

## INJECTION OF CONCRETE MEMBERS WITH LIQUID EPOXY ADHESIVES

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 in concrete up to 1/4" wide where the liquid adhesive can 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 liquid epoxy adhesives into cracks in concrete using the SCB® (Structural Concrete Bonding®) Process from Master Builders, Inc. SCB CONCRETSIVE® 1380 or SCB CONCRETSIVE® 1360 or other SCB CONCRETSIVE Injection 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 adhesive.

#### 1.2 Pre-qualification

- A. Applicator's Qualification: Epoxy Injection shall be performed by a certified 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, wooden timbers and beams, the technical aspects of correct material selection and use, and the operation, maintenance and trouble shooting of equipment.

### PART 2 - PRODUCTS

#### 2.1 Epoxy Adhesive for Injection

- A. (In this section, insert the specification for the injection product selected showing the test methods 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 injection adhesive components and inject the mixed adhesive into the crack shall be portable, positive displacement type pumps with interlock to provide positive ratio control of exact proportions of the two components at the nozzle. The pumps shall be electric or air powered and shall provide in-line metering and mixing.

2.3.2 Discharge Pressure: The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 160 +/- 5 psi and shall be equipped with a manual pressure control override.

2.3.3 Ratio Tolerance: The equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of +/- 5% by volume at any discharge pressure up to 160 psi.

2.3.4 Automatic Shut-off Control: The injection equipment shall be equipped with sensors on both the component A and the component B reservoirs that will automatically stop the machine immediately when either reservoir becomes dry.

## 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

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 next adjacent port where epoxy adhesive has appeared.

3.2.3 Epoxy adhesive injection shall be performed continuously until cracks are completely filled.

3.2.4 If port to port travel of epoxy adhesive is not indicated, the work shall be immediately stopped and the Engineer notified.

### 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 draining or run-back of epoxy adhesive material from the cracks.

### 3.3 Finishing, continued

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 and a suitable grout mix. 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 areas 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 confirm to requirements of 3.4.3 "Bond Strength" above, the work shall be re-injected and re-tested for acceptance.

### 3.4 Field Quality Control, continued

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 (rework) 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 Pressure Test of Injection Equipment

Method: The mixing head of the injection equipment shall be disconnected and the two adhesive component delivery lines shall be attached to the pressure check device. The pressure check device shall consist of two independent valved nozzles capable of controlling back pressure by opening or closing the valve. There shall be a pressure gauge capable of sensing the pressure build up behind each valve. The valves in the pressure check device shall be closed and the equipment operated until the gauge pressure on each line reads 160. The pumps shall be stopped and the gauge pressure shall not drop below 150 psi within 2 minutes.

Frequency of Pressure Test: The pressure test shall be run for each injection unit at the start of the day and every four hours thereafter that the unit is in use.

#### 3.4.7 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 through the ratio check device. The ratio check device shall consist of two independent valved nozzles capable of controlling back pressure by opening or closing the valve. There shall be a pressure gauge capable of sensing the back pressure behind each valve. The discharge pressure shall be adjusted to 160 psi for both adhesive components. Both adhesive components shall be simultaneously discharged into separate calibrated containers. The amounts discharged into the calibrated containers during the same time period shall be compared to determine that the volumes discharged deviate no more than 5 % from the correct ratio as specified in the manufacturers product data sheet.

Frequency of Ratio Test: The pressure test shall be run for each injection unit at the start of the day and every four hours thereafter that the unit is in use.

3.4.8 Proof of Ratio and Pressure Testing: At all times during the course of the work the Contractor shall keep complete and accurate records of the pressure and ratio tests specified 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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