



DIVISION 3 -CONCRETE
Section 03930 Concrete Rehabilitation
Epoxy-Injected Crack Repair

Part 1 - General

1.01 Summary

- A. This specification describes the pressure injection of cracks with an epoxy resin adhesive.

1.02 Quality Assurance

- A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001/9002 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
- B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.
- C. Install materials in accordance with all safety and weather conditions required by the manufacturer, or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.03 Delivery, Storage, and Handling

- A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
- B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.
- C. Condition the specified product as recommended by the manufacturer.

1.04 Job Conditions

- A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 40°F (5°C) and rising.
- B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified product.

1.05 Submittals

- A. Submit two copies of manufacturer's literature, to include: Product Data Sheets, and appropriate Material Safety Data Sheets (MSDS).

1.06 Warranty

- A. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) one, beginning with date of substantial completion of the project.

Part 2 - Products

2.01 Manufacturers

- A. **Sikadur 52**, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio 43302 is considered to conform to the requirements of this specification.
- B. **Sikadur 31 Hi-Mod Gel**, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio 43302 is considered to conform to the requirements of this specification

2.02 Materials

- A. Epoxy resin adhesive for pressure injection of cracks shall be **Sikadur 52**:
 - 1. Component "A" shall be a modified epoxy resin of the diglycidether bisphenol A Type or containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
 - 2. Component "B" shall be primarily a reaction product of a selected amine blend with an epoxy resin of the diglycidether bisphenol A Type containing suitable viscosity control agents, pigments, and accelerators.
 - 3. The ratio of component A: componet B shall be 2:1 by volume
 - 4. The material shall not contain asbestos.
- B. Epoxy resin adhesive for sealing of cracks & porting devices shall be **Sikadur 31 Hi-Mod Gel**:
 - 1. Component "A" shall be a modified epoxy resin of the diglycidether bisphenol A Type or containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
 - 2. Component "B" shall be primarily a reaction product of a selected amine blend with an epoxy resin of the diglycidether bisphenol A Type containing suitable viscosity control agents, pigments, and accelerators.
 - 5. The ratio of component A: componet B shall be 1:1 by volume
 - 6. The material shall not contain asbestos.
- C. Porting devices as required for either manual or automated application. Porting devices for automated application shall be supplied from maufacturer of the pressure injection equipment.

2.03 Performance Criteria

- A. Properties of the mixed epoxy resin adhesive used for the pressure injection grouting::
 - 1. Pot Life: Approx. 30 minutes (60 gram mass) @ 73° F
 - 2. Tack-Free Time: 90°F (32°C) 1.5 to 2 hours
75°F (24°C) 3 to 3.5 hours
40°F (5°C) 14-16 hours
 - 3. Viscosity: Approx. 200 cps. (mixed)
 - 4. Color: Clear, pale yellow
- B. Properties of the cured epoxy resin adhesive used for pressure injection of grout:
 - 1. Compressive Strength (ASTM D-695)
 - a. 3 day: 10,000 psi (68.9 MPa)
 - b. 7 day: 11,300 psi (77.9 MPa)
 - c. 28 day: 12,000 psi (82.7 MPa)Compressive Modulus, psi
 - a. 7 day 350,000 psi (2400 Mpa)
 - 2. Shear Strength (ASTM D-732)
 - a. 14 day: 4,300 psi (29.6 MPa)
 - 3. Flexural Strength (ASTM D-790)
 - a. 14 day: 5,400 psi (37.2 MPa)

Tangent Modulus of Elasticity in Bending

- b. 14 days: 380,000 psi (2,600 Mpa)
- 4. Bond Strength (ASTM C-882) ,14 days (moist cure)
 - a. Hardened Concrete to Hardened Concrete 2,200 psi (15 Mpa)
- 5. Water Absorption (ASTM D-570), 7 day
 - 1.50% (2 hour boil)
- 6. Tensile properties (ASTM D-638) min.
 - a. 7 day Tensile Strength 7,900 psi (54 Mpa)
Elongation at Break 3.1%
 - b. 14 day Modulus of Elasticity 200,000 psi (1,400 Mpa)

C Properties of the mixed epoxy resin adhesive used for sealing of cracks & porting devices::

- 1. Pot Life: Approx. 60 minutes (500 gram mass) @ 73° F
- 2. Tack-Free Time: 75°F (24°C) 1.5 – 2.5 hours
40°F (5°C) 14-16 hours
- 3. Consistency: Non-Sag paste
- 4. Color: Concrete Gray

D. Properties of the cured epoxy resin adhesive used for sealing of cracks & porting devices:

- 1. Compressive Strength (ASTM D-695) @ 73F
 - a 1 day: 13,000 psi (89.6 MPa)
 - b. 3 day: 14,000 psi (96.5 MPa)
 - c. 28 day: 16,000 psi (110.3 MPa)Compressive Modulus, psi : .min.
 - a. 7 day 795,000 psi (Mpa)
- 2. Shear Strength (ASTM D-732)
 - a. 7 day: 4,600 psi (31.7 MPa)
- 3. Flexural Strength (ASTM D-790) min.
 - a. 7 day: 6,100 psi (42 MPa)Tangent Modulus of Elasticity in Bending .min.
 - b. 7 day: 167,000 psi (11,520 MPa)
- 5. Bond Strength (ASTM C-882), 14 day (moist cure) min.
 - a. Hardened Concrete to Hardened Concrete 2,900 psi (20 Mpa)
- 5. Water Absorption (ASTM D-570)
 - a. 24 hour 0.07%
- 3. Tensile properties (ASTM D-638) min.
 - a. 7 day Tensile Strength 3,300 psi (22.7 Mpa)
Elongation at Break 0.9%

Note: Tests above were performed with material & curing conditions at 73F & 45-55% relative humidity.

Part 3 - Execution

3.01 Mixing and Application

- A. Mixing the epoxy resin adhesive for sealing the cracks & porting devices: Pre mix each component. Proportion equal (A:B = 1:1) parts by volume of Component "A" and Component "B" into a clean, dry mixing pail. Mix thoroughly for 3 minutes with a jiffy paddle on a low-speed (400-600 rpm) drill. Mix only that quantity of material that can be used within its potlife (60 minutes, 500gram mass @ 73F).
- B. Mixing of the epoxy resin adhesive used for the pressure injection grouting:
 - 1. Manual: Proportion two parts by volume of Component "A" to one part Component "B" into a clean, dry mixing pail. Mix thoroughly for 3 minutes with a jiffy paddle on a low-speed (400-600 rpm) drill. Mix only that quantity of material that can be used within its potlife (20-30 minutes 73F).
- C. Placement procedure:
 - 1. The epoxy resin adhesive for sealing the cracks & porting device: Set the porting devices as required by the equipment manufacturer. Spacing of the porting devices shall be accomplished as required to achieve the travel of the epoxy resin for the pressure injection grouting between ports and fill the cracks to the maximum. On structures open on both sides, provide porting devices on opposite sides at staggered elevations. Apply the mixed epoxy resin adhesive for sealing over cracks and around each porting device to provide an adequate seal to prevent the escape of the epoxy resin adhesive for the injection grouting. Where required by the Engineer, apply the epoxy resin adhesive for sealing in such a manner that minimal defacing or discoloration of the substrate shall result.
 - 2. The epoxy resin adhesive for the pressure injection grouting:

Manual: Load the mixed epoxy resin adhesive for grouting into a disposable caulking cartridge or bulk-loading caulking gun. Inject the prepared cracks with a constant pressure in order to achieve maximum filling & penetration without the inclusion of air pockets or voids in the epoxy resin adhesive. Begin the pressure injection at the widest part of the crack being injected and continue until there is the appearance of epoxy resin adhesive at an adjacent port, thus indicating travel. When travel is indicated, to discontinue or continue the pressure injection from that port should be made by the contractor based on his experience, with the approval of the Engineer. Continue procedure until pressure injectable cracks has been filled.

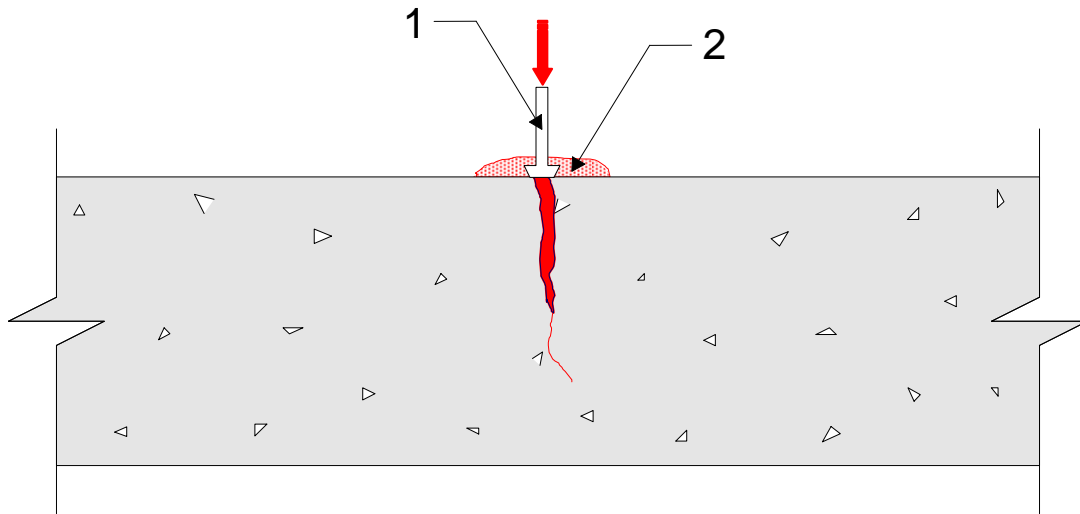
Automated: Dispense the epoxy resin adhesive for grouting under constant pressure in accordance with procedures recommended by the equipment manufacturer as required to achieve maximum filling and penetration of the prepared cracks without the inclusion of air pockets or voids in the epoxy resin adhesive. The pressure injection of single or multiple ports, by use of a manifold system, is possible. This decision should be made by the contractor, with the approval of the Engineer. Continue the approved procedure until all pressure injectable cracks have been filled.
- D. If penetration of any cracks is impossible, consult the Engineer before discontinuing the injection procedure. If modification of the proposed procedure is required to fill the cracks, submit said modification in writing to the Engineer for acceptance prior to proceeding.
- E. Adhere to all limitations and cautions for the epoxy resin adhesive in the manufacturers current printed literature.

3.02 Cleaning

- A. After the epoxy resin adhesive for grouting has cured, the epoxy resin adhesive for sealing cracks and porting devices shall be removed as required by the Engineer. Clean the substrate in a manner to produce a finish appearance acceptable to the Owner.
- B. The uncured epoxy resin adhesive can be cleaned from tools with approved solvent. The cured epoxy resin adhesive can only be removed mechanically.
- C. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

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**Sikadur[®] 52 /
Sikadur 31 Hi-Mod Gel
Crack Filler / Cap Seal**



1. Set porting devices over cracks.
2. Place mixed Sikadur 31, Hi-Mod Gel epoxy resin adhesive over cracks and around each injection port a minimum of 1" wide by a ¼" thick.
3. Allow sufficient time for epoxy resin adhesive cap seal to set before injecting.
4. When the cap seal has cured, inject Sikadur 52 with steady pressure.
 4. Use automated injection equipment or manual method.

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