

## SEWPERCOAT®

### SUGGESTED TECHNICAL SPECIFICATION FOR STRUCTURAL/STRUCTURALLY ENHANCED LINING INSTALLATIONS IN CORROSIVE MUNICIPAL ENVIRONMENTS

REFERENCE US 08/06

#### **PART 1 – GENERAL**

- 1.1. General: This specification defines the method and material for the rehabilitation of sanitary sewer structures (manholes, wet wells, lift/pump stations, large diameter concrete pipe, etc.) utilizing a spray applied calcium aluminate cementitious structural rehabilitation system. The purpose of this project is to obtain a dense and durable concrete lining that is resistant to biosulfuric acid attack and meets the strength requirements described elsewhere in this specification. The work covered in this specification consists of furnishing all labor, equipment, materials, and supervision necessary to accomplish the rehabilitation as specified. When complete the rehabilitated structure shall:
  - 1.1.1. Provide for a uniformly smooth surface of specified thickness.
  - 1.1.2. Minimize, if not eliminate sources of inflow/infiltration (I/I).
  - 1.1.3. Provide a service life that is supported by documented test analysis.
- 1.2. Contractors Sequence of Operation
  - 1.2.1. The Contractor's sequence of operation relative to structural rehabilitation shall include, but not be limited to the following:
    - 1.2.2. Eliminate all sources of groundwater infiltration and voids in walls.
    - 1.2.3. Rehabilitate all interior surfaces including walls, ceilings and floors in accordance with specification and nature of the sub-surfaces.
    - 1.2.4. Provision to "cure" the installed lining material.
    - 1.2.5. Provision to "test" lining and structural rehabilitation materials.
- 1.3. Submittals
  - 1.3.1. The Contractor shall furnish detailed and complete data pertaining to the surfaces of the structure to be rehabilitated, the rehabilitation product, surface preparation and installation to the engineer for approval. The submission of this data shall be made in a timely manner to prevent project delay. At the request of the Engineer, the Contractor shall test for adverse chemical conditions that may hinder overall product performance.
  - 1.3.2. Prior to initiating the work, the Contractor shall submit specific technical data with complete physical properties of the structure to be rehabilitated and the proposed product for the rehabilitation of the structure, as well as a specific plan for sub-surface preparation.
  - 1.3.3. A certificate of "Compliance with Specifications" shall be furnished for all materials supplied.
  - 1.3.4. A work plan.
  - 1.3.5. A safety plan. It is the contractor's responsibility to comply with OSHA standards and all regulations pertaining to the work including confined space entry.

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**PART 2 – PRODUCTS**

2.1 Materials

2.1.1 Lining material furnished under this specification shall be a prepackaged mortar mix, including all cement, aggregates, and any required additives. It is the intent of this specification that the Contractor only be required to add the proper amount of potable water so as to produce concrete suitable for spray application. Do not add portland cement, other aggregates, or any admixtures whatsoever to lining material. Typical package weights shall not be less than 50 lbs and shall be identical for all material furnished on this project.

2.1.2 The chemical composition of the cement portion as well as the aggregates of the mortar mix shall be as follows:

Al <sub>2</sub> O <sub>3</sub>	CaO	FeO + Fe <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>
39-44%	35-39%	9-14%	5-7%

2.1.3. The design properties of the mortar mix shall be as follows:

Compressive Strength (ASTM C109)	> 6,000 psi	24 hours
	> 8,000 psi	28 days
Flexural Strength (ASTM C293)	> 1,300 psi	24 hours
	> 1,600 psi	28 days
Splitting Tensile Strength (ASTM C496)	> 900 psi	24 hours
Slant Shear test (ASTM C882)	> 2,300 psi	28 days
Shrinkage at 28 days (ASTM C596)	< 0.08% cured @ 90% relative humidity	
Freeze/Thaw after 300 Cycles (ASTM C666)	No visible damage after 300 cycles	

2.1.4. The mortar mix shall be either “SewperCoat PG” or “SewperCoat 2000HS Regular”, both as manufactured by Kerneos Inc. – Chesapeake, Virginia.

2.1.5. Mortar mix must have at least seven (7) years of successful performance in similar applications and be supplied by an ISO 9001 certified manufacturer. Manufacturer’s ISO 9001 certificate shall be submitted to engineer and owner.

2.1.6. In addition, the mortar mix shall be designed to withstand long-term exposure to a bacterially corrosive hydrogen sulfide environment that may be expected to produce a pH of 1 on normal Portland cement based concrete or typical brick and mortar surfaces.

2.1.7. Water used in mixing shall be fresh, clean, potable water, free from injurious amounts of oil, acid, alkali, vegetable, sewage and/or organic matter. Water shall be considered as weighing 8.32 pounds per gallon.

2.1.8. Mortar mix shall be stored with adequate provisions for the prevention of absorption of moisture. It shall be stored in a manner that will permit easy access for inspection and identification of each shipment.

**PART 3 – EXECUTION**

3.1 Sampling and Testing

3.1.1 A recognized independent testing laboratory shall test mortar materials used on the project. The Manufacturer, instead of an independent laboratory, may test project sample specimens, provided the Owner, Engineer, and Manufacturer are in agreement of this testing method prior to project commencement. Specific materials recommended by the Engineer shall then be tested.

3.1.2 The cost of sampling and testing of the mortar mix during placement and the surface to which it is applied shall be born by the Contractor. Other testing required showing conformance with these specifications shall be the responsibility of the Contractor. Certified test reports and certificates, when so directed, shall be

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submitted in duplicate to the Engineer and to such other agencies or persons the Engineer may designate.

3.1.3 Any materials failing to meet the requirements of these specifications shall not be incorporated into the work plan.

### 3.2 Qualification of Work Crew

3.2.1 The lining material Manufacturer shall maintain a listing of competent contractors that have demonstrated requisite skill and training to be qualified applicators of their materials.

3.2.2 Prior to project commencement, the Contractor must satisfy the Engineer that all Contractor's work crew personnel have performed satisfactory work in similar capacities elsewhere for a sufficient period of time to be fully qualified to properly perform the work in accordance with the requirements of the related specifications.

3.2.3 Foreman shall have at least 4 years experience with similar work and project conditions.

3.2.4 Nozzlemen shall be qualified by having had similar work experience.

3.2.5 Work Crew responsibilities prior to application of lining material shall include the following:

- a) Surface preparation as discussed in section 4.1.
- b) Ensure the operating air pressure is uniform and provides adequate nozzle velocity for proper compaction.
- c) Continuously regulate the water content so that the applied materials consistently achieve proper compaction with a low percentage of rebound and no visible "sag".
- d) Ensure that the installation equipment nozzle is held at the proper distance away from and as nearly perpendicular to the prepared sub-surface as the working conditions will permit to secure maximum material compaction with minimum rebound and no visible "sag".
- e) Follow a sequence routine that will fill corners with adequately compacted material applied at a maximum practicable layer thickness.
- f) Determine necessary operating procedures for placement in confined spaces, extended distances or around unusual obstructions where placement velocities and mix consistency may need to be adjusted.
- g) Direct the crew as to when to start and stop the flow of materials during installation and to immediately stop all work when material is not arriving uniformly at the nozzle.
- h) Ensure that slough pockets are removed and prepared for installation of replacement material.
- i) Bring the installed materials to established finished elevations in a neat and timely manner and within established tolerances.

3.2.6 Applicator's job foreman shall operate the mixing/placing equipment and direct the work of mixing crew personnel. Applicator's work crew shall also maintain proper line pressures throughout the mixing/placing equipment to ensure the necessary consistent nozzle velocity. Applicator's work crew shall further see that all material fed to the nozzle is uniformly fed through this equipment.

### 3.3 EQUIPMENT

3.3.1 Equipment shall be of spray type and approved by the material manufacturer. Alternate equipment may be utilized provided it meets the performance requirements of the specification. All equipment must be kept in operating condition and good repair.

## PART 4 - CONSTRUCTION METHODS

### 4.1 SURFACE PREPARATION

4.1.1 Ensure all sub-surfaces are clean and free of laitance, loose material, residue and all existing coating and

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lining materials. See Section 4.4 for Inflow and Infiltration Prevention. For detailed explanation of the required surface preparation see ACI RAP-3 “Spall Repair by Low Pressure Spraying” page 2. ACI 546R “Concrete Repair Guide”, chapter 2 also provides a good reference for important considerations for repairing concrete surfaces using mortar.

4.1.2 Sub-surfaces shall be thoroughly saturated with water prior to the application of the lining materials. In no instance shall shotcrete be applied in an area where running water exists. It is the intent of this specification that the existing surface be saturated and free of any running water just prior to installation – or SSD, “saturated surface dry condition.” To achieve this condition it may be necessary to presoak the sub-surface for a at least 24 hours.

4.2 OPERATIONS

4.2.1 The Contractor shall provide all equipment necessary to individually gauge, control, and monitor the actual amounts of all component materials necessary to complete the lining installation. The type of equipment and methods used to gauge, control, and monitor component materials shall be subject to approval by the Engineer and Manufacturer.

4.2.2 All lining materials shall be thoroughly mixed by mechanical means to ensure all agglomerated particles are reduced to original size or removed prior to placement into the application equipment (i.e. the hopper). Each batch of material should be entirely discharged before recharging with fresh material. Mixing equipment shall be cleaned at regular intervals to remove all adherent materials.

4.2.3 The addition of water to the mix shall be in strict accordance with the Manufacturer’s recommendations.

4.2.4 Re-mixing or tempering shall not be permitted. Rebound materials shall not be reused.

4.3 PROTECTION OF ADJACENT SURFACES

4.3.1 During progress of the work, adjacent areas or grounds which may be permanently discolored, stained or otherwise damaged by dust and rebound material, shall be adequately protected and, if contacted, shall be cleaned by early scraping, brushing or washing as the surroundings permit.

4.4 INFLOW and INFILTRATION PREVENTION

4.4.1 If inflow or infiltration is observed within the structure after surface preparation is complete, a rapid setting crystalline enhanced hydraulic cement product specifically formulated for infiltration control shall be used to stop minor infiltration flows in accordance with the manufacturer's recommendations. The material shall meet the following strength requirements:

Compressive Strength (ASTM C597B)	600 psi	(24 hours)
	1,000 psi	(7 days)
Bond Strength (ASTM C321)	30 psi	(1 hour)
	80 psi	(1 day)

4.4.2. The material shall be Preco Plug, Octocrete, Burke Plug or Engineer approved equal. Where infiltration flows are more severe, pressure grouting may be required. The material for pressure grouting shall be Avanti A-220, DeNeef or Engineer approved equal installed in accordance with the manufacturer's written instructions.

4.4.3. All materials, labor, equipment, and incidentals required to correct inflow and infiltration conditions will be considered incidental to rehabilitation.

4.5. APPLICATION OF MATERIALS

4.5.1 Lining material shall not be applied to a frozen surface or to a surface that may freeze within 24 hours of application. Frozen conditions shall be defined as ambient temperatures of 32 degrees Fahrenheit or below.

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- 4.5.2. Sequence of application may be from bottom to top or vice versa if rebound is properly removed.
- 4.5.3. Application shall be from an angle as nearly perpendicular to the surface as practicable, with the nozzle held at least 1 foot from the working sub-surface (except in confined control). If the flow of material at the nozzle is not uniform and slugs, sand spots, or wet sloughs result, the nozzleman shall direct the nozzle away from the work until the faulty conditions are corrected. Such defects shall be replaced as the work progresses.
- 4.5.4. Application shall be suspended if:
  - 1) Air velocity separates the cement from the aggregate at the nozzle.
  - 2) Ambient temperature approaches freezing and the newly placed SewperCoat cannot be protected and insulated.
- 4.5.5. The time interval between successive layers of material application must be sufficient to allow "tackiness" to develop but not final set. If final set does occur, this surface shall be prepared in accordance with Sections 4.1.1 of this document.
- 4.5.6. Construction joints within a manhole shall be avoided. In the event a construction joint is necessary and approved by the Engineer, it shall be sloped off to a thin, clean, regular edge, at a 45-degree angle. Prior to placement of the adjoining materials, the sloped portion and adjacent applied material shall be thoroughly cleaned as necessary, then moistened and scoured with an air jet.
- 4.5.7. Nozzleman shall bring the material to an even plane and to well-formed corners.
- 4.5.8. After the body coat has been placed, the surface shall be trued with a thin-edge screed to remove high areas and expose low areas. Low areas shall be properly filled with additional material to insure a true, flat surface in accordance with Section 4.5.5 of this document.
- 4.5.9. For manhole applications, the minimum thickness of SewperCoat shall be a ½-inch cover over all surfaces. For other larger structures (lift stations, wet wells, treatment plant structures, etc.), the minimum thickness of SewperCoat shall be a 1-inch cover over all surfaces.

#### 4.6. CURING

If the material has been applied and furnished in accordance to the specifications, and it has been determined that the environment is not moist enough for natural curing, the contractor will be required to apply a curing compound to all coated surfaces. Curing compound shall meet the requirements of ASTM C309 and have the approval of the lining material Manufacturer and the Engineer prior to use.

Moist curing may also be used in lieu of curing compound. If moist curing is selected, it should be implemented just after the notice of uniform heat generation of the installed lining. Moist curing can consist of the use of soaker hoses, water sprinklers, or vapor/misting machines. Regardless of delivery method, moist curing should continue for a minimum of 18 hours.

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