



***STORM SEAL<sup>®</sup> SPECIFICATIONS:***  
***for REHABILITATION of CORRUGATED METAL PIPE, CONCRETE PIPE,***  
***CULVERTS, CATCH BASINS, and STORM DRAINS***

**INTENT: To provide a system for stormwater structures that stops inflow, infiltration and exfiltration, restores structural integrity, and rehabilitates corrugated metal pipe, concrete pipe, culverts, catch basins and storm drains.**

## **1.0 GENERAL**

- 1.1 This specification shall govern all work, materials, and equipment required for substrate rehabilitation for the purpose of eliminating infiltration and exfiltration, repair of voids, and restoration of the structural integrity of the substrate as a result of applying a monolithic fiber-reinforced structural cementitious liner to the interior of corrugated metal pipe, concrete pipe, or other masonry construction materials.
- 1.2 Described are procedures for cleaning, preparation, application and testing. The applicator, approved and trained by the manufacturer, shall furnish all labor, equipment and materials for applying a cementitious mix to form a structural monolithic liner of a minimum 1 inch thickness, with machinery specially designed for the application. All aspects of the installations shall be in accordance with the manufacturer's recommendation and per the following specifications which includes:
  - A. The removal of any loose and unsound material
  - B. Cleaning of the area to be sprayed
  - C. The elimination of active infiltration prior to liner application
  - D. The repair and filling of voids
  - E. The repair and sealing of the invert and benches
  - F. The spray application of a cementitious mix to form a structural monolithic liner

## **2.0 MATERIALS**

### **2.1 PATCHING MATERIAL (Strong-Seal<sup>®</sup> QSR):**

Strong-Seal<sup>®</sup> QSR, a quick setting fiber reinforced calcium aluminate corrosion resistant cementitious material, may be used as a patching material and is to be mixed and applied according to manufacturer's recommendations and shall have the following minimum requirements:

<b>Strong-Seal® QSR Minimum Requirements</b>		
Compressive Strength	ASTM C109	>1800 psi, 1 hr. >2600 psi, 24 hrs. >3000 psi, 28 days
Bond	ASTM C882	>1600 psi, 28 days
Calcium Aluminate Cement		Sulfate resistant
Applied Density		105 pcf ± 5 lbs.
Shrinkage	ASTM C596	0% at 90% R.H.
Placement Time		5 to 10 minutes
Set Time		15 to 30 minutes

## 2.2 INFILTRATION CONTROL MATERIAL (Strong-Seal® Strong-Plug®):

Strong-Plug®, a rapid setting cementitious product specifically formulated for leak control, may be used to stop minor water infiltration and shall be mixed and applied according to manufacturer's recommendations and shall have the following minimum requirements:

<b>Strong-Seal® Strong-Plug® Minimum Requirements</b>		
Compressive Strength	ASTM C109	>1000 psi, 1hr. >2500 psi, 24 hrs.
Sulfate Resistance	ASTM C267	No weight loss after 15 cycles @ 2000 ppm
Freeze/Thaw	ASTM C666 "Method A"	100 cycles
Pull Out Strength	ASTM C234	14,000 lbs.
Set Time		<1.0 minute

## 2.3 INVERT REPAIR:

Strong-Seal® Grout 12,000 may be used to repair severely damaged inverts and fill voids to provide for a consistent installation of the Strong-Seal® Storm Seal® cementitious liner. Strong-Seal® Grout 12,000 shall be mixed and applied according to manufacturer's recommendations and shall have the following minimum requirements:

<b>GROUT 12,000</b>			
Compressive Strength	ASTM C109	28 days	>12000 psi
Tensile Strength	ASTM C496	28 days	>1200 psi
Flexural Strength	ASTM C293	28 days	>1800 psi
Shrinkage @90% R.H.	ASTM C596	28 days	0%
Density, When Applied			140 ± 5lbs/ft <sup>3</sup>
Freeze/Thaw	ASTM C666	N/A	300 cycles no visible damage

#### 2.4 GROUTING MATERIAL:

2.4.1 Strong-Seal<sup>®</sup> Grout 250, a cementitious grout, may be used for stopping active infiltration and filling large voids outside the structure and shall be mixed and applied according to manufacturer's recommendations. The cementitious grout shall be volume stable, and have a minimum 28 day compressive strength of 250 psi.

2.4.2 Strong-Seal<sup>®</sup> Grout 1000, a cementitious grout, may be used for the same application as Grout 250, but is designed for special soil conditions, and shall be used per manufacturer's recommendations. The cementitious grout shall be volume stable and have a minimum 28 day compressive strength of 1000 psi.

2.4.3 Chemical grouts may also be used for stopping very active infiltration and shall be mixed and applied per manufacturer's recommendation.

#### 2.5 STRONG-SEAL<sup>®</sup> STORM SEAL<sup>®</sup> LINER MATERIAL:

Strong-Seal<sup>®</sup> Storm Seal<sup>®</sup> cementitious liner product shall be used to form a structural monolithic liner covering all interior substrate surfaces and shall have the following minimum requirements:

<b>STORM SEAL®</b>			
Compressive Strength	ASTM C109	28 days	>9000 psi
Tensile Strength	ASTM C496	28 days	>800 psi
Flexural Strength	ASTM C293	28 days	>1200 psi
Shrinkage @90% R.H.	ASTM C596	28 days	0%
Bond	ASTM C882	28 days	>2000 psi
Density, When Applied			134 ± 5lbs/ft <sup>3</sup>
Freeze/Thaw	ASTM C666	N/A	300 cycles no visible damage

2.5.1 Strong-Seal® Storm Seal® shall be made with Type I Portland Cement and shall be used according to manufacturer's recommendations in applications where there is no evidence of sulfide conditions (substrate surface of pH 3.0 or higher). Strong-Seal® Storm Seal® or approved equal shall be factory blended requiring only the addition of water at the jobsite. The bag weight shall be 63-67 pounds. The contents shall have a dry bulk density of 82-85 pounds per cubic foot. When mixed with manufacturer's recommended amount of water it shall have a wet nozzle density in the range of 130-140 pounds per cubic foot and shall have a typical yield of .57 cubic feet per bag.

2.5.2 Strong-Seal® Storm Seal® shall be reinforced with alkaline resistant fiberglass rods not less than 1/4 inch in length.

2.5.3 The material should meet or exceed industry standards and shall not have any basic ingredient that exceeds EPA maximum allowable limits for any heavy metals.

2.6 WATER:

Water used to mix product shall be clean and free from contaminants. Questionable water shall be tested by a laboratory per ASTM C-94 procedure. Potable water need not be tested.

2.7 OTHER MATERIALS:

No other material shall be used with the mix without prior approval or recommendation from The Strong Company, Inc.

### **3.0 EQUIPMENT**

- 3.1 Applicator must use approved equipment designed and manufactured by the material supplier specifically for the application of cementitious liners. Other models may be approved after review by Strong-Seal<sup>®</sup> personnel.
- 3.2 Specially designed machines consisting of a progressive cavity pump and an air system for low velocity spray application of product, shall be used for applying Strong-Seal<sup>®</sup> Systems products. Equipment is complete with water storage and metering system. SprayMate<sup>®</sup> models 35C, 35D and Minimate II are approved machines for applying Strong-Seal<sup>®</sup> Systems products. Other models may be approved after review by Strong Company personnel.

### **4.0 APPLICATION**

#### **4.1 PREPARATION:**

- 4.1.1 The contractor, if required, shall be responsible for the control of the flow around the sections of the drain or pipe where the rehabilitation shall be performed.
- 4.1.2 The contractor shall be responsible for removing obstructions from the drain or pipe that prevent the cementitious liner from being installed. The contractor shall notify the owner of any obstructions not removable by conventional sewer cleaning methods and equipment.
- 4.1.3 Active leaks may be stopped using quick setting, specially formulated mixes, such as Strong-Plug<sup>®</sup> (2.2) according to manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during the application. After application the weep holes shall be plugged with the quick setting material Strong-Seal<sup>®</sup> QSR<sup>®</sup> (2.1) prior to final coat. When severe infiltration exists, drilling may be required in order to pressure grout using a cementitious grout, Strong-Seal<sup>®</sup> Grout 250, Strong-Seal<sup>®</sup> Grout 1000 or chemical grouts (2.4.3). Manufacturer's recommendations shall be followed when pressure grouting is required.

#### **4.2 MIXING OF LINER MATERIALS:**

- 4.2.1 For each bag of product, use the amount of water required per manufacturer's recommendations following mixing procedures noted on product bag. Only enough water shall be used to produce a mix consistency to allow application of liner material up to one

inch thick in a single application without material "sagging" on vertical surface and using the approved equipment for mixing and application.

4.2.2 Prepared mix shall be discharged into a hopper and another batch prepared to occur in such a manner as to allow application continuously without interruption until each application is complete.

#### 4.3 SPRAYING:

4.3.1 The surface shall be clean and free of all foreign material and shall be damp without noticeable free water droplets or running water. Materials shall be applied up to one (1) inch thick in one or more passes.

4.3.2 A rotating caster may be used to apply the material. Position the caster in the center of the pipe and retrieve the equipment at a steady rate for the material to be applied at the required thickness.

### 5.0 CURING

5.1 Caution will be taken to minimize exposure of applied product to quick surface drying and air movement. In extremely hot and arid climates, these structures should be shaded while reconstruction is in progress and a concrete curing agent that meets ASTM C309 should be used. Contact manufacturer for curing compound recommendations.

### 6.0 WEATHER

6.1 No application shall be made if ambient temperature is below 40 degrees Fahrenheit. No application shall be made to frozen surfaces or if freezing is expected to occur within the substrate within 24 hours after application.

6.2 Precautions shall be taken to keep the mix temperatures at time of application below 90 degrees Fahrenheit. Water temperature shall not exceed 80 degrees Fahrenheit. Chill with ice if necessary.

### 7.0 PRODUCT TESTING

7.1 Four (4) - two inch cubes shall be cast each day or from every pallet of product used, and shall be properly packaged, labeled and returned to manufacturer for testing in accordance with the owner's or manufacturer's directions for compressive strength per ASTM C109 procedure.

## **8.0 FINAL ACCEPTANCE TESTING**

8.1 At the direction of the owner or his assignee, the reconstructed structure shall be tested by the following method:

8.1.1 Visually verify the absence of leaks.

## **9.0 LIMITED WARRANTY**

**The Strong Company, Inc. warrants that this product was produced in conformity with its standard specification or formulations within recognized tolerances, free of adulteration or contamination, and that the product will perform in accordance with representations in Strong-Seal® Systems literature and Technical Data Sheets when properly applied in strict conformance with the printed instructions on container and prescribed in technical data instructions and when applied to a properly prepared surface. The sole remedy of the purchaser shall be replacement of the product or refund of the purchase price of the product if any defect in material or variance in the product beyond recognized tolerances in the specifications are found to exist.**

**No other remedy including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss shall be available to the purchaser.**

### **DISCLAIMER**

**THE WARRANTY DESCRIBED IN THE ABOVE PARAGRAPHS SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.**

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