DESCRIPTION:

Install injection ports, seal crack and joint opening, inject the opening with grout, and restore the sealed masonry surface to a flush condition in areas visible to the public. Perform the work at locations indicated on the contract plans or where directed by the Engineer.

MATERIAL REQUIREMENTS:

A. Sealant - epoxy paste that completely cures in 4 hours or less and retains the injected grout. Any other type of sealant is subject to a project demonstration and approval by the Engineer.

B. Portland Cement Grout Ingredients.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Type II</td>
<td>§701-01</td>
</tr>
<tr>
<td>Fly Ash (Type F)</td>
<td>§711-10</td>
</tr>
<tr>
<td>Microsilica</td>
<td>§711-11</td>
</tr>
<tr>
<td>Grout Sand</td>
<td>§703-04</td>
</tr>
<tr>
<td>Water</td>
<td>§712-01</td>
</tr>
<tr>
<td>Admixtures</td>
<td>§711-08</td>
</tr>
<tr>
<td>Expansive Agent</td>
<td>-</td>
</tr>
</tbody>
</table>

Include an air entraining admixture to create 5 - 15% air entrainment. If an expansive agent is used, use a maximum 1%, by weight of cementitious material, and eliminate any air entraining admixture.

Openings 3 mm to 6.5 mm. Design a grout (portland cement, water and admixtures) with a minimal water content that will fill and flow throughout the opening. Up to 25% by loose volume of the portland cement may be replaced, in combination or alone, as follows:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Replacement Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fly Ash</td>
<td>0 to 25%</td>
</tr>
<tr>
<td>Microsilica</td>
<td>0 to 10%</td>
</tr>
</tbody>
</table>

Openings 6.5 mm wide and wider. Use a loose volume ratio of 1 part cementitious material (portland cement, fly ash, microsilica) to 1 - 3 parts grout sand.

Perform mix trials to select a suitable grout for the application. When the repairs will be visible to the public, match the color of the repair to the adjacent material, to the satisfaction of the Engineer.

Demonstrate that the grout to be used flows satisfactorily through an installed injection port.

EQUIPMENT:

Use only equipment in good working order, as approved by the Engineer.

A. Mortar or Paddle Wheel Type Mixer - machine operated. (These type mixers fail to break up small clumps of cement, which leads to plugging in openings smaller than 3 mm.)

B. Positive Displacement Pump - to maintain a consistent, uninterrupted pressure (maximum pressure 30000 Pa) to uniformly force grout into the openings. Provide easily viewable, accurate pressure gauges.
Item 05555.8199 M - Crack & Joint Repair (3 Mm or Wider) by Injection of Portland Cement Grout

that enable the operator to fully control the grout pressure at the injection point. (Low injection pressure allows the grout to flow easier and farther into the opening. High injection pressure forces water out of the grout, thickens it, and causes plugging in the opening.)

CONSTRUCTION DETAILS:

A. Mixers. Use a mortar mixer, drill powered paddle wheel mixer or other method to mix grout, as approved by the Engineer.

B. Surface Preparation. Remove all debris or contaminants accessible within the openings by using hand tools, water blasting or oil-free high pressure air blasting, vacuuming, or other methods suitable to the Engineer. Remove all materials, including moisture, from the surface adjacent to the opening which might interfere with sealant bonding.

C. Injection Port Installation. Attach injection ports to the prepared surface by placing them into or onto the openings and affixing with sealant. Other injection port designs and attachment methods require approval by the Engineer.

Use the following general guidelines for spacing injection ports when openings are uniform in width through the structure. For openings that become tighter with depth, double this spacing.

1. Openings accessible from one side - not less than the thickness of the member.

2. Openings accessible from both sides - not less than twice the thickness of the member and stagger them relative to the ports on the opposite side. Make the stagger between ports (on opposite sides of the member) at least the thickness of the member.

Place the end-most ports at the ends of the opening so as to insure complete filling. When these guidelines cannot be followed, use port locations approved by the Engineer.

D. Closure Seal. After the ports have been installed, fill the opening with sealant, being careful not to plug the injection ports. Allow the sealant to cure completely before injecting grout.

Apply sealant when surface and ambient temperatures are above 10ºC.

E. Water Flush. Prior to any grout injection, flush the opening with pressurized water using the grout injection procedure, or a similar procedure, to clean out any remaining debris, verify that water exits from all the installed ports, check for leaks, and dampen the walls of the opening. The Engineer will decide whether this procedure is suitable for a particular opening.

F. Grout Injection. Perform grout injection only when the surface and ambient temperatures are above 7ºC and are not expected to fall below 7ºC during the next 24 hours.

Start at either end of a horizontal opening, or at the lowest point of a sloping or vertical opening. Secure the feed line to the first port. Initiate and continue flow until grout exits from the adjacent port. Temporarily stop the injection process, remove the feed line, and seal the port. Attach the feed line to the adjacent port and repeat this procedure along the opening until the last port is sealed. Exercise care to assure a continuous grouting operation. When warranted, adjacent ports may be plugged and injection continued through the same port.
Allow the grout to fully cure prior to performing subsequent work in the repaired area.

G. **Clean Up.** In all areas visible to the public, remove spillage, ports, and sealant until flush with the adjacent surface. Remove stains and repair any damage to the satisfaction of the Engineer at no additional cost.

**METHOD OF MEASUREMENT:**

The work will be measured as the number of square meters of masonry repaired as required.

**BASIS OF PAYMENT:**

Include the cost of all labor, materials and equipment necessary to complete the work in the price bid per square meter of masonry repaired.

The Engineer will authorize payment after the measured surface area has been repaired, and cleaned, as required.