



FIVE STAR PRODUCTS, INC.

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DESIGN-A-SPEC™ GUIDELINES FIVE STAR INJECTION GEL

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PART A - GENERAL CONDITIONS - EPOXY ADHESIVES

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 or crack repair 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 hand application. 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 epoxy adhesive shall meet all the following typical performance criteria when cured at 73°F (23°C):
- | | | |
|----|-------------------------------------------------------------------|--------------------------------------|
| 1. | Viscosity | Gel |
| 2. | Gel Time, ASTM C 881 | 40 Minutes |
| 3. | Flexural Strength, ASTM D 790 | 5,500 psi (38 MPa) |
| 4. | Shear Strength, ASTM D 732 | 3,500 psi (24.2 MPa) |
| 5. | Bond Strength, ASTM C 882 | |
| | 2 Days | 2,200 psi (15.2 MPa) |
| | 14 Days | 4,600 psi (31.6 MPa) |
| 6. | Compressive Strength, ASTM D 695 | 10,000 psi (68.3 MPa) |
| 7. | Compressive Modulus, ASTM D 695 | 2.8 x 10 ⁵ psi (1931 MPa) |
| 8. | Water Absorption, ASTM D 570 | 0.10% |
| 9. | Meets ASTM C 881, Types I, II, IV and V
Grade 3, Classes B & C | |

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[®] Injection Gel

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 - EPOXY ADHESIVES - 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. Sides of anchor holes should have a rough finish. 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 HOLE DIAMETER

[Clearances are dependent on specified product, environmental conditions and embedment length. Hole dimensions, type of anchors, embedment length, spacing, and edge distances must be specified and approved by the engineer. The engineer should incorporate an appropriate safety factor. Select one or more of the following.]

Epoxy Anchoring

Hole Diameter

- A. Hole diameter shall be a maximum of the anchor diameter plus ¼ inch (6 mm).

Length of Embedment

- A. Embedment length for anchors shall be as shown on drawings or as specified by the Engineer.

3.04 ENVIRONMENTAL CONDITIONS

Epoxy Anchoring

- A. Condition and maintain all materials and surfaces that contact anchoring material to between 60°F and 80°F (15°C and 27°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 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. Pour properly proportioned (1:1 ratio) Component A (resin) and Component B (hardener) into pail. Mix thoroughly with a slow speed mixer for approximately 3 minutes; avoid air entrapment. When mixing full units, pour off mixed adhesive into smaller containers to reduce exotherm resulting from mass of material that will be generated by adhesive in a single container.
- B. Do not mix more material than can be placed within 30 minutes.
- C. Do not add solvents to increase flowability.

PART C – PREPARATION - EPOXY ADHESIVES – CRACK REPAIR

4.01 CONCRETE SURFACES

- A. For crack sealing applications, route cracks to a maximum $\frac{1}{4}$ - $\frac{1}{2}$ inch (6 - 12 mm) width. Remove all loose material and dust via oil-free compressed air or vacuum.
- B. For pressure injection applications, identify optimum port locations and determine proper port spacing based upon crack width, crack depth, accessibility and injection pressures. Position ports on open segments of crack, crack intersections, at areas which permit maximum flow into crack and at locations that will ensure sufficient travel of epoxy between ports.
- C. Apply epoxy capping material directly over crack $\frac{1}{2}$ inch wider than crack on both sides of crack in a suitable thickness to withstand injection pressures and thermal movement. Firmly place tool capping material in both directions across the crack to ensure adequate seal and complete encapsulation of crack.
- D. Allow epoxy capping material to cure prior to resin injection.

4.02 CRACK SIZE

- A. Cracks up to $\frac{1}{4}$ inch (6 mm) maximum may be best repaired with a low viscosity system.
- B. Cracks $\frac{1}{4}$ inch to $\frac{1}{2}$ inch maximum shall be repaired with a gel system.

4.03 ENVIRONMENTAL CONDITIONS

- A. Condition and maintain materials to between 70°F and 80°F (21°C and 27°C) and all surfaces to between 40°F and 90°F.

4.04 EQUIPMENT AND MATERIALS

- A. All necessary tools, 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 product specified.

4.05 MIXING

Drill and Paddle Mixer

- A. Premix each component.
- B. Place properly proportioned (1:1 ratio) components into clean, dry pail. Mix thoroughly for approximately 3 minutes; avoid air entrapment.
- C. Do not mix more material than can be placed within the working time of the material. When mixing full units, pour off mixed adhesive into smaller containers to reduce exotherm resulting from mass of material that will be generated by full unit of adhesive in a single container.
- D. Do not add solvents.

Automated

- A. Premix each component.
- B. For automated mixing, a dual component dispenser that meters the components to the proper ratio and delivers them to an in-line mixer should be used. Dispenser should have two positive displacement metering pumps.
- C. Do not add solvents.

PART D – APPLICATION - EPOXY ADHESIVES - ANCHORING

5.01 PLACEMENT PROCEDURES

Epoxy Anchoring

- A. Pour material to bottom of hole and fill hole to desired level.
- B. Coat anchor with adhesive.
- C. Insert anchor and rotate clockwise slowly in hole.
- D. Anchor shall be properly seated in bottom of hole. Align or center anchor as specified.

PART D – APPLICATION - EPOXY ADHESIVE - CRACK REPAIR

5.01 CRACK REPAIR

- A. Inject epoxy in accordance with equipment manufacturer's recommendations. Typical injection pressures range from 20 – 400 psi; pressures will be higher or lower depending upon crack width, port spacing and injection equipment used.
- B. Monitor flow of epoxy from injection port to adjacent ports. Continue injecting as epoxy reaches adjacent ports until injection port no longer accepts epoxy (refusal). Refusal may be indicated when pumping motion stops or pressures stability in dispensing line.
- C. For crack sealing applications, place adhesive over v-notched cracks and firmly work into crack using margin trowel or similar tool.

PART E – FINISHING AND CURING - EPOXY ADHESIVE - ANCHORING

6.01 FINISHING

- A. All excess material shall be removed from around hole before it hardens. After hardening, excess material must be mechanically removed via grinding or similar method.

6.02 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 ADHESIVES - CRACK REPAIR

5.01 FINISHING

- A. Upon completion of curing, all ports and epoxy capping material shall be removed as directed by the engineer.

5.02 CURING

- A. No curing is required.

PART F – EXTREME WEATHER CONDITIONS - EPOXY ADHESIVES

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 ADHESIVES

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).