

## **SECTION 411 EPOXY INJECTION OF CRACKS IN CONCRETE STRUCTURES**

### **411-1 Description.**

Inject epoxy into cracks in portland cement concrete.

### **411-2 Materials.**

Meet the requirements of Section 926 and as follows:

Use Type E compound epoxy for injection.

Use Type F-1 compound epoxy for sealing crack surfaces in preparation for injection.

Use epoxy materials on the Qualified Products List.

### **411-3 Equipment.**

For the equipment used to inject the epoxy, meet the recommendations of the epoxy injection material manufacturer and the following requirements:

(1) Use equipment that has the capacity to automatically proportion the material components within the mix ratio tolerances set by the epoxy materials manufacturer.

(2) Use equipment that has the capacity to automatically mix the epoxy component materials within the pump and injection apparatus. The Engineer will not allow batch mixing.

(3) Use equipment that has the capacity to inject the epoxy resin under controlled variable pressures up to 200 psi [1.4 MPa], with a pressure gauge mounted at or near the nozzle to indicate the actual working pressure.

### **411-4 Injection Personnel Qualifications.**

Employ personnel trained in performing injection work similar to that required for the project to carry out the epoxy injection of cracks in concrete. Provide an on-site supervisor for the epoxy injection work who is qualified by one of the following methods:

(1) Certified by the manufacturer of the epoxy injection material as having the necessary competence to accomplish the epoxy injection work in a satisfactory and safe manner in compliance with these Specifications.

(2) He can furnish documented evidence that he has a minimum of three years experience of on-site supervision of similar epoxy injection work and a list of five contracts in which similar epoxy injection was acceptably completed. Ensure that the listed experience in on-site supervision and completed contracts contains the project name and location, names of contracting parties, the owner's name, brief description of the work, and dates of completion of the epoxy injection work.

Furnish written evidence showing personnel training and the on-site supervisor's qualification to the Department prior to beginning any epoxy injection work.

### **411-5 Crack Surface Preparation and Cleaning Requirements.**

Clean the area surrounding the cracks of all deteriorated concrete, efflorescence and other contaminants detrimental to the adhesion of the surface sealing epoxy compound. Clean the interiors of the cracks with air under sufficient pressure to remove loose materials entrapped within the crack including efflorescence.

### **411-6 Sealing Cracks for Epoxy Injection.**

After cleaning, drill injection port holes using a swivel drill chuck and hollow drill bits, including a vacuum attachment which will remove dust and debris generated during drilling. Determine the spacing of the injection port holes by the size of the crack and the depth of the crack in the concrete substrate.

Generally, space the injection ports from 4 to 8 inches [100 to 200 mm] apart. Determine the actual spacing of injection ports by field trials. Drill the holes to a minimum depth of 5/8 inch [16 mm], exercising care in aligning the hole along the plane of the crack so that the hole follows the crack for the full 5/8 inch [16 mm] depth.

Insert the injection ports in the drilled holes approximately 1/2 inch [13 mm], allowing for a small reservoir below the injection port.

After cleaning the cracks and drilling the injection port holes, seal the crack surface and the injection ports with suitable epoxy.

#### **411-7 Epoxy Injection.**

Inject the epoxy in accordance with the epoxy manufacturer's instructions. Determine the actual injection procedures and pressures in field trials, based on crack widths and depth into the substrate and sufficiency of the results.

#### **411-8 Cleaning After Epoxy Injection.**

Clean concrete surface areas of excess epoxy materials and injection ports after completing the epoxy injection work. Clean in a manner which will not damage the concrete by scraping, light sand blasting, grinding, use of solvents, or any other appropriate method approved by the Engineer. Clean excess materials so that no epoxy material or injection ports extend beyond the plane surface of the concrete.

#### **411-9 Acceptance.**

Drill three cores located in each day's work as directed by the Engineer. Take drilled core samples containing representative crack sizes. The Engineer will accept the epoxy injection work represented by the core samples when the core samples indicate that 90% of the crack void greater than 0.006 inch [0.15 mm] wide is filled with epoxy resin and the concrete of the core sample is bonded through the crack into a unit.

Reinject epoxy injection work which does not satisfy the acceptance criteria, and correct it as necessary at no expense to the Department. Install additional injection ports as required to achieve satisfactory reinjection of epoxy resin.

After the epoxy injection work is completed and accepted, fill the core holes with an epoxy mortar consisting of one part by volume epoxy injection resin and four parts by volume clean, dry sand. Supply the sand in moisture proof bags. Do not use previously opened bags of sand for making epoxy mortar. The Contractor may use one part by volume epoxy material for sealing with one part by volume clean, dry sand in lieu of the above.

#### **411-10 Method of Measurement.**

**411-10.1 Epoxy Material:** The quantity to be paid will be the volume, in gallons [liters], authorized, injected, and accepted.

**411-10.2 Inject and Seal Crack:** The quantity to be paid will be the length, in feet [meters], authorized and accepted, measured along the approximate centerline of the sealed crack.

#### **411-11 Basis of Payment.**

**411-11.1 Epoxy Material:** Price and payment will be full compensation for all work specified in this Section, including furnishing the epoxy material, and miscellaneous related costs, storage, handling, etc.

**411-11.2 Inject and Seal Crack:** Price and payment will constitute full compensation for furnishing all labor, equipment, incidentals and materials (except epoxy), for cleaning and sealing the crack, and all labor and equipment for injecting the crack.

**411-11.3 Payment Items:** Payment will be made under:

Item No. 400-134-	Epoxy Material - per gallon.
Item No. 2400-134-	Epoxy Material - per liter.
Item No. 400-135-	Inject and Seal Crack - per foot.
Item No. 2400-135-	Inject and Seal Crack - per meter.