SECTION 0000

**PRESSURE TESTING AND GROUTING**

**OF LATERAL CONNECTIONS**

PART 1 - GENERAL

* 1. DESCRIPTION
1. The Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified, and required for testing lateral connections by applying a positive air pressure, monitoring and recording the pressure in the void. The intent of connection testing is to identify those lateral connections that are not watertight and that can be successfully sealed by packer injection grouting.
2. The Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to grout lateral connections to the sewer mainlines using a packer injection method.

	1. Requirements

1. The Contractor shall be trained in appropriate and satisfactory safety methods regarding the grouts used under this contract. These methods shall include handling, mixing, and transporting of chemical grouts.

1.03 Related Sections **TO BE SUPPLIED BY THE ENGINEER**

1.04 QUALIFICATIONS

1.05 SUBMITTALS

1. Equipment operating procedures and systems;
2. Chemical Grout information:

	1. Description of chemical grout materials to be used per sections 2.03 and 2.04.
	2. MSDS sheets for all materials to be used.
3. Identification of the Manufacturer(s) of the packers to be utilized on the project;

1.06 REFERENCE STANDARDS TO BE USED

1. National Association of Sewer Service Companies (NASSCO) prepared *Pipeline Assessment and Certification Program (PACP)*, TV inspection form and sewer condition codes.
2. ASTM F2304 Standard Practice for Rehabilitation of Sewers using Chemical Grouting
3. ASTM F2454 Standard Practice for Sealing Lateral Connections and lines from the Mainline Sewer Systems by Lateral Packer Method, Using Chemical Grouting

PART 2 - PRODUCTS

2.01 Grout(S) – GENERAL REQUIREMENTS

1. Grouting materials should be handled, mixed, and stored by the Contractor in accordance with the Manufacturer(s)’ recommendations. The grouting materials shall be delivered to the site in unopened original Manufacturer’s containers.

2.02 GROUT(S) cHARECTERISTICS

1. Acrylamide and Acrylic base grouts shall be utilized and have the following characteristics:
2. A minimum of ten percent (10%) base material by weight in the total grout mix. A higher concentration of base material is recommended to increase strength or offset dilution during injection;
3. Product Manufacturer:

	1. Avanti AV-100;
	2. Avanti AV-118; or
	3. Approved equal (s).

2.03 ADDITIVES

1. **NOTE TO SPECIFIER:** The engineer must select additives to be used within the Manufacturer(s)’ recommended quantities.
2. Strengthening Agents:
3. For lateral grouting, a latex additive shall be used to increase compressive and tensile strength. The quantity of strengthening agent additive shall be as recommended by the Manufacturer(s) and approved by the Engineer.
4. Product(s) Manufacturer(s):
5. Avanti AV-257 Icoset;
6. Approved equal(s).
7. Dye:
	1. A Manufacturer(s) approved water soluble dye without trace metals may be added to the grout tank(s) for visual confirmation.
8. Gel Time Modifier:
	1. A gel time extending agent may be used in accordance with the Manufacturer(s)’ recommendations to extend gel time as necessary.
9. When using non-soluble additives, the grout tanks must have mechanical mixing devices to keep the additives in suspension and maintain a uniform solution of grout and additive.

PART 3 - EXECUTION

3.01 CONTROL TESTS

1. Testing – Tests shall be performed under reference standards found in section 1.06 above.
2. Pump Tests - At the beginning of the contract, prior to application of grout, the Contractor shall perform a pump test. This test shall determine if proper ratios are being pumped from the grout component tanks at the proper rates and shall also measure pump rates. The Contractor shall use separate containers to capture the discharges from each of the grout component hoses to simulate the actual volumes of each component through the interconnect hoses, hose reel and length of grout hose, and to confirm accuracy of the grout pump totalizer. The Contractor shall take corrective action if ratios or rates are not within the Manufacturers’ recommended standards.
3. Grout Tests – The Contractor shall perform and record a grout gel test in the presence of the Engineer. This test shall include the recording of the grout tank solution temperature, catalyst tank solution temperature,ambient air temperature in truck, and gel time of the sample. The test shall be performed whenever the following conditions occur:
4. At the beginning of each day. The material in the hoses shall be recycled to the tanks and a sample shall be taken;
5. Whenever new batches of grout are mixed; and
6. Whenever the temperature in the tanks or ambient temperature have changed by more than plus or minus ten degrees Fahrenheit (+/- 10°F) from the previous gel test.

3.02 TESTING AND GROUTING Equipment

1. The equipment shall be constructed in such a way as to provide a means for introducing air under pressure into the void area created by the expanded ends of the packer against the host pipe. The equipment shall also provide a means for continuously measuring, viewing and recording the actual static pressure of the test medium and grout within the void area only.
2. The grout packer for testing lateral connections shall consist of inflatable mainline end elements and a lateral grouting plug that creates a void area extending beyond the main connection. Whenever possible, the Contractor shall use a lateral grouting plug sized to match the diameter of the lateral being grouted with an effective sealing length of at least 18”. Where the lateral is capped, the Contractor shall utilize alternate lateral grouting plugs or equipment sized appropriately for the capped lateral. In cases were the lateral transitions from six inches (6”) to four inches (4”) in diameter, the Contractor shall use a four inch (4”) lateral grouting plug. However, it should be noted that in some cases a lateral plug may not launch and thus the service may not be “groutable”.
3. Void pressure data shall be transmitted from the void area directly to the monitoring equipment in the grouting truck. All test monitoring shall be above ground and in a location to allow for simultaneous and continuous observation of the televising monitor and test monitoring equipment.
4. Grouting equipment shall consist of the packer and appropriate pumping and hosing systems capable of supplying flow of sealing materials to completely fill the voids.
5. The volume of mixed grout pumped must be measured and recorded for each grouted connection.
6. The Contractor shall provide back-up bladders for all packers on-site any time grouting work is being conducted. Equipment for cleaning lateral blockages shall be readily available while any grouting work laterals and connections are being conducted.
7. **NOTE TO SPECIFIER – THE ENGINEER MUST SELECT SEALING LENGTH AT 18”, 24”, 36”, 5’, 10’, 15’, ETC.**

3.03 PIPE PREPARATION

1. Prior to the application of the chemical grouting materials, the Contractor shall thoroughly clean the mainline pipe.
2. If lateral connection grouting is following mainline pipe lining work, the contractor is responsible for trimming and/or preparing the liner lateral cuts to allow for proper positioning of the lateral connection packer. The Engineer shall specify whether this preparatory step is included in the pipe preparation phase or specify a separate line pay item for this work.

3.04 LATERAL CONNECTION CONDITIONS

1. During mainline sewer cleaning, televising, pipe lining or joint testing (if any), the Contractor shall document all lateral connections. For each such connection, the Contractor shall submit a screen shot image clearly showing the lateral connection. Said images shall be reviewed with the engineer to determine which laterals are to be (a) grouted or (b) removed from the scope of work (due to structural defects and/or roots, deposits, debris, inferior or defective pipe material, etc).

3.05 GROUT PREPARATION

1. The Contractor shall follow the Manufacturer(s)’ recommendations for mixing and safety procedures.
2. Gel time shall be adjusted as necessary to compensate for changes in temperature in grout component tanks or hoses. The addition of dilution water to extend gel times is not acceptable unless the resulting base material exceeds ten percent (10%) by weight for solution grouts.
3. During the grouting process, the Contractor’s grouting technician(s) shall monitor the grout component tanks to make sure that proper ratios are being pumped. If unequal levels are noted in the tanks, the technician(s) shall repeat the pump test as described above and correct any defective equipment.
4. Gel times shall be within the following formula calculations unless the Contractor’s experience and/or field conditions dictate otherwise.

3.06 LATERAL connection TESTING PROCEDURE

1. Lateral connection joint testing pressure shall be equal to one half (0.5) PSI per vertical foot (VF) plus two (2.0) PSI, i.e. (0.5 PSI per/VF + 2.0 PSI). However, the test pressure shall not exceed five (5.0) PSI.
2. Air testing lateral connections shall be accomplished by isolating the area to be tested with the lateral connection packer and then applying positive pressure into the isolated void area. The lateral bladder shall be inverted from the mainline assembly into the lateral pipe and inflated. The mainline elements shall then be inflated to isolate the lateral connection and the portion of the lateral to be tested. A sensing unit shall monitor the pressure of the packer void and shall accurately transmit a continuous readout to the control panel at the grouting truck or to a pressure gauge on the packer (said gauge being read and recorded via the CCTV camera).
3. The test procedure shall consist of applying a controlled air pressure into each isolated void area. 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 two (2.0) PSI (>2.0 PSI) above the required test pressure) is observed on the pressure monitoring equipment. Once the designated pressure in the isolated void is displayed on the meter of the control panel, the application of air pressure shall be stopped, and a fifteen (15) second waiting period shall commence. The void pressure shall be observed during this period. If the void pressure drop is greater than two (2.0) PSI within fifteen (15) seconds, the lateral shall be considered to have failed the air test and shall be grouted and retested.

3.07 LATERAL CONNECTION SEALING from the mainline

1. Lateral connection sealing shall begin if the lateral connection does not pass the air test or shows evidence of leakage. The lateral packer shall remain in position during the pressure test, thus maintaining the isolated void. The Contractor shall pressure inject grout through the lateral packer into the annular space between the lateral grouting plug and the lateral pipe.
2. When pumping grout, the Contractor shall operate the pumps until “refusal”. Refusal shall mean the mixed grout has:

	1. Flowed through any joint failure or any annular space, and into the surrounding soil;
	2. Gelled or filled the available void space;
	3. Formed a cohesive seal stopping further grout flow; and
	4. A minimum of eight (8) PSI back pressure is achieved while pumping.

	As grout pumping continues the void pressure shall slowly rise to a range of two to four (2-4) PSI. The Contractor shall continue pumping until there is a sudden increase in the void pressure. This increase from 2-4 PSI range to a range from eight to ten (8-10) PSI takes place in a matter of a few seconds and is referred to as “pumping to the refusal point”. If the grout pumped exceeds one (1) gallon per foot of lateral bladder plus three (3) gallons, it shall be suspected that there are significant voids on the outside of the pipe or that the packer is not properly sealed. The Contractor shall then check that the packer is sealed properly. If it is determined that the seal is proper and correct, the Contractor shall then modify the grouting procedure. This modification shall include staging grouting by pumping additional grout equivalent to one (1) gallon plus one quarter (.25) gallon per foot of lateral bladder, waiting one (1) full minute, and then retesting. Maximum number of stages shall not exceed two (2) stages unless authorized by the Engineer.
3. Upon completion of the lateral connection sealing procedure, the Contractor shall deflate the lateral bladder, then re-inflate and air test the lateral connection a second time to confirm the sealing of the connection in accordance with the air testing procedure. If the lateral connection fails this air test, the Contractor shall repeat the grouting procedure at no additional cost to the Owner, except for the additional grout used. Air tests after grouting laterals containing roots is not required.
4. The Contractor shall confirm lateral flow after sealing of each lateral connection. If a blockage exists in the lateral, the Contractor shall immediately clear the lateral at no additional cost to the Owner. Blockages in the lateral that are not the result of grouting operations shall not be the responsibility of the Contractor to remove or clear.

3.08 lateral SEALING VERIFICATION

1. The Contractor shall record grouting of laterals in conjunction with the testing of laterals. This shall include recording the void pressure drop continuously on video and in writing immediately before sealing, and immediately after grouting. After the packer is deflated and moved, the Contractor shall record on video the visual inspection of the lateral.
2. Use of standardize test and seal data sheets shall be used in this/these procedures.

3.09 LATERAL TESTING REPORTS

1. The Contractor shall submit to the Engineer a report showing the following data for each lateral connection tested, grouted or attempted to be grouted:

	1. Type of pipe material, diameter and depth of pipe to the surface at manholes;
	2. Test pressure used and duration of test;
	3. Pass/fail results for each lateral connection tested;
	4. Location stationing of each connection tested, and location of any connections not tested with an explanation for not testing;
	5. Volume of grout material used on each connection;
	6. Video recordings shall include testing and sealing operations for each connection (including inflation and deflation over the connection) displaying the final air test of laterals.

3.10 DISPOSAL OF EXCESS MATERIALS

1. The Contractor shall collect and properly dispose of cleaning materials used in the cleaning of the grouting equipment.

3.11 Quality Control

1. The Contractor shall conduct warranty CCTV inspection of mainline sewers on all of the pipe sections which contain lateral grouting. This work shall be completed during conditions of high ground water. This work shall commence a minimum of fifteen (15) months after final completion and be completed a maximum of twenty-four (24) months after final completion. Any lateral connections which were originally sealed and are observed to be leaking shall be re-sealed by the Contractor at no cost to the Owner.

**Recommended Payment Schedule**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Item** | **Description** | **Qty.** | **Unit** | **Unit Price** | **Total Price** |
| 1 | Pre CCTV & cleaning of main lines including root removal  |  | Linear Foot |   |   |
| 2 | Reaming of Mineral Deposits in mainlines |  | Linear Foot |  |  |
| 3 | Test/Seal of Lateral Connections 4” and 6” (5 gallons allowance per lateral) |  | Each |  |  |
| 4 | Acrylamide Gel Grout Pumped in Excess of Allowance Per Lateral |  | Gallon |  |  |
|  |  |  |  |

**Supplementary Unit Prices**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Item | Description | Quantity | Unit | Unit Price | Total Price |
| 1 | Chemical grout beyond allowance (Quantity to be determined by engineer) |  | Gallon |   |   |