FIVE STAR PRODUCTS, INC.

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DESIGN-A-SPEC™ GUIDELINES
FIVE STAR STRUCTURAL CONCRETE V/O

CONTENTS

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 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 - CONCRETE REPAIR

1.01 SCOPE

The work covered by this document consists of furnishing all equipment, materials, labor and performing all operations required for concrete repairs as directed by the engineer or owner.

1.02 QUALITY ASSURANCE

A. The manufacturer shall have been in the business of manufacturing similar products for over ten years, maintain a strict quality assurance program, offer technical services and provide a representative at the jobsite for product training, prior to product installation, upon written request.
B. The contractor shall submit to the engineer, or owner, at least three job references where the contractor has 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.
B. Store and condition the specified product as per the appropriate product data sheet.
C. For handling instructions, refer to the Material 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.

1.05 MEASUREMENT AND PAYMENT

A. Measurement for concrete repairs shall be on a cubic foot/square foot (liter/square meter) basis of material in place.
B. Payment for concrete repairs shall be at the unit price bid on a cubic foot/square foot (liter/square meter) basis. This payment shall constitute full compensation for all labor, materials, tools, equipment and other items as necessary to complete the work as described in the contract documents. Progress payments will be made on the percentage of the work satisfactorily completed during each payment period in accordance with the provisions of the contract documents.

PART B - MATERIAL SPECIFICATION - CONCRETE REPAIR

2.01 MATERIALS

A. The concrete repair material shall be a vertical/overhead hand 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 certified and have at least ten years experience in the manufacture of concrete repair materials. The manufacturer shall offer technical services and provide a representative at the jobsite for product training prior to product installation upon five days advance notice.

B. The concrete repair material shall meet all the following typical performance criteria when cured at 73°F (23°C):

1. Compressive Strength, ASTM C 109

3 Hours	2,500 psi (17.2 MPa)
1 Day	3,500 psi (24.2 MPa)
7 Days	4,000 psi (27.6 MPa)
28 Days	5,000 psi (34.5 MPa)

2. Bond Strength, ASTM C 882

1 Day	1,500 psi (10.4 MPa)
7 Days	2,200 psi (15.2 MPa)

3. Length Change, ASTM C 157

28 Days Wet	+0.04%
28 Days Dry	-0.12%

4. Chloride Ion Permeability, ASTM C 1202

3 Days	Very Low

5. Freeze/Thaw Resistance, ASTM C 666A

Relative Durability Modulus %	95%

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. An acceptable product which meets these criteria is:

Five Star Structural Concrete® V/O

As manufactured by Five Star Products, Inc., Fairfield, CT 06824 (203) 336-7900.

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, as well as a minimum ten year history of use in the industry. The testing laboratory shall certify to any modifications made to the tests performed and provide details of modifications.

PART C – PREPARATION - CONCRETE REPAIR

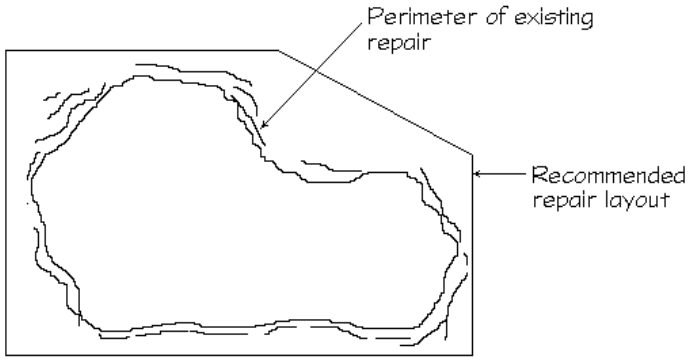
3.01 CONCRETE SURFACES

A. Completely remove all loose, delaminated and weak concrete, oil, grease, laitance and other contaminants. Prepare concrete using acceptable mechanical means (and concrete cleaners as necessary) to obtain clean, sound and rough surfaces. Mechanically roughen concrete surfaces to an ICRI (International Concrete Repair Institute Technical Guideline 03732) Concrete Surface Profile of 6 or greater. Coarse aggregate shall be exposed. Blow out surfaces using oil free compressed air to remove all dust, debris and other contaminants.

B. The edges of the repair shall be vertical and have a rough profile. Avoid abrupt changes in depth.

C. For vertical and overhead repairs with a depth greater than two inches (50 mm), mechanical anchors may be considered.

D. The perimeter of the repair shall be kept to a simple shape. Avoid reentrant corners.



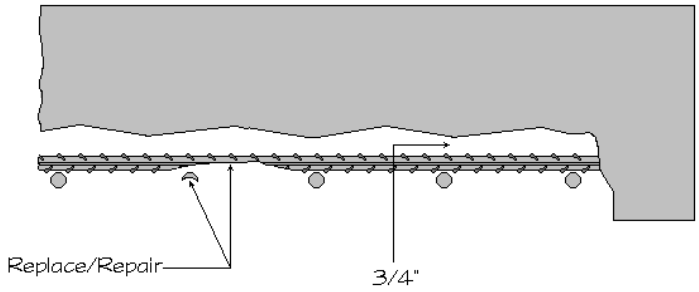
E. All cracks shall be brought to the attention of the engineer and a determination made of whether the cracks are subject to movement. The cracks shall be repaired as directed prior to application of the repair material.

F. All existing joints shall be maintained. New joints, if any, shall be installed as detailed on the drawings.

G. Soak concrete surfaces thoroughly with potable water prior to placement. Concrete shall be saturated and free of standing water at time of placement. An epoxy bonding agent may be considered in lieu of presoaking. When an epoxy bonding agent is used, concrete surfaces must be completely dry prior to application.
[For more detailed information, refer to the following source: "Guide For Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion", Guideline No. 03730, prepared by the Technical Guidelines Committee of ICRI, March 1995.]

3.02 REINFORCEMENT

A. All reinforcing steel that has lost bond with the concrete or has more than one-half of its circumference exposed shall be undercut by at least 3/4 inch (18 mm) or two times the maximum aggregate size.



B. All reinforcement shall be rigidly secured and supported.

C. If more than 20% of the diameter of a reinforcing bar has been deteriorated, the bar will require replacement or will need to be spliced as directed by the engineer.

D. All exposed reinforcing steel shall be free of all loose scale and rust, and other contaminants.

E. The minimum cover over reinforcement shall be in accordance with job specifications or 3/4 inch (18 mm), whichever is greater.

3.03 ENVIRONMENTAL CONDITIONS

A. Condition and maintain all materials and surfaces that contact repair material to between 35°F and 90°F (2°C and 32°C), but optimally between 55°F and 75°F (13°C and 24°C) whenever possible. Shade from direct sunlight as necessary.
[Revise the temperature range above as appropriate based upon product specified and jobsite conditions. For detailed conditioning procedures for Cold Weather or Hot Weather Grouting, refer to PART F – EXTREME WEATHER CONDITIONS.]

3.04 EQUIPMENT AND MATERIALS

A. All necessary tools, equipment and materials shall be clean, 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.

3.05 MIXING

Mortar Mixer (Stationary Barrel with Moving Paddles)

A. Five Star Structural Concrete V/O is a rapid-setting material – do not mix more material than can be placed with 15 minutes.
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 repair material and mix to a uniform consistency for 2 -3 minutes. Stop mixer and check consistency. Add some or all remaining water if necessary to achieve desired non-sag consistency. Do not exceed maximum water content as stated on product packaging or an amount that will cause segregation.
D. Continue to mix thoroughly for a total mixing time of 4 – 5 minutes.
E. Place material immediately after mixing.

Drill and Paddle Mixer

A. Start by adding the minimum amount of premeasured potable water into large mixing container or large pail. While mixing, slowly add repair material and mix to a uniform consistency for 2 – 3 minutes. Check consistency. If necessary add some or all of remaining water to achieve desired consistency. Continue mixing for 2 minutes. Do not exceed maximum water content as stated on product packaging or an amount that will cause segregation.
B. Continue to mix thoroughly for a total mixing time of 4 – 5 minutes.
C. Place material immediately after mixing.

PART D – APPLICATION - CONCRETE REPAIR

4.01 PLACEMENT PROCEDURES

TROWEL - VERTICAL/OVERHEAD

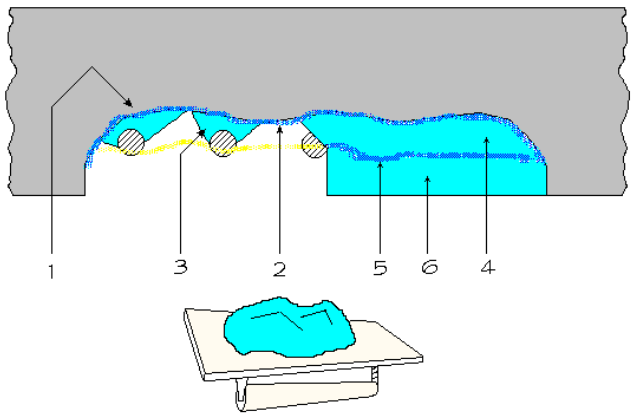
[For vertical and overhead repair areas with limited reinforcement.]

A. Substrate shall be saturated and free of water during application except where an epoxy bonding agent is utilized. Surfaces shall be completely dry if use of an epoxy bonding agent is undertaken. Apply epoxy bonding agent in accordance with manufacturer's recommendations., ensuring a uniform and even coat of bonding agent on all repair surfaces. Ensure installation of Structural Concrete V/O is within specified open time of bonding agent (while bonding agent is still tacky).

B. Apply thin layer / scrub coat of repair material and work firmly into roughened substrate filling all pores and voids (place scrub coat only over area that can be immediately covered with repair material). Follow immediately by firmly applying layer of repair material ½ inch to 1 inch thick over scrub coat, depending upon size of repair. Overhead repairs layers will require thinner applications to prevent sagging.

C. For multiple lift applications, scratch surface of initial lift using a nail in a checkerboard pattern to create a bond profile for next lift. Allow initial lift to stiffen sufficiently to hold next lift and place second lift of repair material. Firmly work repair material into initial lift.

D. Placement shall proceed continuously until area is completely filled.



1. Saturated surface
2. Thin layer of repair material
3. Fill behind reinforcement
4. First layer of repair material
5. Thin layer of repair material
6. Final layer of repair

PART E - FINISHING AND CURING - CONCRETE REPAIR

5.01 FINISHING

A. Finish repair material to desired texture when it offers stiff resistance. A wood float, sponge float, brush, or trowel may be used for finishing.

5.02 CURING

A. Wet cure repair material for 30 - 60 minutes after placement.
B. Repair material shall be protected from excessive evaporation prior to set, freezing, rain, hydrostatic pressure, vibration and traffic as recommended by the manufacturer.

PART F – EXTREME WEATHER CONDITIONS - CONCRETE REPAIR

6.01 COLD WEATHER REPAIRS

[Low temperatures delay the set, increase working time and delay the strength development of cement-based products. Cold substrate temperatures also make repair material harder to hang on vertical and overhead surfaces. The procedures below will compensate for these conditions.]

A. All surfaces shall be preconditioned and maintained between 45°F and 90°F (7°C and 32°C) and materials conditioned to between 45°F and 80°F (7°C and 27°C). . Due to the mass of palletized material, up to 48 hours of heating / conditioning may be required. Presoak area with hot water where applicable.

B. Heating the substrate of repair area shall 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 35°F (2°C) minimum until material reaches 1000 psi (6.9 MPa) 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 - CONCRETE REPAIR

6.01 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 and bulk packaging, 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).

C. Cooling of surfaces, materials and equipment can be accomplished by using iced water for mixing and presoaking concrete. Do not put ice directly into repair material. Shade area from direct sunlight or pour material when temperatures are decreasing.

D. Wind breaks shall be provided when necessary to prevent rapid evaporation.

E. Repair material shall remain protected and curing shall be dependent on specified product. Cure repair material in accordance with manufacturer's recommendations. *[Specify appropriate curing method.]*

REFERENCE

ACI 305R-91
"Hot Weather Concreting"