

**ITEM 10560.1312 M - REPAIR OF STONE MASONRY AND CONCRETE CRACKS**  
**NARROWER THAN 12 mm**

**DESCRIPTION.** This work shall consist of applying a moisture insensitive epoxy repair paste surface seal over the length of the crack and pressure injecting low viscosity, moisture insensitive epoxy into the crack. Cracks wider than 12 mm wide shall not be repaired using this item.

**MATERIALS.**

**Epoxy Repair Paste.** Epoxy repair paste shall be a low modulus, non-sagging, two component 100 percent solids epoxy capable of bonding firmly to concrete and steel surfaces submerged in a salt water environment and curing fully within 24 hours at temperatures as low as 15 degrees C, meeting the following requirements:

1. Compressive Strength (ASTM C 695), 24 hours - 45 MPa
2. Bond Strength (ASTM C 882), 13 MPa – dry surface.
3. Shrinkage (ASTM C 883), no shrinkage/used with concrete.
4. Pot Life, minimum 2 hours at 20 degrees C.

Epoxy paste shall be manufactured by Fox Industries, Sika, Tamms Industries, or an equal as approved by the Engineer. The manufacturer shall provide written certification that their material meets the above properties.

**Epoxy.** Epoxy shall be a 100 percent solids, low viscosity, moisture insensitive material which meets and exceeds any and all physical requirements of ASTM C 881-87, Types I, II, IV, Grade 1, and Classes B and C. Epoxy shall also mix and be applied with automatic pressure injection and shall be capable of bonding to concrete and steel surfaces submerged in a salt water environment. Viscosity shall be sufficient for pressure injection into hairline cracks. Epoxy shall also meet the following requirements:

1. Compressive Strength (ASTM D 695) neat, 75 MPa minimum in seven days.
2. Tensile Strength (ASTM D 638), 55 MPa minimum in 14 days.
3. Flexural Strength (ASTM D 790), 80 MPa minimum in 14 days.
4. Shear Strength (ASTM D 732), 30 MPa minimum in 14 days.
5. Bond Strength-Slant Shear (ASTM C 882), 15 MPa minimum in seven days (hard to hard).
6. Compressive Strength (ASTM C 109), 1 day 55 MPa minimum, 3 days 65 MPa minimum.

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Samples of the epoxy shall be submitted for approval by the Director, Materials Bureau. Low viscosity epoxy material shall be manufactured by Fox Industries, Sika, Tams, or equal as approved by the Engineer.

The Contractor may propose alternatives to the above materials to the Director, Materials Bureau, through the Engineer.

**Samples.** Prior to the start of the work, samples of the epoxy paste and low viscosity epoxy shall be submitted for testing to the EIC. For the epoxy paste a well blended representative sample, 2 liter minimum of each component shall be supplied. For the low viscosity epoxy, a minimum 2 liter sample with manufacturer mixing instructions shall be supplied.

**CONSTRUCTION DETAILS.** The Contractor shall begin in a tidal zone location that is easily accessible for inspection, as approved by the Engineer, such that actual repair work is done under water during high tide, and then it is fully exposed to air during low tide. The Engineer will then inspect and evaluate the repair material for complete filling, a good bond to the material being repaired, and finishing the area to match the surrounding material. If the repair is inadequate, the Contractor shall remove all the repair material, clean the repair area again, and modify installation methods and/or seek technical assistance until satisfactory results are obtained. Upon approval, the Contractor shall continue with those methods for the rest of the work.

**Equipment.** Prior to the start of the project, the Contractor shall demonstrate, to the satisfaction of the Engineer, the equipment's ability to pump the low viscosity epoxy, such that a consistent flow is achieved. Pressure pot systems, hand-held caulking guns, or grease guns shall not be allowed.

The equipment shall be furnished with applicator wands and nozzles of sufficient size, shape, and flexibility such that they can be inserted into injection ports.

**Cleaning.** All cracks shall be thoroughly cleaned of all sea growth, barnacles, vegetation, loose or unsound mortar or any other debris by mechanical abrasion. Methods of mechanical abrasion shall be approved by the Engineer.

**Port Installation and Joint Sealing.** The Contractor shall firmly attach suitable ports along the length of the crack. For masonry blocks, a port spacing of one-half (1/2) the thickness of the block shall be used. A maximum spacing of any port shall be 500 mm. After the ports are attached, cracks shall be sealed along their full surface length with epoxy repair paste. The epoxy repair paste shall be placed across the entire width of the crack opening in accordance with the manufacturer's placing instructions. This epoxy paste repair shall fully cure before any epoxy injection is begun.

The Contractor shall follow the epoxy repair paste's manufacturer's storing, mixing, and placing instructions. The epoxy repair paste shall not be placed when the ambient

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temperature is, or is expected to drop below 15 degrees C, during the 24 hours following the time of epoxy application. Application of epoxy paste at temperatures lower than 15 degrees C will require prior written approval by the Director, Materials Bureau.

The cracks shall be sealed within 24 hours of cleaning operations.

**Epoxy Injection.** After the epoxy repair paste seal has fully cured, low viscosity epoxy shall be injected into the ports. The epoxy shall be mixed according to the manufacturer's instructions. Before injection, 4 Liters of epoxy shall be wasted. Injection shall begin at the lowest crack elevation and proceed to the highest elevation. After epoxy flows from an adjacent port, the port being injected shall be plugged and the injection operation advanced to the adjacent port. In cases where the epoxy flow does not appear at the adjacent port, the Engineer will determine as to when an increase in pumping pressures, or a halt in the pumping of the epoxy and moving to the next port is needed. Epoxy shall not be placed when the ambient temperature is below 15 degrees C, unless special construction procedures for cold weather placement, outlined by the manufacturer are followed. No additional payment will be made for following cold weather placement procedures.

**Removal of Ports.** After the low viscosity epoxy has cured, the ports shall be removed. The voids left by removing the ports shall be filled with epoxy repair paste.

**METHOD OF MEASUREMENT.** The work will be measured by the linear meter of crack repaired. Measurement will be taken after the Engineer has determined that the cracks have been satisfactorily repaired.

**BASIS OF PAYMENT.** The unit cost per linear meter of repair shall include the cost of all material, labor, equipment, and incidentals necessary for the successful completion of the work. Payment will not be made for delays or repairs necessitated by the Contractor's operations.