

INJECTION OF CRACKS IN CONCRETE WITH PASTE EPOXY ADHESIVE

The specification information below is intended for use by architects, engineers or other specifiers as a guideline in defining the requirements of Epoxy Adhesive Injection for the structural repair of cracks and voids in masonry and concrete where the liquid adhesive cannot be contained in the crack or void.

NOTES TO THE SPECIFIER

This document has been prepared to assist specifiers in the preparation of the specifications for the injection of paste epoxy adhesives into cracks in concrete using the SCB® (Structural Concrete Bonding®) Process from Master Builders, Inc. CONCRESLIVE® 1428 or other CONCRESLIVE® 1419 Paste Epoxy Adhesives are recommended materials for such applications.

This document was designed as part of a complete project specification, that is, it is not intended to be a "stand alone" item.

PART 1 - GENERAL

1.1 Scope

- A. The contractor or his subcontractor shall furnish all materials, tools, equipment, appliances, transportation, labor and supervision required to repair cracks by the injection of an epoxy resin adhesive.

1.2 Pre-qualification

- A. Applicator's Qualification: Epoxy Injection shall be performed by a licensed applicator of the SCB® (Structural Concrete Bonding®) Process.
- B. Workman's Qualification: Contractors/Subcontractors workmen engaged in the epoxy injection process shall have satisfactorily completed a program of instruction in the methods of restoring concrete structures, wooden timbers and beams utilizing the specific epoxy injection process indicated. The curriculum shall include theory in the nature and causes of cracking in concrete and wood, methods for permanently repairing damaged concrete structures, the technical aspects of correct material selection and use, and the operation, maintenance and trouble shooting of equipment.

PART 2 - PRODUCTS

2.1 Epoxy Resin Adhesive for Injection

- A. (In this section, insert the specification for the injection product selected, showing the test method and physical properties.)

2.2 Surface Seal

2.2.1. Description: The surface seal material is that material used to confine the injection adhesive in the fissure during injection and cure.

2.2.2 Properties: The surface seal material shall have sufficient strength to resist injection pressures adequately to prevent leakage during injection.

2.3 Equipment for Injection

2.3.1 Type: The equipment used to meter and mix the two adhesive components and inject the mixed adhesive into the crack shall be a portable, positive displacement type pump unit that provides positive ratio control of exact proportions of the two components at the injection nozzle. The pumps shall be air powered and shall provide in-line metering and mixing.

2.3.2 Ratio Tolerance: The injection equipment shall have the capability of maintaining the weight ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of +/-5% by volume at all flow rates between 30 grams/min and 750 grams/min.

PART 3 - EXECUTION OF WORK

3.1 Preparation

3.1.1 Surfaces adjacent to cracks or other areas of application shall be cleaned of dirt, dust, grease, oil, efflorescence or other foreign matter detrimental to bond of epoxy injection surface seal.

3.1.2 Entry ports shall be provided along the crack at intervals of not less than the thickness of the concrete at that location.

3.1.3 Surface seal material shall be applied to the face of the crack between the entry ports. For through cracks, surface seal shall be applied to both faces.

3.1.4 Enough time for the surface seal material to gain adequate strength shall pass before proceeding with the injection.

3.2 Epoxy Injection of Paste Adhesives

3.2.1 Injection of epoxy adhesive shall begin at lowest entry port and continue until there is an appearance of epoxy adhesive at the next port adjacent to the entry port being pumped

3.2.2 When epoxy adhesive travel is indicated by appearance at the next adjacent port, injection shall be discontinued on the entry port being pumped, and epoxy injection shall be transferred to the port adjacent to the port where epoxy adhesive has appeared.

3.2.3 Injection shall continue at every other port as described in 3.2.2 above until the end of the crack has been reached.

3.2.4 Injection shall begin at the lowest port that has not been injected and inject until adhesive is forced out of the next adjacent port.

3.2.5 Injection shall continue, injecting the ports that have not been injected successively as described in 3.2.4 above.

NOTE TO THE SPECIFIER: The injection sequence described above is to be used only when the back or underside of a through crack cannot be sealed, and the crack is of sufficient width (greater than 20 mills) to allow the injection of a paste adhesive. If both planes of the crack can be sealed, the port-to-port injection sequence described in Specification Bulletin 6S1, "Injection of Concrete Members with Liquid Epoxy Adhesives", would apply.

3.3 Finishing

3.3.1 When cracks are completely filled, epoxy adhesive shall be cured for sufficient time to allow removal of surface seal without any flowing out of epoxy injection material.

3.3.2 Surface seal material and injection adhesive runs or spills shall be removed from concrete surfaces.

3.3.3 The face of the crack shall be finished flush with the adjacent concrete showing no indentations or protrusions caused by the placement of entry ports.

3.3.4 After the work has been accepted by the Engineer, cored holes shall be repaired using a two component bonding agent. The bonding agent shall be applied to the surfaces of cored holes followed by application of grout mix placed by hand trowel, thoroughly rodded and tamped in place, and finished to match color, finish and texture of existing concrete to the satisfaction of the Engineer. Material and procedure for filling testing core holes shall be submitted to and approved by the Engineer before proceeding with this work.

3.4 Field Quality Control

3.4.1 Core testing to verify penetration and strength. (NOTE: It is imperative that no tendons be cut.)
Initial Cores: The contractor/subcontractor shall obtain core samples adequate in diameter to intersect the crack to the full depth of the core. Three core samples shall be taken in the first one hundred lineal feet of crack repaired and one core for each one hundred lineal feet thereafter. The cores shall be for full crack depth and taken at locations selected by the Engineer. The contractor/subcontractor shall provide at no additional expense to the owner the following labor, materials, and services required for the core sampling and testing specified herein as directed by the Engineer, including but not limited to: preparation, handling, storage and transportation of epoxy injection concrete core test specimens; suitable containers for the storage, curing and transportation of test specimens; suitable storage for supply of test equipment and other items required for sampling and testing.

3.4.2 Methods of Testing Initial Cores:

Penetration: Visual examination

Bond Strength/Compression Test: ASTM C 39-86

3.4.3 Test Requirements:

Penetration: A minimum of 90 percent of the crack shall be filled with epoxy adhesive. Bond Strength: Concrete failure before adhesive failure, or 6,500 psi with no failure of either concrete or adhesive.

3.4.4 Evaluation and Acceptance of Tests

If the initial cores conform with the requirements of 3.4.3 "Penetration" and 3.4.3 "Bond Strength", epoxy adhesive injection work at the area represented by the cores shall be accepted. If the initial cores do not conform to 3.4.3 "Penetration" above, the work shall not proceed further until the area represented by the cores are re-injected and re-tested for acceptance. After re-work of areas represented by failed initial cores is complete, the contractor shall obtain verifying cores, the number and location to be determined by the Engineer. Verifying cores shall be tested in accordance with paragraphs 3.4.2 and 3.4.3 for compliance. If cores do not conform to requirements of 3.4.3 "Bond Strength" above, the work shall be re-injected and re-tested for acceptance.

3.4.5 Payment for Core Testing

Testing of initial core samples which have been taken by the contractor will be performed by the owner's representative at the owner's expense.

Additional cores, called verification cores, required as indicated in Paragraph 3.4.4. herein, will be tested by the Owner at the Contractor's expense in accordance with a fee schedule established by the Engineer.

3.4.6 Ratio Test of Injection Equipment

Method: The mixing head of the injection equipment shall be disconnected and the two adhesive components shall be pumped simultaneously into separate containers. The amounts discharged are to be weighed to determine the ratio of the two components. The ratio test shall be performed for the flow rate of the combined components of 30 grams/min, and again at 750 grams/min. The ratio shall conform to the requirements of Paragraph 2.3.2 "Ratio Tolerance".

3.4.7 Proof of Ratio and Pressure Test

At all times during the course of the work, the contractor shall keep complete and accurate records of the ratio test specified in Paragraph 3.4.6 above. These records shall be available to the Engineer. In addition, the Engineer, at any time without prior notification of the Contractor, may request the Contractor to conduct the tests specified above in the presence of the Engineer.

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