



Designation: F2551 – 09

# Standard Practice for Installing a Protective Cementitious Liner System in Sanitary Sewer Manholes<sup>1</sup>

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## INTRODUCTION

A sanitary sewer manhole may be repaired or rehabilitated by applying a prepackaged cementitious liner to the interior surface after it has been properly prepared and cleaned. Sanitary sewer manholes can be damaged by dynamic loading, abrasion, erosion, and corrosion.

### 1. Scope

1.1 This specification describes all the work required to structurally reinforce, seal, and protect sanitary sewer manholes. Applications include applying a prepackaged cementitious liner that can function as a full depth restoration or a partial depth repair. A uniform high-strength, fiber-reinforced cementitious mortar should be manually sprayed and hand troweled or centrifugally cast in a uniform, prescribed thickness to all cleaned, interior surfaces from the bottom of the frame to the bench. The cementitious liner may be applied to manholes constructed of brick, concrete, block, and various other materials.

1.2 A manufacturer's approved applicator shall furnish the complete application of the protective, prepackaged cementitious liner material. All of the cleaning, preparation, and application procedures shall be in accordance with the manufacturer's recommendations.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Manholes are permit required confined spaces in accordance with OSHA definition and should be treated as such, requiring confined space entry permits, appropriate monitoring equipment, and the associated personal protective equipment.*

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee F36 on Technology and Underground Utilities and is the direct responsibility of Subcommittee F36.20 on Inspection and Renewal of Water and Wastewater Infrastructure.

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### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens

C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)

C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete

C494/C494M Specification for Chemical Admixtures for Concrete

C969 Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

C1140 Practice for Preparing and Testing Specimens from Shotcrete Test Panels

C1244 Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill

C1315 Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

F2414 Practice for Sealing Sewer Manholes Using Chemical Grouting

#### 2.2 ACI Standards:<sup>3</sup>

ACI 301-05 Specifications for Structural Concrete

ACI 305R-99 Hot Weather Concreting

ACI 306R-88 Cold Weather Concreting

ACI 308R Practice for Curing Concrete

ACI 506R Guide to Shotcrete

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, <http://www.concrete.org>.

### 2.3 ICRI Technical Guidelines:<sup>4</sup>

**Guideline No. 03732** Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

**Guideline No. 03737** Guide for the Preparation of Concrete Surfaces for Repair Using Hydro-demolition Methods

## 3. Ordering Information

3.1 *Submittals*—Orders for all prepackaged materials listed under this practice shall include the following:

3.1.1 Product data, including manufacturer and brand name;

3.1.2 Technical data stipulating physical characteristics of applied liner material; and

3.1.3 Manufacturer's Safety Data Sheets.

3.2 *Delivery, Storage, and Handling:*

3.2.1 The prepackaged cementitious materials should be stored according to the manufacturer's recommendations. No modification should be made to the manufacturer's recommendations for handling and delivery of these products.

## 4. Materials and Manufacture

4.1 All prepackaged materials shall be designed, manufactured, and intended for sewer manhole rehabilitation and the specific application in which they are used. Each material shall be designed for application over damp surfaces without degradation of the final product or the bond between the product and the manhole surface.

4.2 *Materials for Substrate Repairs*—All voids and irregularities of the substrate should be filled or repaired with structurally sound materials before applying the cementitious liner material.

4.2.1 *Cementitious Repair Materials*—Hand mix and apply for filling voids and reforming benches and resurfacing the brick, concrete walls, and bench surfaces of the sewer manhole. Mix the cement repair material and apply according to the manufacturer's instructions. The cementitious liner material can be used as the repair material.

4.3 *Infiltration Water Control Materials*—Specifically formulated for stopping water leaks and minor infiltration.

4.3.1 *Cementitious Water Control Materials*—Used to stop flowing water leaks in concrete and masonry structures. This material may be applied in dry form directly to the leak area or mixed with potable water to a soft putty consistency for larger active leaks. This material is held in place until it sets and the leak stops. Mix and use according to the manufacturer's instructions.

4.3.2 No modification should be made to the products recommendations for handling, mixing, placing, and finishing without the manufacturers prior written approval.

4.4 *Chemical Grout Material*—To stop water leaks and infiltration with chemical grout, refer to Practice **F2414**.

4.5 *Lining Material*—Prepackaged cementitious lining materials are specifically designed to repair or rehabilitate sewer manhole.

<sup>4</sup> Available from the International Concrete Repair Institute, Inc. (ICRI), 3166 S. River Road, Ste 132, Des Plaines, IL 60018, <http://www.icri.org>.

4.6 *Other Materials*—No other material shall be used with or added to the prepackaged cementitious liner materials without prior written approval from the manufacturer.

## 5. Surface Preparation, Cleaning, and Repair

5.1 The applicator is responsible to ensure that the manhole is properly cleaned and prepared.

5.2 Place wooden or plastic covers or other protective devices over the sewer manhole invert while cleaning the manhole wall and bench sections before applying the prepackaged cementitious liner. Wire mesh and fabric filters allowing water to pass are also acceptable.

5.3 Remove all foreign materials from the manhole wall and bench sections. Remove all loose and protruding bricks, mortar, and concrete. Remove metal, plastic, or brick stairs, if required, before applying the new liner. Fill any large voids with fast setting cementitious repair material.

5.4 *Surface Cleaning Procedures:*

5.4.1 *High Pressure Cleaning*—Properly cleaning the surface of the structure is critical to the success of this rehabilitation method. Use a high-pressure washer delivering a minimum of 3500 psi (2413 MPa). A minimum of two and a half gallons per minute (9.46 litres per minute) should be delivered through the spray tip. The spray tip should be kept between 6 and 12 in. (15.24 and 30.48 cm) from the surface and be held at an angle between 45° and 90° to the surface being cleaned. The spray tip should be directed across the surface at a speed of no more than one foot per second (0.3 metres per second). If the surface is especially dirty or greasy, cleaning agents may be added to the pressure washer water or the water may be heated. When hot water is required, it should be heated to 210°F (99°C). Care should be taken to clean the frame sealing surface where the lid fits into the frame, removing any debris or other materials that negatively impact the lids ability to seal against the frame. Cleaning should begin with the frame surface and progress down to and include the bench. A rotating spray nozzle may be used for cleaning, if it meets pressure and flow requirements. Care should be taken to avoid further structural damage to the existing surface.

5.4.2 In some situations, when removing existing coatings or linings, pneumatic hammers, hydro-demolition, or sand blasting may be required. Refer to Guideline No. 03732 or Guideline No. 03737.

5.4.3 Some substrates may require more surface preparation including acid washing. If acid washing is performed, the acid cleaned surface should be neutralized.

5.4.4 Remove any loose material after all preparations and cleaning has been completed. Do not allow soil, sand, debris, or runoff to enter the sewer system. Properly dispose of any deleterious materials removed from the manhole according to local, state, and federal guidelines.

5.5 *Surface Repair:*

5.5.1 *Repair the Invert and Bench Sections*—Repair any invert and bench section that exhibits visible damage, degradation, or water infiltration. Remove obstructions and loose materials from benches prior to shaping inverts. Form smooth, u-shaped channels across the floor of the manhole. Use