



# FIVE STAR PRODUCTS, INC.

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## DESIGN-A-SPEC™ GUIDELINES FIVE STAR® EPOXY ADHESIVE LV

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## **PART A - GENERAL CONDITIONS - EPOXY ADHESIVE**

### **1.01 SCOPE**

The work covered by this document consists of furnishing all equipment, materials, labor and performing all operations required for the installation of anchors in concrete, repair of cracks in concrete or bonding of concrete 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 anchoring, crack repair or bonding shall be on a per anchor basis, linear foot or square foot applied.
- B. Payment for anchoring, crack repair or bonding work shall be at the unit price bid per anchor, linear foot or square foot cubic foot applied. 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 - EPOXY ADHESIVE**

## 2.01 MATERIALS

A. The epoxy adhesive shall be a two component, 100% solids, moisture insensitive structural epoxy suitable for pressure injection or gravity feed. The manufacturer shall be ISO 9001 certified and have at least 10 years experience in the manufacture of epoxy systems. 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 grout material shall meet all the following typical performance criteria when cured at 73°F (23°C):

1.	Viscosity, ASTM D 2393	400 cps
2.	Gel Time, ASTM C 881	30 Minutes
3.	Flexural Strength, ASTM D 790	9,600 psi (66.2 MPa)
4.	Compressive Strength, ASTM D 695	16,300 psi (112 MPa)
5.	Compressive Modulus, ASTM D 695	3.8 x 10 <sup>5</sup> psi (2,600 MPa)
6.	Shrinkage, ASTM D 2566	0.07%
7.	Heat Deflection Temperature, ASTM D 648	122°F (50°C)
8.	Bond Strength, ASTM C 882	Concrete Failure

*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® Epoxy Adhesive LV**

As manufactured by Five Star Products, Inc., Fairfield, CT 06825, (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 - EPOXY ADHESIVE - ANCHORING**

### 3.01 ANCHOR HOLES

- A. All anchor holes shall be free of water, dust, debris, drilling slurries and other contaminants. Prepare concrete using acceptable mechanical means and concrete cleaners as necessary to obtain clean, sound and rough surfaces. Remove all loose material with a stiff nylon brush. Blow out hole with moisture and oil-free compressed air.
- B. Prior to epoxy anchoring, all holes shall be visibly dry.

### 3.02 ANCHOR SURFACES

- A. All bolts, reinforcing steel, dowels and pins shall be free of oil, grease, rust and other contaminants. Use acceptable mechanical and chemical means as necessary to clean anchor surfaces.
- B. Where no bond to anchor is required to allow free length stretching during torquing, apply a bond breaker such as duct tape or other suitable material.
- C. When centered in holes prior to anchoring, all anchors shall be adequately secured to resist movement from forces developed during grouting.

### 3.03 Epoxy Anchoring (Two-Component System)

- A. Hole diameter shall be a maximum of the anchor diameter plus 1/4 inch (6 mm).
- B. Embedment length shall be as shown on drawings.

### 3.04 ENVIRONMENTAL CONDITIONS

#### Epoxy Anchoring

- A. Condition and maintain all materials and surfaces that contact anchoring material to between 60°F and 90°F (15°C and 32°C). Shade from direct sunlight as necessary. *[For detailed conditioning procedures for Cold Weather or Hot Weather Anchoring, refer to PART F – EXTREME WEATHER CONDITIONS.]*

### 3.05 EQUIPMENT AND MATERIALS

#### Epoxy Anchoring

- A. All necessary tools, equipment and materials shall be as close as possible to the anchoring area.
- B. Appropriate clothing and safety equipment shall be worn to avoid breathing dust and to prevent eye and skin contact with components and mixed material.
- C. A strong detergent/water solution or solvent cleaner as appropriate shall be available for clean up. Refer to data sheet of the product specified for proper cleaning solution.

### 3.06 MIXING

#### Drill and Paddle Mixer

- A. Pre-mix each component thoroughly. Pour pre-proportioned Component A (resin) and pre-proportioned Component B (hardener) into pail at 2:1 (resin:hardener) ratio. Mix thoroughly with a slow speed mixer for 3 minutes; avoid air entrapment.
- B. Do not mix more material than can be placed within the working time of the specified product.
- C. Do not add solvents to increase flowability.

## **PART C – PREPARATION – EPOXY ADHESIVE – CRACK REPAIR**

### 3.01 CONCRETE SURFACES

- A. For crack filling applications, if required, route cracks to a maximum 1/8 to 1/4 inch (3 – 6 mm) width. Remove all loose material and dust via oil free compressed air or vacuum.
- B. For pressure injection applications, identify optimum port spacing and locations based upon crack width, depth, length and accessibility. Position ports on open segments of crack, crack intersections at areas which permit maximum flow into crack and at sufficient locations that will ensure sufficient travel of epoxy between ports.
- C. For pressure injection applications, apply epoxy capping material over crack 1/2 inch (12 mm) wider than crack on both sides of crack in a suitable thickness to withstand injection pressures and thermal movement. Firmly tool capping material in both directions across crack ensuring adequate seal and complete encapsulation of crack.
- D. Allow epoxy capping material to completely cure prior to pressure injection of epoxy adhesive.
- E. For gravity fill applications, apply bead of caulk or sealant along length of crack on both sides of crack to act as reservoir for epoxy adhesive. Allow sealant or caulk to fully cure before gravity filling cracks.

### 3.02 CRACK SIZE

- A. Cracks up to ¼ inch may be injected or filled with adhesive. Larger cracks should be filled using a gel consistency epoxy adhesive.

### 3.03 ENVIRONMENTAL CONDITIONS

- A. Condition and maintain all materials and surfaces contacting epoxy adhesive to between 60°F and 90°F (15°C and 32°C). Shade from direct sunlight as necessary.

### 3.04 EQUIPMENT AND MATERIALS

- A. All necessary tools and equipment and materials shall be as close as possible to area being repaired. Equipment shall be clean and dry.
- B. Appropriate clothing and safety equipment shall be worn to avoid breathing vapors and prevent eye and skin contact with components and mixed material.
- C. An appropriate solvent shall be available for clean up. Refer to data sheet of material specified.

### 3.05 MIXING

- A. Pre-mix each component thoroughly. Pour pre-proportioned Component A (resin) and pre-proportioned Component B (hardener) into pail at 2:1 ratio (resin:hardener). Mix thoroughly for 3 minutes avoid air entrapment.
- B. Do not mix more material than can be placed within the working time of the product.
- C. Do not add solvents to increase flowability.

## **PART D – APPLICATION - EPOXY ADHESIVE - ANCHORING**

### **4.01 PLACEMENT PROCEDURES**

#### Epoxy Anchoring

- A. When pouring material before anchor is positioned in hole, fill hole to approximately two-thirds full. Carefully insert anchor to bottom of hole.
- B. Carefully rod material in hole to displace entrapped air and to raise material to finish level.
- C. Align or center anchor as specified.

#### Crack Repair

- A. For gravity feed applications, pour epoxy adhesive into crack and allow material to penetrate crack. Continue process until rejection and epoxy no longer fills crack.
- B. For pressure injection applications, inject epoxy according to equipment manufacturer's recommendations and recommended injection pressures.
- C. Monitor flow of epoxy adhesive from injection port to adjacent ports. Continue injecting until port no longer accepts epoxy (rejection). Refusal may be indicated when pumping motion stops or pressures increase in line.

## **PART E – FINISHING AND CURING - EPOXY ADHESIVE - ANCHORING**

### **5.01 FINISHING**

- A. All excess material shall be removed from around hole and anchor before it hardens.

### **5.02 CURING**

- A. Protect from temperature extremes, rain and water after placement. Do not wet cure epoxy grout.
- B. Protect from temperatures below 45°F (7°C) until required strength is achieved.
- C. In-service operation may begin immediately after minimum strength and modulus have been achieved.

## **PART E – FINISHING AND CURING - EPOXY ADHESIVE - CRACK REPAIR**

### 5.01 FINISHING

- A. Upon completion of curing, all ports and epoxy capping material shall be removed as directed by the engineer. Mechanical grinding of excess epoxy material is required after curing

### 5.02 CURING

- A. No curing is required.

## **PART F – EXTREME WEATHER CONDITIONS - EPOXY ADHESIVE**

### 6.01 COLD WEATHER

*[Low temperatures decrease flow, delay set and strength development of epoxy products. The procedures below may compensate for these conditions.]*

- A. Materials shall be conditioned so that the mixed epoxy is between 70°F and 80°F (21°C and 27°C). Conditioning for 24 - 48 hours may be required, depending upon quantity of material.
- B. All surfaces in contact with epoxy adhesives shall be preconditioned and maintained at a temperature above 40°F (4°C).

## **PART F – EXTREME WEATHER CONDITIONS - EPOXY ADHESIVE**

### 6.01 HOT WEATHER

*[High temperatures accelerate the set, decrease working time, and accelerate the strength gain of epoxy products. The procedures below may compensate for these conditions.]*

- A. Materials shall be conditioned as necessary so that the mixed epoxy adhesive is between 70°F and 80°F (21°C and 27°C). Conditioning for 24 - 48 hours may be required.
- B. All surfaces in contact with epoxy adhesives shall be conditioned to below 90°F (32°C).