

## SECTION 02331

## SLIPLINING GROUT

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. This Section specifies the furnishing and placing of grout in the annular space between the slipliner pipe and the host sewer.

## 1.02 UNIT PRICES

- A. No separate payment will be made for Work performed under this Section. Include the cost of such Work in contract unit prices for sliplining sanitary sewers.

## 1.03 SUBMITTALS

- A. At least 30 days prior to grouting, submit details of equipment, grout mixes, and procedures in accordance with all sections and provisions of these specifications. The shop drawings and product data shall include, but not be limited to, the following:
  - 1. A detailed description of equipment and operational procedures to accomplish the annular grouting operation, including mixing and pumping schedule, grouting pressures, rates of pumping, and methods to monitor the effectiveness of the grouting.
  - 2. A detailed description and drawing indicating locations of surface mixing equipment, subsurface injection points, flowlines, waste grout recovery, and grout pressure limiting equipment, bulkhead design, and venting system.
  - 3. Grout mix design and trial mix tests with set time, compressive strength, and density test results.
  - 4. Qualifications and experience of grout mix applicator.
- B. During pressure grouting operations, maintain and submit daily logs of grouting operations including pressure, grout volume pumped, and such other data as required by the Owner's Representative.

## 1.04 PERFORMANCE REQUIREMENTS

- A. The grout mix shall be designed to be pumpable through a 2-inch-diameter hose for a distance of 1,000 feet with a maximum allowable pressure at point of placement of 5 psi. The cast density shall be 55 pcf plus or minus 5 pcf. The minimum penetration

resistance after 24 hours shall be 100 psi in accordance with ASTM C403. The minimum compressive strength at 28 days shall be 200 psi, in accordance with ASTM C495. The grout mix shall have less than 1 percent shrinkage by volume.

- B. The application system shall have sufficient gages, monitoring devices, and tests to determine the efficiency and effectiveness of the grouting work and provide means of accurately determining the amount of grout injected. The Contractor shall be prepared to modify or change his operation should the grouting not perform as proposed. Such modifications and changes shall be done in a timely manner to avoid unnecessary delay to the completion of the Project.
- C. No deleterious amounts of toxic or other poisonous substances shall be included in the grout mix nor otherwise injected underground.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS/APPLICATORS

- A. The applicator of the grout mix shall be certified by the grout mix manufacturer and approved by the Owner's Representative. The certified applicator shall be regularly engaged in the placement of grout, including completion of pipeline grouting installations.

### 2.02 MATERIALS

- A. Cement: The cement shall comply with ASTM C150. Pozzolans and other cementitious materials are permitted.
- B. Fly Ash: The fly ash shall comply with ASTM C618. Either Type C or Type F shall be used.
- C. Sand, if provided, shall conform to ASTM C144, except as modified below:

U.S. Standard	Percent Passing
<u>Sieve Size</u>	<u>by Weight</u>
No. 16	100
No. 30	60-85
No. 50	10-35
No. 100	5-25

No. 200

0-10

- D. Water: Use potable water free from deleterious amounts of alkali, acid, and organic materials which would adversely affect the setting time or strength of the sliplining grout.
- E. Admixtures: Admixtures shall be selected by the manufacturer of the sliplining grout to meet the performance requirements, to improve pumpability, to control set time, and to reduce segregation.

### PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Owner's Representative shall be notified at least 24 hours in advance of grouting operations.
- B. Grouting equipment and procedures shall be selected and operated with sufficient safety and care to avoid damage to existing underground utilities and structures.

#### 3.02 EQUIPMENT

- A. Mixers and Pumps: The grout shall be delivered to the injection point at a steady pressure with a nonpulsating centrifugal or triplex pump at the mix tank. Means shall be provided to increase or decrease the water-cement ratio. The system shall mix the grout to a homogeneous consistency. Means of accurately measuring grout component quantities, pumping pressures, and volumes pumped shall be provided.
- B. Pressure Gauges. Contractor shall provide one pressure gauge at the point of injection and one pressure gauge at the grout pump. Grouting shall not proceed without appropriate gauges in place and in working order. Pressure gauges shall be equipped with diaphragm seals, have a working range between 1.5 to 2.0 times the design grout pressure, and have an accuracy within 0.5 percent of full range.

#### 3.03 GROUTING

- A. Scope: Grout shall be placed in the annular space between the sliplining pipe and the host sewer. The annular space shall be completely filled without deflecting the pipe greater than 1.5 percent. The grout equipment and procedures shall be tested in accordance with the Contractor submittals approved by the Owner's Representative. The test shall be performed on the first pipeline segment to be grouted and observed by the Owner's Representative. If the grout does not totally fill the annular space, the

Contractor shall adjust his procedure mix and rerun the test on the first pipeline segment.

B. Procedure:

1. The grout shall be placed for a given pipeline segment between bulkheads. Bulkheads shall be placed at the ends of each pipeline segment to seal the annular space from sewer flow. Bulkheads shall not be removed until after the grout has set.
2. The slipliner pipe shall be equipped with a weir to fill the slipliner pipe to prevent flotation during the grouting operation.
3. Standing or running water in the annular space shall be removed or controlled to maintain the correct water ratio of the grout mixture. The annular space shall be grouted by injecting grout from one end of the pipeline segment, allowing it to flow toward the other end. The annular space shall be vented to assure uniform filling of the void space.
4. Pressure on the annular space shall be limited to prevent damage to the liner and shall not exceed 5 psi. Regardless of the pressure, the Contractor shall be solely responsible for any damage or distortion to the slipliner pipe due to grouting. An open ended, high point tap or equivalent vent must be provided and monitored at the bulkhead opposite to the point of grouting.
5. Grout shall be pumped until a grout of within 0.3 pounds per gallon of specified grout injection density discharges from the end opposite the injection point. This procedure is intended to ensure that the grout is not diluted by extraneous water in the annulus.
6. The drilling of access holes from the surface to facilitate backfilling shall not be allowed.

3.04 FINAL CLEANUP

- A. No hardened grout shall be permitted in the slipliner pipe invert after completion of grouting operations.

3.05 DEWATERING SYSTEM OPERATION

- A. The dewatering system shall be operated until the grouting of the slipliner pipe is complete.

3.06 TESTING

- A. Density: During placement of the grout, the density shall be measured in accordance with ASTM C138 a minimum of twice per hour. Adjust the mix as required to obtain the specified cast density.
- B. Sampling:
  - 1. Take four test specimens for each 100 cubic yards of grout or for each four hours of placing.
  - 2. Test in accordance with ASTM C495 except:
    - a. The specimens shall be 3 inch by 6-inch cylinders covered after casting to prevent damage and loss of moisture. Moist cure specimens for a period up to 7 days prior to a 28-day compressive strength test.
    - b. Do not oven dry specimens that are load tested. Specimens may be tested at any age to monitor compressive strength. The material may require special handling and testing techniques.

END OF SECTION