

Revision of Section 519 Epoxy Resin (Injection)

Add Section 519 to the Standard Specifications as follows:

Description

519.01 This work consists of furnishing and injecting existing concrete cracks with epoxy resin on an existing bridge. All work shall be in accordance with these specifications and in conformity with the plans or as directed by the Engineer.

Materials

519.02 If the epoxy is used in conjunction with a Fiber Reinforced Polymer (FRP) composite system, the epoxy shall be compatible with the FRP composite system selected for this project.

The Epoxy shall be a two-part type, low viscosity epoxy adhesive material containing 100% solids and shall meet or exceed the following characteristics when tested in accordance with the following standards:

(a) Characteristics of Components:

- 1) Component A - shall be a blend of modified epoxy resins.
- 2) Component B - shall be a blend of modified amine curing agents.

(b) Test Method Requirements:

- 1) Component A - Brookfield RVT, 700 maximum; Viscosity @ 77 +/- 3 degrees F., cps; Spindle No. 2 @ 20 rpm.
- 2) Component B - Brookfield RVT, 240 maximum; Viscosity @ 77 +/- 3 degrees F, cps; Spindle No. 2. @ 20 rpm.

(c) Properties of Combined Components: When mixed in the ratio of two parts Component A to one part Component B by volume; or 100 parts Component A to 44 parts Component B by weight, shall be:

- 1) Potlife, 60g @ 77 +/- 3 degrees F., minutes; 25 minutes maximum.

(d) Properties of the Cured Adhesive: When cured for seven days @ 77 +/- 3 degrees F., unless otherwise specified, shall be:

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- 1) Ultimate Tensile Strength, psi: ASTM D638; 8000 minimum.
- 2) Compressive Yield Strength, psi: ASTM D695*; 15,000 minimum.
- 3) Heat Deflection Temperature: ASTM D648*; 130 F. minimum.

Test specimens must be cured in a manner such that the peak exothermic temperature of the adhesive does not exceed 77 degrees F.

The Contractor shall submit a Manufacturer's Certificate of Compliance to the Engineer, in accordance with Section 106.12, confirming that they conform to the material properties specified above and are compatible with the FRP system if applicable.

Construction Requirements

519.03 General. Existing cracks or construction joints with a width greater than or equal to 0.010 inches shall be pressure injected with epoxy in accordance with ACI 224.1R-07. Crack width determination shall be taken a minimum of 1/8 inch below the concrete surface using a measuring device capable of penetrating into the crack.

519.04 Equipment.

- (a) *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. The same manufacturer shall be used for both the injection equipment and the epoxy resin adhesive.
- (b) *Discharge Pressure.* The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 200 psi + 5 psi and shall be equipped with a manual pressure control override. For injection of gel epoxies, the equipment shall be equipped with the above features and be able to pump at up to 5,000 psi.
- (c) *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 200 psi. For gel epoxies, the ratio will be checked by weight at up to 5,000 psi.
- (d) *Automatic Shut-Off Control.* The injection equipment shall be equipped with sensors on both the Component A and B reservoirs that will automatically stop the machine when only one component is being pumped to the mixing head.

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519.05 Surface Preparation.

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

Installation of crack or construction joint surface sealers shall not proceed until contaminants capable of interfering with their adhesion are removed from joint substrates.

Surface seal material shall be applied to the face of the crack or construction joint or end. For through cracks or construction joints, surface seal shall be applied to both faces. Both sides of the crack shall be sealed with an epoxy mortar or oil-free clay, leaving small holes (entry ports) through which epoxy resin shall be injected. 1/8" to 1/4" diameter tubing may be used to form holes. Entry ports shall be 2"-4" long and shall be provided along the crack or construction joint at intervals of not less than the thickness of the concrete member at that location.

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

519.06 Installation and Application.

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

When epoxy adhesive travel is evident 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.

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

If port to port travel of epoxy adhesive is not evident, the Contractor shall stop work immediately and notify the Engineer.

When cracks or joints are completely filled, epoxy adhesive shall be cured for sufficient time for the epoxy adhesive to set prior to removal of injection or port sealing devices.

519.07 Storage and Handling. Storage and handling of all components of the epoxy system shall conform to Sections 106.08 and 106.09, and shall be in accordance with the manufacturer's instructions, and as approved by the Engineer.

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All materials shall be used and installed before the shelf life expiration date. All materials for which the shelf life date has been reached and surpassed shall be removed from the project site.

Method of Measurement

519.08 Epoxy Resin (Injection) will be measured by the actual length of cracks injected and accepted. Injection length will be the minimum distance between the ends of the crack along each face to be sealed. Epoxy Resin (Injection) of any cracks with a width less than 0.010 inches will not be measured or paid for.

Basis of Payment

519.09 The accepted quantities of Epoxy Resin (Injection) will be paid at the contract unit price.

Payment will be made under:

Pay Item	Pay Unit
Epoxy Resin (Injection)	Linear Foot

Payment for Epoxy Resin (Injection) will be full compensation for all labor, equipment, materials, tools, and all incidentals necessary to prepare the surfaces, seal the surfaces, install and remove ports and complete the epoxy injection.

Instructions to Designers (delete instructions and symbols from final draft):

Use this project special provision for Epoxy Resin (Injection) of concrete cracks and construction joints.

Permanent Changes to Project Dated Special Provisions

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Date	Author	Description of Change
1/14/19	BPM Cons.	Initial Website Issue
04.11.2023	M. Kayen	Revisions to make spec online accessibility-compliant. 5.22.23 Additional accessibility work.