pipe penetrations plugged for a minimum of four hours, at 75 degrees, after applying the epoxy coating. Protect the uncured epoxy coating from water damage. An approved certified applicator shall apply the protective epoxy coating. The applicator shall furnish all of the labor, equipment, materials and application as required by the manufacturer.

C. Coat the specified surface with a moisture tolerant, solvent-less, 100% solids, self-priming epoxy coating as described herein. Apply the epoxy coating over the concrete as soon as possible. Contact your Standard Cement Materials representative for details about spray equipment.

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.

3.05 CURING

The ambient temperature and condition in the sewer lift station wet well is usually adequate for curing. Protect it from the heat, wind changes or extremes. Keep the epoxy coating system dry and clean for a minimum of 8 hours.

3.06 INSPECTION SECTION

A. INSPECTION

1. Visually inspect each structure the same day following the application of the epoxy coating.

2. The Contractor will be required to use an Engineer approved third party inspector to inspect the completed lining system. Use a NACE accredited inspector or the manufacturer's representative. Check for holidays and voids. Upon final completion of the work, the manufacturer will provide a written certification to the Engineer. The certification will confirm that the epoxy coating materials were applied per the manufacturer's recommendations. Contact your Standard Cement Materials representative for more help with the inspection services.

3. Any water leaks, or blisters will be chipped back, plugged and coated immediately with the epoxy coating. Allow the repair areas to cure for 4 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