

SECTION XXXXX

CHEMICAL GROUTING

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Provide all labor, materials, accessories, equipment, and tools required for the rehabilitation, infiltration reduction, and root treatment of pipe sections, lateral connections, and manholes using chemical grouting as shown on the Drawings and as specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section XXXXX – Submittals
- B. Section XXXXX – Wastewater Flow Control
- C. Section XXXXX – Sewer Line Cleaning
- D. Section XXXXX – Segmental Replacement (Pipe and Tap Connections)
- E. Section XXXXX – Sanitary Sewer Television Inspection
- F. Section XXXXX – Cured-in-Place Pipe Lining

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

- 1. ASTM F2304 Standard Practice for Sealing of Sewers Using Chemical Grouting
- 2. ASTM F2414 Standard Practice for Sealing Sewer Manholes Using Chemical Grouting
- 3. ASTM F2454 Standard Practice for Sealing Lateral Connections and lines from the mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting
- 4. NASSCO Specification Guidelines – Specification for Sewer Line Cleaning

5. NASSCO Specification Guidelines – Specification for Television Inspection Main Sewer
6. NASSCO/ICGA Suggested Standard Specification for Pressure Testing and Grouting of Sewer Pipe Joints, Laterals and Lateral Connections Using the Packer Method with Solution Grouts

1.04 SUBMITTALS

- A. Shop Drawings: The Contractor shall submit the following in accordance with the requirements set forth in Section 01300 – Submittals:
 1. Chemical grout and additive product data showing physical and chemical properties
 2. Manufacturer's installation instructions
 3. MSDS sheets

1.05 QUALIFICATIONS

- A. The qualifications of the Contractor shall be submitted with the Bid Proposal. These qualifications shall include detailed descriptions of the following:
 1. Name, business address, and telephone number of the Contractor
 2. Name(s) of all supervisory personnel that will be directly involved in the Project
 3. Proposed product information showing compliance with the specified requirements listed herein, including chemical grouts, additives, and packers
 4. Documentation of certification of Contractor/installer by the chemical grout manufacturer and/or its authorized representative
 5. A reference list of previous projects on which the Contractor and/or installer has provided chemical grouting over the last five years, including project name, project number, customer name, and owner's contact information (name and phone number)
 6. The chemical grout shall have documented service of successful performance in similar usage, with a minimum of 10,000 joints, laterals, and manholes grouted in the United States.
 7. The Contractor shall sign and date the information provided and certify that, to the extent of his knowledge, the information is true and accurate and that the supervisory personnel will be directly involved with and used on the Project. Substitutions of personnel and/or methods will not be allowed without written authorization by the Owner and/or Engineer.

PART 2 -- PRODUCTS

2.01 CHEMICAL GROUT

- A. For main lines and laterals, chemical grout shall be a minimum of 10 percent acrylamide base material by weight.
- B. Chemical grout shall have the ability to tolerate dilution and react in moving water.
- C. Chemical grout shall have the ability to increase viscosity, density, and strength with the use of approved additives.
- D. Chemical grout shall have an initial viscosity of approximately 2 centipoise.
- E. Chemical grout shall have a controllable reaction time of 10 seconds to 60 minutes.
- F. Contractor shall provide a chemical sealant solution containing a principal chemical sealant constituent, initiator (trigger), and catalyst specifically recommended for the purpose of sealing in sanitary sewer lines and manholes. Chemical sealant constituent, initiator (trigger), and catalyst shall be compatible when mixed.
- G. After final reaction, cured grout shall be continuous, irreversible, impermeable, firm yet flexible, chemically-stable, and non-biodegradable.
- H. Grout used shall be Avanti AV-100 acrylamide or Engineer pre-approved equal. Urethane based grout may be used for infiltration control in manholes.

2.02 ADDITIVES

- A. The following additives, in quantities as recommended by the manufacturer and as approved by the Engineer, shall be used for all grouting applications:
 - 1. Strengthening Agents: For joint grouting, a latex or diatomaceous earth additive shall be added to increase compressive and tensile strength. The strengthening agent shall be Avanti AV-257 Icoset or Engineer-approved equal.
 - 2. Root Inhibitor: A root deterrent chemical shall be added to control root re-growth. The root inhibitor shall be Avanti AC-50W or Engineer-approved equal.
- B. If required by field conditions, the following additives, in quantities as recommended by the manufacturer, may be used at the Contractor's discretion:
 - 1. Dye: A manufacturer-approved water soluble dye without trace metals may be added to the grout tank(s) for visual confirmation.
 - 2. Gel Time Modifier: A gel time extending agent may be used to extend gel time as necessary.
 - 3. Freeze/Thaw: In those lines where the grouting material may be exposed to a freeze-thaw cycle, ethylene glycol or an alternative Engineer-approved additive shall be used to prevent chemical grout cracking once set.

- C. When using non-soluble additives, the grout tanks shall have mechanical mixing devices to keep the additives in suspension and maintain a uniform solution of grout and additive.

PART 3 -- EXECUTION

3.01 CLEANING SEWER LINES

- A. Prior to any chemical grouting of a pipe, the Contractor shall remove internal deposits, protrusions, and anything that prevents proper packer seating from the pipeline in accordance with Section XXXXX – Sewer Line Cleaning. After application of the chemical grout, the Contractor shall remove any excess chemical grout in accordance with Section XXXXX – Sewer Line Cleaning prior to post-installation inspection.

3.02 TELEVISION SURVEY

- A. Prior to application of the chemical grout and again after application of the chemical grout, a television survey of each grouted pipeline shall be performed in accordance with Section XXXXX – Sanitary Sewer Television Inspection. Post-installation inspection shall be submitted and approved by the Engineer prior to approval of payment application.
- B. The interior of the pipeline shall be carefully surveyed to determine the location(s) and extent(s) of any structural failures. The location(s) of any conditions which may prevent proper application of grouting materials in the pipeline shall be noted so that these conditions can be corrected. A videotape and suitable log shall be maintained and submitted to the Engineer.

3.03 FLOW BYPASSING

- A. When required, the Contractor shall provide for the transfer of flow around a section or sections of pipe to be grouted. The proposed bypassing system shall be approved in advance by the Owner and Engineer. The approval of the bypassing system shall in no way relieve the Contractor of his responsibility and/or public liability. The flow bypassing shall be performed in accordance with Section XXXXX – Wastewater Flow Control.
 - 1. If the grouting can be completed in a few hours, bypass pumping may not be required. The placement carriage shall be equipped with a bypass section to allow flow once grouting is completed.

3.04 LINE OBSTRUCTIONS

- A. The Contractor shall clear each pipeline of obstructions prior to grouting. If the survey reveals an obstruction that cannot be removed by conventional cleaning equipment, the Contractor shall notify the Engineer.

3.05 CHEMICAL GROUT APPLICATION

- A. The entire chemical grouting process shall be performed in strict accordance with the manufacturer's current guidelines. If any deviations from the guidelines are proposed,

Contractor shall submit explanation and approval from grout and/or packer manufacturer(s).

B. Repairs shall take place at joints, generally small circumferential cracks, small holes, or similar points of infiltration as listed in the Pipe Rehabilitation Schedules and Manhole Rehabilitation Schedules on the Drawings. The repair shall not permanently reduce or change the original cross-sectional area and shape of the interior of the sewer pipeline.

C. Sewer Pipe Joints or Defects:

1. Contractor shall position the sealing packer over the area to be repaired using a metering device at the surface and CCTV camera in the line.
2. Accurate measurement of the location of the defect to be sealed shall be made using the portion of sealing packer as the datum (i.e. measurement point or target).
3. A similar measurement to the target shall also be used to obtain the necessary measurement for positioning the injection area of the sealing packer over the area to be sealed.
4. Contractor shall expand the sealing packer sleeves using controlled pressures.
5. Expanded sleeve shall seal against the inside periphery of the pipeline to form a void area at the point of infiltration that is completely isolated from the rest of the pipeline.
6. Contractor shall pump sealant materials into the isolated area through those systems at controlled pressures that are in excess of groundwater pressures.
7. Contractor shall pump as much grout as is required to seal any leaks and fill the voids. Under pressure, the grout shall then be forced out into the soil through any leaking joints and pipe defects. No more than 20 gallons of grout shall be pumped into a single sewer section. If a sewer section requires more than 20 gallons of grout to achieve an effective seal, the Engineer shall be notified and shall approve the use of the additional grout before pumping is continued.
8. Chemical grout shall break away from the packer and stay in place when the packer is deflated and moved from the point of infiltration.
9. Upon completion of injection, Contractor shall test the point of repair. If testing shows the seal was not completely effective, Contractor shall repeat the sealing process until the defect successfully passes the pressure test.
10. After sealing each sewer section, Contractor shall remove surplus grouting material from the section at the manhole immediately downstream of the grouting location.
11. If surplus grouting materials left in a sewer section by the Contractor result in sewer surcharging and subsequent damage to public or private property, Contractor shall be responsible for damage to property and payment of any related expenses incurred by Owner.

12. For sealing main line sewer pipe joints and laterals connected to manholes by packer injection grouting, gel times shall be plus or minus 30 seconds unless otherwise approved by Engineer.

D. Lateral Connections:

1. All lateral connections that are not designated on the Drawings or directed by the Owner and/or Engineer to be replaced via excavation shall be chemically grouted after the CIPP liner is installed and lateral opening has been reinstated in accordance with Section XXXXX – Cured-in-Place Pipe Lining. The grout shall extend a minimum of 6 inches up the lateral pipe. If a minimum of 6 inches of grout in the lateral cannot be achieved due to blockages, the Contractor shall proceed to the next connection and shall immediately inform the Engineer of the location and cause of the blocked connection.
2. The lateral packer shall remain in position during the sealing of the connection so the isolated void is maintained. Grout shall be pressure-injected through the lateral packer into the annular space between the inversion tube and the lateral pipe. Under pressure, the grout shall then be forced out into the soil through any leaking joints and pipe defects. No more than 20 gallons of grout shall be pumped through a single lateral connection. If a connection requires more than 20 gallons of grout to achieve an effective seal, the Engineer shall be notified and shall approve the use of the additional grout before pumping is continued.
3. Upon completion of the lateral sealing procedure, the lateral shall be air-tested to confirm the sealing of the connection. If the lateral fails the air test, the grouting procedure shall be repeated at no additional cost to the Owner. This sequence of grouting and subsequent air testing shall be repeated until either the lateral is sealed or it is determined that the grout consumption is too high and may result in the blockage of the lateral pipe. The final determination to stop subsequent attempts to seal a lateral will be jointly made by the Engineer and the Contractor.
4. The Contractor shall confirm lateral flow after the successful sealing of each lateral tap. With the lateral packer in position, the inversion tube shall be retracted and air shall be pressure-injected into the lateral. If a pressure builds in the lateral and does not drop to approximately zero in a few seconds, the packer shall be moved off the connection and the connection shall be viewed with a television camera. With the camera viewing the connection point, an attempt shall be made to obtain a water flush by the property owner served by the lateral. If water is not visible during this flushing procedure, it shall be assumed that the building sewer connection is blocked with grout and the Contractor shall clear the lateral at no additional cost to the Owner. Contractor shall not be responsible for clearing blockages in the lateral that are not due to grouting operations.

3.06 ACCEPTANCE AND TESTING

- A. Prior to and during the joint testing phases of the work, the Contractor shall perform control, intermediate, and final testing in accordance with ASTM F2304, ASTM F2414, and ASTM F2454.

B. Testing Sewer Main Joints:

1. Joint testing pressure shall be equal to 0.5 psi per vertical foot of pipe depth plus 2 psi. Test pressure shall not exceed 10 psi without prior approval by the Engineer.
2. Joints in laterals which are directly connected to manholes shall be tested to 18 inches.
3. Each sewer pipe joint shall be tested at the previously-specified pressure in accordance with the following air test procedure:
 - a. The packer shall be positioned within the pipe so it straddles the joint to be tested.
 - b. The packer ends shall be expanded so the joint is isolated from the remainder of the pipe and a void area is created between the packer and the pipe joint. The ends of the testing device shall be expanded against the pipe per the manufacturer's recommendations. If all attempts to isolate the joint fail, grout shall be pumped to seal the leak around the packer end elements. The Contractor shall be paid at the unit price for grout to seal the packer unless the Engineer determines that the sewer was inadequately cleaned or the packer is not properly working.
 - c. Air shall then be slowly introduced into the void area until a pressure equal to or greater than the required test pressure, but in no cases greater than 2 psi above the required test pressure, is observed on the pressure monitoring equipment. When the desired pressure is reached, the air flow shall be stopped. If the void pressure decreases by more than 1.0 psi within the next 15 seconds, the joint will have failed the test and shall be sealed.
 - d. Upon completing the testing of each individual joint, the packer shall be deflated with the pressure meter continuing to display void pressure. If the void pressure reading does not drop to 0.0 plus or minus 0.5 psi, the test equipment shall be cleaned of residual grout material or repaired as needed to result in an accurate void pressure reading.

C. Testing Lateral Connections:

1. Lateral connection testing pressure shall be equal to 0.5 psi per vertical foot of pipe depth plus 2 psi. Test pressure shall not exceed 10 psi without prior approval by the Engineer.
2. Each lateral connection shall be tested at the previously-specified pressure in accordance with the following air test procedure:
 - a. The area to be tested shall be isolated using the lateral connection packer and by applying positive pressure into the isolated void area. For laterals directly connected to the main line sewer, a pan and tilt camera shall be used to position the lateral packer.

- b. The lateral bladder shall be inverted from the main line assembly into the lateral pipe and inflated. The main line elements shall then be inflated to isolate the lateral connection and the portion of the lateral to be tested.
- c. A sensing unit shall monitor the pressure of the packer void and shall accurately transmit a continuous readout of the void pressure to the control panel at the grouting truck or to a pressure gauge on the packer recorded by the CCTV camera.
- d. Air shall then be slowly introduced into the void area until a pressure equal to or greater than the required test pressure, but in no cases greater than 2 psi above the required test pressure, is observed on the pressure monitoring equipment. When the desired pressure is reached, the air flow shall be stopped. If the void pressure decreases by more than 2.0 psi within the next 15 seconds, the lateral will have failed the test and shall be grouted and retested.
- e. Upon completing the testing of each individual lateral, the lateral packer shall be deflated with the pressure meter continuing to display void pressure. If the void pressure reading does not drop to 0.0 plus or minus 0.5 psi, the test equipment shall be cleaned of residual grout material or repaired as needed to result in an accurate void pressure reading.

3.07 SITE RESTORATION

- A. After the grouting has been completed and accepted by the Owner, the Contractor shall restore the entire Project area and shall return the ground cover to its original or better condition. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.
- B. A container shall be furnished for the collection of solvents used in the cleaning of the grouting equipment. Contractor shall use an approved solvent recovery process to dispose of the collected solvents. Disposal of cleaning solvents into the sewer system or into natural watercourses is strictly prohibited.

3.08 BID ITEMS

DESCRIPTION	UNIT	QTY
1. Air Test Lateral Connection or Mainline Joint	EA	XX
2. Chemical Grout Mainline Joint (up to 5 gallons)	EA	XX
3. Chemical Grout Lateral Connection (up to 5 gallons)	EA	XX
4. Additional Chemical Grout Required (> 5 gallons)	GAL	XX

- END OF SECTION -