

Storm Seal® High Strength (HS)

Specifications

Rev: 08-2019



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, 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 material to form a structural monolithic liner

2.0 Materials

- 2.1 Patching Material:
Strong-Seal® QSR, a quick-setting, corrosion resistant, fiber reinforced, calcium aluminate cement based product, shall be used as a patching material and is to be mixed and applied per manufacturer's recommendations. QSR shall meet the following performance specifications:

QSR Performance Specifications:

Compressive Strength	ASTM C109	>1,500 psi @ 1 hour >2,000 psi @ 24 hours >3,000 psi @ 28 days
Bond Strength	ASTM C882	>1,500 psi @ 28 days
Drying Shrinkage	ASTM C596	0% @ 90% RH
Wet Unit Weight	ASTM C138	105 ± 5 lb/ft ³
Placement Time		5 – 15 minutes
Set Time	ASTM C403	15 – 30 minutes

- 2.2 Infiltration Control Material:
Strong-Seal® Strong-Plug®, an instant-setting cementitious product specifically formulated for leak control, shall be used to stop minor water infiltration and shall be mixed and applied per manufacturer's recommendations. Strong-Plug® shall meet the following performance specifications:

Strong-Plug® Performance Specifications:

Compressive Strength	ASTM C109	>1,000 psi @ 1 hour >2,500 psi @ 24 hours
Sulfate Resistance	ASTM C267	No weight loss after 15 cycles @ 2000 ppm
Freeze/Thaw Resistance	ASTM C666	100 cycles
Pull Out Strength	ASTM C234	14,000 lb
Set Time	ASTM C403	<1 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® High Strength (Storm Seal HS) cementitious liner. Strong-Seal® Grout 12,000 shall be mixed and applied according to manufacturer's recommendations and shall have the following minimum requirements:

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Grout 12,000 Performance Specifications:

Compressive Strength	ASTM C109	>12,000 psi @ 28 days
Tensile Strength	ASTM C496	>1,200 psi @ 28 days
Flexural Strength	ASTM C293	>1,800 psi @ 28 days
Shrinkage @ 90% RH	ASTM C596	0% @ 28 days
Density, when applied		140 ± 5lbs/ft ³
Freeze/Thaw	ASTM C666	300 cycles, no damage

2.4 Grouting Material:

- 2.4.1 Strong-Seal® Grout 250, a cementitious grout, shall be used for stopping very active infiltration and filling voids and shall be mixed and applied per manufacturer's recommendations. Grout 250 shall be volume stable and shall have a minimum 28 day compressive strength of 250 psi.
- 2.4.2 Strong-Seal® Grout 1,000, a cementitious grout, shall be used in special soil conditions for stopping very active infiltration and filling voids, and applied per manufacturer's recommendations. Grout 1,000 shall be volume stable, and shall have a minimum 28 day compressive strength of 1000 psi.
- 2.4.3 Chemical grouts may be used for stopping very active infiltration and shall be mixed and applied per manufacturer's recommendations.

2.5 Liner Material:

Strong-Seal® Storm Seal® High Strength (Storm Seal HS) cementitious liner product shall be used to form a structural monolithic liner covering all interior substrate surfaces and shall have the following minimum requirements:

Storm Seal® High Strength Performance Specifications:

Compressive Strength	ASTM C109	>10,000 psi @ 28 days
Tensile Strength	ASTM C496	>900 psi @ 28 days
Flexural Strength	ASTM C293	>1,500 psi @ 28 days
Bond Strength	ASTM C882	>2,900 psi @ 28 days
Freeze/Thaw Resistance	ASTM C666	300 cycles, no damage
Drying Shrinkage	ASTM C596	0% @ 90% RH
Wet Unit Weight	ASTM C138	129 ± 5 lb/ft ³
Modulus of Elasticity		>5.4 million @ 28 days
Coulombs		<50

- 2.5.1 Strong-Seal® Storm Seal® High Strength (Storm Seal HS) 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® High Strength (Storm Seal HS) or approved equal shall be factory blended requiring only the addition of water at the jobsite. The bag weight shall be a minimum of 60 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 of about 129 pounds per cubic foot and shall have a typical yield of .57 cubic feet per bag.
- 2.5.2 Strong-Seal® Storm Seal® High Strength (Storm Seal HS) 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 C94. 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® 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® Systems products. Equipment is

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complete with water storage and metering system. SprayMate® models 35C, 35D and Minimate II are approved machines for applying Strong-Seal® Systems products. Other models may be approved after review by Strong Company personnel.

4.0 Application

- 4.1 Surface 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® (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® QSR® (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® Grout 250, Strong-Seal® Grout 1000 or chemical grouts (2.4.3). Manufacturer's recommendations shall be followed when pressure grouting is required.
- 4.2 Mixing of Liner Material:
 - 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 of Liner Material:
 - 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 substrates or if the substrate is expected to freeze within 24 hours after application.
- 6.2 Precautions shall be taken to keep the mix temperature at time of application below 90 degrees Fahrenheit. Water temperature shall not exceed 80 degrees Fahrenheit. Chill with ice if necessary.

7.0 Acceptance

- 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 Limited Warranty

The Strong Company, Inc. warrants that this product was produced in conformity with its standard specifications or formulations within recognized tolerances, free of adulteration or contamination, and that the product will perform in accordance with representations in Strong-Seal® literature 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.

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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 is 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.