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DESIGN-A-SPEC™ GUIDELINES

FIVE STAR CENTRI-CAST® PIPE REPAIR MORTAR
FIVE STAR CENTRI-CAST® PIPE REPAIR MORTAR HS

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This document is provided for informational purposes only and as a general guideline for consideration by contractors and engineers. While every reasonable effort has been made to ensure that this information is accurate and authoritative, Five Star Products, Inc. does not warrant the accuracy or completeness of this information, or for its appropriateness for any particular purpose. The user of this document remains solely responsible for the specification of all methods, materials and practices.

PART A - GENERAL CONDITIONS

1.01 SCOPE

This specification document contains the minimum material requirements and installation techniques required for pipe lining rehabilitation / repair to sewer, storm drainage and related pipe as may be directed by the appropriate engineer, owner or DOT agency.

1.02 QUALITY ASSURANCE

A. The manufacturer shall have been in the business of manufacturing high performance cement-based repair mortars for over 15 years, maintain a strict quality assurance program in accordance with ISO 9001:2008, offer technical services and provide a representative at the project site for product training, prior to product installation.
B. The contractor shall submit to the engineer, or owner, at least three job references where the contractor and product manufacturer have successfully completed similar applications.

1.03 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered to the jobsite in their original, unopened packages, clearly labeled with the manufacturer's identification, printed instructions and batch code for shelf life and traceability.
B. Store and condition the specified product as per the appropriate product data sheet.
C. For handling instructions, refer to the Safety Data Sheet.

1.04 PROJECT/SITE CONDITIONS

Refer to PART C - PREPARATION, ENVIRONMENTAL CONDITIONS, or contact the manufacturer directly for any physical or environmental limitations required by the product.

PART B - MATERIAL SPECIFICATIONS

2.01 MATERIALS

A. The pipe lining / rehabilitation material shall be a centrifugally spray-applied, pre-packaged cement-based mortar requiring only the addition of potable water. The material shall not contain any chlorides or lime other than amounts contained within the hydraulic cement composition. The manufacturer shall be ISO 9001:2008 certified and have at least 15 years experience in the manufacture of cementitious repair materials. The manufacturer shall offer technical services and provide a representative at the project site for product training prior to product installation upon advance notice.

B. NORMAL STRENGTH MORTAR

The pipe lining / rehabilitation material shall meet all the following typical performance criteria when cured at 70ºF (21ºC):

1.	Compressive Strength, ASTM C 109	
	1 Day	3,000 psi (20.7 MPa)
	7 Days	6,000 psi (41.4 MPa)
	28 Days	8,000 psi (55.2 MPa)
2.	Bond Strength, ASTM C 882	
	7 Days	2,000 psi (13.8 MPa)
3.	Length Change, ASTM C 157	
	28 Days Wet	+0.05%
	28 Days Dry	-0.15%
4.	Chloride Ion Permeability, ASTM C 1202	
	28 Days	Low
5.	Freeze / Thaw Resistance, ASTM C 666A	90% RDM @ 300 cycles
6.	Working Time	30 minutes

The data shown above reflect typical results based on laboratory testing under controlled conditions. Reasonable variations from the data shown above may result in the field. Test methods are modified where applicable.

C. HIGH STRENGTH MORTAR

The pipe lining / rehabilitation material shall meet all the following typical performance criteria when cured at 70ºF (21ºC):

1.	Compressive Strength, ASTM C 109	
	1 Day	5,000 psi (34.5 MPa)
	7 Days	9,000 psi (62.1 MPa)
	28 Days	11,500 psi (79.3 MPa)
2.	Bond Strength, ASTM C 882	
	28 Days	Concrete Failure
3.	Chloride Ion Permeability, ASTM C 1202	
	28 Days	Low
4.	Working Time	30 Minutes

D. Subject to meeting the performance criteria stated above, other products may be formally submitted to the engineer for approval up to three days prior to the bid date. All requests for approval shall contain certified test data verifying conformance with this specification. Three references of successfully completed projects of similar nature and scope of the work detailed in this specification shall be provided. The testing laboratory shall certify to any modifications made to the tests performed and provide details of modifications.

E. Materials that meet these specifications are Five Star Centri-Cast® Pipe Repair Mortar and Five Star Centri-Cast® Pipe Repair Mortar High Strength respectively, manufactured by Five Star Products, Inc. of Shelton, CT.

PART C – PREPARATION

3.01 PIPE CONDITIONS

A. Completely remove or mitigate all obstructions that may hinder proper installation of product prior to commencing work.
B. Ensure all active water flow is diverted or stopped prior to commencing work.
C. Completely remove all loose, delaminated and weak materials including dirt and debris from work area. Prepare pipe surfaces using high pressure water blasting to thoroughly remove all contaminants and bond-inhibiting materials. Severely corroded pipe sections may need replacement. Metal surfaces should be blasted to a clean substrate condition; concrete surfaces should be mechanically prepared to an ICRI Concrete Surface Profile (CSP) of 5 or greater. Metal surfaces may require treating with a corrosion inhibitor after surface prep if they will not be repaired immediately and if additional corrosion of surfaces is anticipated before commencing work.
D. The sections to be repaired should be free of standing water; concrete pipe should be presoaked prior to material installation.
E. All cracks in pipes identified shall be brought to the attention of the engineer and a determination made of whether the cracks are subject to movement and may compromise the installation. The cracks shall be repaired or mitigated as directed prior to application of the pipe lining rehabilitation material.
F. All existing joints in pipe shall be maintained.
G. All surfaces must be blown clean from surface preparation debris and residue prior to commencing work.
H. Due to the potential corrosion reactivity between cementitious materials and aluminum pipe, all aluminum pipe should be coated with a coal tar type coating (or similar material) prior to application of Five Star Centri-Cast® Pipe Repair Mortar.
I. Protruding bolts in segmental pipe may reduce isolation or coverage

3.02 ENVIRONMENTAL CONDITIONS

A. Condition and maintain all materials and surfaces that contact pipe lining rehabilitation material to between 50°F and 90°F (10°C and 32°C), depending on ambient and pipe surface temperatures.

3.03 EQUIPMENT AND MATERIALS

A. All necessary tools, equipment and materials shall be in good condition and as close as possible to area being repaired.
B. Appropriate clothing and safety equipment shall be worn to avoid breathing dust and prevent eye and skin contact with both dry and mixed repair materials.
C. An ample source of potable water shall be available for preconditioning, mixing, cleaning and curing.

3.04 MIXING

Mortar Mixer (Stationary Barrel with Moving Paddles)

A. Provide an adequate number of mortar mixers in good operating condition for uninterrupted placement. Do not exceed one-half the maximum capacity of the mortar mixer.
B. Pre-wet mortar mixer, empty excess water.
C. Start by adding the minimum amount of premeasured potable water to mixer. While mixing, slowly add pipe lining rehabilitation material and mix to a uniform consistency.
D. Mix thoroughly for approximately 3 to 4 minutes. To achieve desired consistency, add remaining water if necessary. Do not exceed maximum water content as stated on product packaging or an amount that will cause segregation.
E. Do not mix more material than can be placed within the working time of the repair material. Do not retemper the mix by adding additional water.
F. A trial mix should be run to optimize water content and application ability.

PART D – APPLICATION

4.01 A. Position spray cast equipment within pipe center and begin pumping material to nozzle. Commence application of material around pipe. Run spin caster equipment fully open. As material is cast around pipe, move applicator head accordingly so as to provide the necessary thickness and uniformity specified. Optimally, apply an initial ¼ inch skim coat throughout and come back the next day and apply balance in full thickness.
B. Movement of the applicator head may be adjusted at any time to ensure proper coverage, thickness and uniformity. An automated winch may be used to move spin cast equipment once proper speed of winch is determined.
C. Coverage thicknesses may be verified at any point during installation to ensure movement rate of applicator head is correct. Multiple passes may be required depending upon total thickness specified.
D. Placement shall be a continuous to minimize or prevent cold joints except over existing joints.

PART E – CURING

5.01 CURING

A. If desired apply curing compound meeting the requirements of ASTM C 309 immediately after placement.
B. Repair material shall be protected from freezing, hydrostatic pressure and vibration as recommended by the manufacturer.

PART F – EXTREME WEATHER CONDITIONS

6.01 COLD WEATHER REPAIRS

[Low temperatures delay the set, increase working time and delay the strength development of cement-based products. The procedures below will compensate for these conditions.]

A. All surfaces shall be preconditioned and maintained between 50°F and 90°F (10°C and 32°C) and materials conditioned to between 50°F and 80°F (10°C and 27°C). Higher substrate and material mix temperatures will result in faster strength development. Due to the mass of palletized material and bulk packaging, up to 72 hours of conditioning may be required.

B. Heating may be accomplished by indirect exposure. Heated enclosures must be windproof and weatherproof. Combustion heaters must be vented and shall not be permitted to heat and dry the concrete locally. *Caution: Exhaust gases may contaminate or cause carbonation within the enclosed environment. Ensure repair material does not dry out during heating.*

C. Maintain temperature above 50°F (10°C) minimum until material reaches 500 psi or the minimum required strength.

D. Gradually allow temperature of material to cool to ambient temperature to avoid thermal shock.

REFERENCE

ACI 306R-88
"Cold Weather Concreting"

PART F – EXTREME WEATHER CONDITIONS

6.02 HOT WEATHER REPAIRS

[High temperatures accelerate the set, decrease working time, and accelerate the strength gain of cement-based products. The procedures below will compensate for these conditions.]

A. Materials shall be conditioned as necessary so that the mixed material is between 50°F and 90°F (10°C and 32°C). Due to the mass of palletized material, up to 72 hours of conditioning may be required.

B. All surfaces in contact with material must be preconditioned and maintained below 90°F (32°C). Pump hoses should be soaked and kept cool.

C. Cooling of surfaces, pump lines, materials and equipment can be accomplished by using iced water. Shade area from direct sunlight or install material when temperatures are decreasing.

REFERENCE

ACI 305R-91
"Hot Weather Concreting"