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SANITARY SEWER CHEMICAL GROUTING

PART 1 - GENERAL

1.01 SCOPE

The work in this Section consists of providing for the rehabilitation of defective pipe joints, some circumferential pipe cracks and other small pipe defects by the application of chemical grouting materials. In Accordance with ASTM Designation F-2304-03. "Standard Practice for Rehabilitation of Sewers Using Chemical Grouting."

1.02 SAFETY

Contractor shall be solely responsible for safety during the performance of all Work. Contractor shall take satisfactory precautions to protect the sewer segments and appurtenances from damage that might be inflicted upon them by the use of grouting equipment. Any damage inflicted upon a sewer segment or other public or private property as a result of the Contractor's grouting operations, regardless of the grouting method used and regardless of any other circumstance which may contribute to the damage, shall be repaired by Contractor at his sole expense.

Contractor shall not enter into any sewer segment where hazardous conditions may exist until such time as the source of those conditions is identified and eliminated by the Contractor. Contractor shall perform all work in accordance with the latest OSHA confined space entry regulations. Contractor shall coordinate his work with local fire, police and emergency rescue units.

1.03 MINIMUM QUALIFICATIONS

Materials: Chemical sealant shall have documented service of successful performance in similar usage, with a minimum of 12,000 joints grouted.

1.04 SUBMITTALS

In addition to the requirements for Schedule and Shop Drawing submittals contained in the General Conditions, and in addition to the equipment and material submittals required elsewhere in this Specification, Contractor shall submit pump calibration information, field sealing records, certification of pressure sensing/monitoring equipment, current documentation of Contractor's compliance with product manufacturer's Safe Operating Practices Procedures (SOPP) as approved by the U.S. EPA. Further, upon request, the Contractor must submit proof of chemical supplier's product liability insurance.

PART 2 PRODUCTS

2.01 MATERIALS

A. Delivery, Storage and Handling

Contractor shall deliver materials to job site in undamaged, unopened containers bearing manufacturer's original labels. Materials used as chemical grout shall be transported, stored, and placed in manner prescribed by manufacturer of those materials, as detailed in published data provided by manufacturer.

B. Materials

1. Chemical Grout

Grout used shall be Avanti AV-100* acrylamide or equal. Contractor shall provide a chemical sealant solution containing principal chemical sealant constituent, initiator (trigger) and catalyst specifically recommended for the purpose of sealing leaks in sanitary sewer lines and manholes. Chemical sealant constituent, initiator (trigger) and catalyst shall be compatible when mixed. Solution shall have ability to tolerate dilution and react in moving water. After final reaction, it shall be a stiff, impermeable, yet flexible gel. The grout proportions shall be such that dilute aqueous solutions – when properly catalyzed – will form stiff gels. Grout shall make true solution at concentrations as high as three pounds per gallon of water. Solutions shall have ability to accept dilution by groundwater of at least 50% by volume, without significantly changing sealing ability of the gel when at rest or in motion. Solutions shall gel in a predetermined time when exposed to normal groundwater pH ranges, and be capable of formula adjustments to compensate for changing conditions. Final reaction shall produce a continuous, irreversible, impermeable stiff gel at chemical concentrations as low as 0.4 lbs per gallon of water that is able to break away from the joint sealing packer when the packer is deflated. Gel shall not be rigid or brittle. Gel shall have negligible corrosion rate on mild steel plates.

2. Chemical Root Inhibitor

- a. Dichlobenil (2-6-dichlorobenzonitrile): Norosac 50W or equal
- b. Contractor shall add root inhibitor to the chemical grout mixture at a safe level of concentration having the ability to remain active within the grout for a minimum of 12 months.

* Technical information and MSDS sheets can be obtained at www.avantigrout.com

- c. Contractor shall mix root inhibitor with the grout according to the instructions of the grout manufacturer and in the specified quantities as recommended by the grout manufacturer.
3. Insoluble (Particulate) Additives

Inactive solids such as diatomaceous earth may be mixed with grout by Contractor as filler only upon written approval of Owner.
4. Water shall be potable.

2.02 EQUIPMENT

Contractor shall provide equipment consisting of closed-circuit television systems, necessary chemical sealant containers/tanks, pumps, regulators, valves, hoses, etc. and joint sealing packers for appropriate sizes of pipe designated to receive chemical grouting. The packer shall be cylindrical and have a diameter less than the pipe size. The packer shall be constructed in a manner to allow restricted amounts of sewage to flow and shall be pneumatically operated. Hydraulically or mechanically expanded devices shall not be permitted.

To test the accuracy, integrity, and performance capabilities of sealing equipment units, Contractor shall perform a demonstration test in a test cylinder constructed so that a minimum of two known leak sizes can be simulated. Contractor shall provide test cylinders and pressure gauges. Contractor shall perform the demonstration test for each chemical sealing unit prior to beginning work. This technique will establish test equipment performance capability in relationship to test criteria and insure that there is no leakage of the test medium from the system or other equipment defects that could affect joint testing results. Tests may be required at any other time during joint testing work if the Owner suspects testing equipment is not functioning properly. All testing costs shall be borne by the Contractor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Cleaning

Prior to the application of chemical grouting materials, Contractor shall thoroughly clean the sewer designated to receive the chemical grouting. Cleaning shall constitute removal of all debris, solids, roots and other deposits in the sewer line; particularly at the sewer pipe joints.

It shall be the responsibility of the Owner to clear the designated sewer line of obstructions such as dropped joints, protruding lateral connections, and broken pipe/crushed pipe which reduces the cross-sectional area by more than 40%, and/or which will prevent the use of grouting equipment. If inspection reveals an obstruction, such as a badly dropped joint or badly misaligned joints, then the Owner shall make a point repair excavation to remove or repair the obstruction. The Owner will be responsible for all work associated with the

point repair including locating all interfering utilities, temporary flow bypassing, traffic control, excavation, shoring, dewatering, pipe repairs or replacement, backfilling, and surface restoration.

Acceptance of cleaning work in sewer line sections shall not be made until testing and sealing of joints and cracks in section of the respective sewer have been completed.

B. Inspection of Pipelines

After cleaning and prior to application of chemical grouting materials, Contractor shall inspect the sewer designated to receive the chemical grouting. Sewer line inspection requirements are contained in Section 13120 – Closed Circuit Television Inspection of Sanitary Sewer.

C. Sewage Flow Control

Contractor shall provide for maintenance of flow in the affected portions of the sewer system during grouting of the sewer line. Requirements for sewage flow control and bypass pumping are contained in Bypass Pumping/Sewage Flow Control.

Sewage flow control shall be employed by Contractor when sewer line depth of flow at the upstream manhole of the sewer line section being worked is above the maximum allowable for joint testing and sealing. Flow control shall be accomplished by bypass pumping of flow from upstream of the sewer segment to be grouted to a point downstream of the sewer segment to be grouted.

Depth of flow shall not exceed that shown below for respective pipe sizes as measured in the upstream and downstream manholes when performing joint testing and sealing.

Maximum Depth of Flow for Joint Testing/Sealing	
8 in. – 24 in. diameter pipe	25% of pipe diameter
Pipe larger than 24 in. diameter.	30% of pipe diameter

D. Pressure Testing Joints in Sanitary Sewer

1. Preconstruction Testing

Contractor shall provide equipment such as pumps, gauges, regulators, and hoses, necessary to perform air tests of each joint in those sewer sections designated for grouting work. Equipment configuration shall be such that there are no valves on or along the air line between the measuring point at the joint and the pressure transducer or sensing device located in the control unit on the surface. Systems which incorporate bladders, hoses, or the like for monitoring the pressures and

which have questionable accuracy shall not be allowed. The amount of pressure being exerted on the joint shall be readable above ground on a pressure gauge.

The accuracy and calibration of pressure sensing/monitoring system shall have been certified by an independent testing firm within a one-month period preceding the use of equipment. Proof of certification shall be submitted to the Owner.

To confirm that joint testing is not a more severe test than the pipe itself can pass, Contractor shall perform an on-job barrel test between joints in each pipe line to be tested to determine that the pipe barrel can pass the test criteria. If the pipe barrel will not pass decay rate limits, adjustment of maximum pressure levels will be evaluated jointly between Contractor and Owner. Owner shall render final written decision on each such situation.

2. Construction Testing

To determine if a joint needs grouting, Contractor shall test each joint by isolating the area to be tested within the testing device and applying positive pressure into the joint and void area created by the test device. Contractor shall then introduce pressurized air into the isolated void created by testing device. Pressure shall be applied until it is determined that the pressure cannot be built in the void or until the test pressure of 1/2 psi per ft of depth plus four psi to a maximum of 10 psi is reached as recorded by the void pressure monitor. When either of these conditions is reached, Contractor shall shut off the air supply.

If the required pressure cannot be developed, joint shall have failed the test. If the required test pressure in the void was increased to 1/2 psi per ft of depth plus four psi, rate of decay of this pressure shall not exceed 1 psi in 30 sec. The joint being tested will also have failed if the pressure drops more than 1 psi in 30 seconds. Failure of the joint indicates the need for sealing. Sealing shall be accomplished by Contractor as specified elsewhere in these Specifications.

3. Test Records

During grout testing, records shall be kept which include identification of the sewer section tested, test pressure used, location (footage) of each grouted defect tested and location of grouted defects not tested due to close proximity to building service connections and sanitary sewer manholes, a statement indicating test results (passed or failed) for each grouted defect tested, test pressure achieved and maintained for each grouted defect passing air test, weekly equipment pressure test results, sewer section barrel test results, daily gel check results, and air temperature at time of testing joints.

E. Chemical Grout Application for Sealing Joints

Repairs shall take place at joints, generally small circumferential cracks, small holes, or similar points of infiltration as identified. The repair shall be such that the original cross-sectional area and shape of the interior of sewer pipe shall not be permanently reduced or changed.

1. Placement of Chemical Grout

Contractor shall position the sealing packer over the area of infiltration by means of a metering device at the surface and closed circuit television camera in the line. Accurate measurement of the location of the defect to be sealed shall be made, using the portion of sealing packer as "Datum" or measurement point or target. Such measurement to the target shall also be used to obtain necessary measurement for positioning the injection area of sealing packer over area to be sealed.

Contractor shall expand the sealing packer sleeves using controlled pressures. Expanded sleeve shall seal against the inside periphery of pipe to form a void area at the point of infiltration, completely isolated from the remainder of the line. Contractor shall pump sealant materials into this isolated area through hose systems at controlled pressures which are in excess of groundwater pressures. Contractor shall pump as much grout as is field-required to seal any leaks and fill the voids. Grout shall break away from the packer and stay in place when the packer is deflated and moved from the point of infiltration.

Upon completion of injection, Contractor shall retest the point of repair. If retesting shows the seal was not completely effective, Contractor shall repeat the sealing process until the defect successfully passes the pressure test. After sealing the entire sewer section, Contractor shall remove surplus grouting material from section at the immediate downstream manhole. If surplus grouting materials left in the sewer section by Contractor results in sewer surcharging and subsequent damage to public or private property, Contractor shall be responsible for damage to property and expenses incurred by Owner.

2. Gel Checks

Contractor shall make gel checks daily for each sealing vehicle to monitor both induction period and gel characteristics. Contractor shall also make checks for every mixed batch or at least twice per day if only one batch is used. Owner reserves the right to request adjustment of gel times or reject the entire batch if acceptable gel characteristics do not exist. Periodic gel checks shall also be made in the pipe (at request of Owner) by seating the sealing packer on the pipe barrel and filling the packer void with grout solutions. Pressure will then be monitored until a rise in pressure is observed, indicating that grout has gelled in the packer void. Contractor shall certify, for each of the sealing vehicles, results of required gel checks.

3. Field Records

Contractor shall keep field records for each sewer section prior to, during, and after completion of the chemical grouting operation. Records shall include information such as accurate locations, gel times, grout volumes, grout pressures, air temperatures, and joints not sealed due to close proximity to building service connections and sanitary sewer manholes.

3.02 WARRANTY

The Contractor shall guarantee the sealing of the pipe joint by the grout for one full year from the date of acceptance of the Owner to the extent that he will repair and/or re-grout any defects including, but not limited to, root penetration, signs of infiltration, and cracks in the pipe or grouting material, which may appear in the structure because of faulty design, workmanship, or material furnished by him.

END OF SECTION