

CHEMICAL GROUTING OF LATERAL CONNECTIONS AND LATERAL SERVICE LINES FROM THE MAINLINE SEWER

(as provided by Logiball, Inc.)

GENERAL CONSIDERATIONS AND SPECIFICATION GUIDELINES

GENERAL CONSIDERATIONS

The infiltration of water in sanitary sewer systems through the lateral service connection is a major problem for collection system owners. The combined length of the lateral services often exceeds the length of the mainline sewer. Traditionally the lateral services have been built with no or insufficient above ground accesses to inspect and monitor them.

Users have an uncontrolled access to the sewer system and some of them will use the lateral service to connect their roof and foundation drains.

The trench of the lateral service collects the rainwater, some of that water will find its way into the system through defective pipe joints, even above the water table. Obviously the ground water will drain into the defective pipe when under the water table. The budgets are never sufficient to cope with all the problems at once and the owner must privilege the interventions with the best short-term return on investment. He must allocate money for the collection of data, the analysis, the corrections of the most critical problems, the control and follow up.

The owner becomes frustrated when too much of his *sparse* money is spent on activities which do not show rapid savings and improvements. The owner may also forget the importance of the control and follow up and try to save on these costs. It is the duty and in the best interest of the engineer to define and propose the best approach to his customer. Sealing of the lateral services must be approached with such a broad view. The following general considerations are written to explain the choices when proposing specification guidelines.

THE COLLECTION OF DATA

The engineer must limit the collection of data to sort out the sections where an intervention is necessary and to get the general idea of the problems. The chosen contractor shall have the proper equipment and operators to complete the collection of data and submit the findings to the engineer for an on-site decision and an immediate action. This implies a wide proposal form and the complete supervision by the engineer. That "Find & Fix" approach keeps to a minimum the non-productive costs of mobilization, traffic control and flow control. It is also fair for all parties and an incentive to invest the money where it is the most useful.

The collection of data must not be limited to the immediate requirements of the present intervention. It must be recognized that each lateral service is a sewer section with its own characteristics and problems. A Lateral Connection Data Report shall be originated with the television inspection for each connection and completed with the additional information as the work is completed. That logbook of the job will constitute an essential tool for the future interventions, control and maintenance, including the elimination or proper closing down of unused services.

The proposed Lateral Connection Data Report form shown as Annexe A is explicit on the extent of the data gathering.

The CCTV inspection cost of laterals is minimal when done with a pan & tilt camera and is sufficient for sealing up the 4 feet or less. For longer sealing distances a special camera should be ran through the lateral from the mainline or an above ground access before and after the sealing. We recommend to inspect as much of the lateral as possible even if the sealing distance is limited. These laterals may require cleaning prior to sealing (roots, grease etc). The extra inspection & cleaning shall be paid per lateral inspected & cleaned.

THE EFFECTIVE SEALING DISTANCE

The specification shall dictate the effective sealing distance into the lateral from the mainline/lateral connection. That distance must be cost efficient and practicable. The sealing cost is about the same to seal the immediate lateral connection or up to 4 feet (distance effectively viewed by the “pan & tilt” camera). We believe that a lateral should not be sealed if it cannot be inspected before and after the sealing procedures. Therefore the cost of sealing over 4 feet shall increase because of the more expensive mode of inspection, but shall increase only proportionally to the distance for the sealing itself.

The Lateral Grouting Packers which work from the mainline can handle sealing distances up to 30 feet. Roots, grease, trash and gravel must be removed prior to the test and seal work. Lateral cleaning launchers have been used to clean up to 70 feet of laterals from the mainline sewer. If this cannot be done or if the condition of the pipe forbids the lateral plug entry and seating then only the immediate lateral connection and a reduced portion of the lateral can be sealed.

For longer distances or when the lateral cannot be sealed from the mainline, a Flexible Push Type Packer introduced through an above ground access may be used to complement the work of the Lateral Grouting Packer. If there is no or insufficient above ground access the engineer shall decide if a permanent access should be installed. The installation of an above ground access shall be paid at the unit price of the Proposal Form or at a negotiated price for each lateral. An extra mobilization fee per lateral sealed from an above ground access shall be paid at the unit price of the Proposal Form. The sealing shall be paid by the linear foot as per the Proposal Form.

Laterals cannot be sealed from the mainline when the packer cannot be seated. It takes a sound pipe wall on both sides of the connection to properly seat the packer. Side by side laterals cannot be sealed if the length of sound pipe between is less than 6 inches. Protruding laterals shall be cut back within 5/8” prior to sealing. Only the common trunk of double connections can be sealed. When there are above ground accesses a push type plug may be installed at the junction to avoid filling up one connection while sealing the other. The cost of installing the plug shall be paid at the unit price of the Proposal Form.

PAYMENT FOR SEALING

Payment for sealing laterals shall be at the unit price per lateral for a predetermined sealing distance plus the cost per gallon of the effective grout pumped.

The long term efficiency of sealing laterals by injection of chemical grout into the soil outside the leaking joints or other defects will be good only if enough grout is pumped into the soil. The grout left inside the pipe is not useful. The quantity of grout necessary to create the more permanent water barrier cannot be accurately predicted. It directly depends on the number and size of the leaks, the soil granulometry and the size of the voids around the pipe. In relined pipes it also depends on the importance of the annulus between the liner and the host pipe.

The cost of the grout is not so important in the overall sealing cost and shall not be a limiting factor. Payment by the gallon of effective grout shall be an incentive to pump enough grout to achieve a permanent seal. The only possible measurement of a satisfactory seal is the pumping to an agreed upon refusal pressure.

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Soil particles might have been washed in by the infiltrating water, forming large caves or honeycomb structures which are unseen. When such conditions happen or when the grout flows outside the pipe from one crevice to another before gelling, the grout consumption must be limited by repetitively pumping and curing the grout until the area is dammed off. We call this technique “stage grouting”. For a rough estimate of the required effective quantity of grout per lateral, one can estimate 3 gallons for the connection itself plus one gallon per foot of lateral to be sealed when using low void lateral packers. That rule of thumb can also be used to decide when it is appropriate to stop the continuous pumping and start the “stage grouting” technique. When using the “stage grouting” technique, the applicator must avoid to plug the crevice from the inside before building up a durable impermeable wall or ring outside the pipe. The intervals between the pump strokes shall be shorter than the gel time. Gel times of the grout must take into consideration the volume of the void (volume between the inflated packer and the pipe walls) vs the pumping rate of the combined chemicals.

TESTING AFTER SEALING

A test after sealing will be full-proof only if the inside grout plugging the crevice is removed. The contractor could decide to test immediately after sealing for his own sake, but the engineer shall require some verification after cleaning.

The sealing at refusal, as long as the proper technique is used, is a test in itself. As a control, the specification shall require that 10% of the sections be cleaned and tested, first before the payment of the monthly estimate and at the end of the warrantee period.

SPECIFICATION GUIDELINES FOR TESTING AND SEALING (CHEMICAL GROUTING) LATERAL CONNECTIONS AND LATERAL SERVICE LINES FROM THE MAINLINE SEWER

PREPARATORY PROCEDURES

- A) Cleaning of the mainline and lateral connection shall be performed by the contractor and is to be adequate for seating a lateral packer in the mainline and inserting and seating an inflatable sealing bladder in the lateral. The lateral shall be cleaned of obstructions and roots on the length to be sealed plus a seating distance of one foot. Payment for cleaning shall be per linear foot of mainline from center of manhole to center of manhole and per lateral. Lateral cleaning should be performed from the mainline pipe to minimize inconveniences to the homeowners.
- B) Videotaped CCTV inspections shall be done in the mainline from manhole to manhole and in each lateral on the length to be sealed plus one foot. A pan & tilt camera, from the mainline, will normally be acceptable for sealing distances of up to 4 feet. For longer sealing distances or when the pan & tilt camera does not provide an acceptable view, a camera pushed or pulled through the lateral should be used. A Lateral Connection Data Report shall be originated at the time of the inspection using the form shown in Annexe “A”. A separate Lateral Connection Data Report form shall be filled out for each lateral with all the required information and produced to the owner’s representative.

- C) Services protruding more than 5/8" into the mainline (8" main) shall be cut back or otherwise removed to avoid interference with the testing and sealing equipment. The cutting of the protruding laterals shall be paid at unit price.

THE LATERAL SEALING PACKERS

The Lateral Sealing Packers are operated from the mainline sewer. It shall be designed to accommodate the various sealing bladders for 4", 5" or 6" diameter laterals and the different sealing lengths up to 30 feet. The sealing bladder shall have an expandable end bulb. The void area or grout chamber of the packer shall be minimal to limit the amount of residual grout in the lateral. A sensing unit located within the void area shall accurately transmit the void pressure (testing & grouting) readouts to the control panel at the grouting truck or gauge viewed by the camera. The packer must have one connection for the test medium and two connections for the two-component grout. Each connection shall have its own port in the grouting chamber and be closed by an adjustable non-dripping check-valve set to open at approximately 20 psi.

TESTING OF LATERALS

The packer and sealing bladder are inflated to isolate the area around the connection and that portion of the lateral to be sealed. An air pressure of 6 psi is applied into this isolated void, the air supply is then shut off and the air test line vented. The pressure will be observed for a period of 15 seconds. If the void pressure is maintained with a pressure drop of 2 p.s.i. or less, then the test is positive. If the void pressure shows additional decay during the 15 seconds, the lateral connection and that portion of the lateral will have failed the test and shall be grouted (*See ASTM F 2454-05*). The results of the air tests must be recorded on the Lateral Connection Data Report form. The contractor shall provide an above ground lateral and pipe connection set up for the size and distance to be tested and grouted. The set up shall have two taps with a valve and a gauge at each end of the lateral to simulate leaks. The contractor uses this set up to prove the validity of the air testing and the reliability of the test equipment.

All laterals shall be tested unless it is obvious that they are leaking. Payment for testing laterals shall be at the unit price per lateral for a predetermined testing distance.

SEALING (CHEMICAL GROUTING) OF LATERALS

Laterals which do not pass the air test shall be sealed. The lateral packer remains in position, maintaining the isolated void. A two-component chemical grout sealant is pressure injected through the lateral packer into the isolated void. The grout material is then forced into the soil through leaking joints and pipe defects. The pumping rate and reaction or gel time must be chosen to ensure that enough grout will be placed outside the pipe to provide an effective seal. Typically a gel time of 20-30 seconds for effective sealing lengths of 4 feet or less is acceptable when using a low void packer. Under normal circumstances, gel times for sealing lengths of more than 4 feet should be 10-15 seconds longer than the time necessary to fill the void between the inflated packer and the pipe wall.

The pumping rate must be sufficient to initially fill up the isolated void before the gelling of the two component grout. After filling up the isolated void, the pumping rate should be adjusted to bring up and maintain a back pressure of 8 p.s.i. into the isolated void at the mainline level. When the time for a drop of pressure of 8 p.s.i. to 6 p.s.i. exceeds 20 seconds without pumping, the sealing is considered successful. However, when the effective quantity of grout pumped exceeds one gallon per foot of sealing distance plus 3 gallons it will be suspected that there are unseen caves or honeycomb structures outside of the pipe and the applicator shall try to build grout dams by repetitively pumping and curing the grout until the area is dammed off and the refusal pressure of 8 psi is

obtained (to avoid plugging the crevices from the inside, the pump stroke interval shall be shorter than the gel time). The owner's representative & contractor may determine that the grout consumption is too high and stop subsequent attempts to seal a lateral. The unit price to seal a lateral and the effective grout pumped will be paid even if the lateral was not effectively grouted. The effective volume of grout pumped is recorded on the lateral data sheet.

The effective volume of grout is the total volume pumped less the void volume of the packer chamber. The volume of the packer chamber is measured in the above ground lateral and pipe connection set up by simulating the actual sealing, using water only, and measuring the quantity of water necessary to fill up the void area.

The amount of chemical per pump stroke shall be measured from time to time and then the number of pump strokes could be used to measure the amount of chemical delivered to each lateral. The payment for sealing laterals shall be at the unit price per each lateral plus the cost per gallon of the effective volume of grout pumped.

The cost of the grout is not an important item considering that the expectancy of the repair is directly proportional to the effective volume of grout pumped. The payment of the grout as a separate item is to remove the incentive to pump too little grout.

FLOW VERIFICATION

It is the responsibility of the contractor to verify that the sealing of the laterals did not restrain the flow and to remove any grout which would significantly restrain the flow. Lateral flow shall be verified after the sealing of each lateral. With the lateral being viewed with the pan & tilt camera, an attempt is made to obtain a water flush by the occupant. If the flow seems abnormal, it is assumed that the building sewer is blocked with grout and must be cleared. If a water flush cannot be obtained and if no other full proof verification technique could be used, the contractor shall inspect the lateral 3 feet further than the sealing distance. The contractor remains responsible for verifying and cleaning the lateral even if his verification is accepted by the engineer.

(Optional) The Contractor shall attach to the door of each home or building for which laterals have been grouted, a notification to the occupant stating that the lateral servicing this listed address was grouted on this particular date and if any blockage of sanitary flow occurs, the occupant should call the Contractor. The Contractor shall supply these notification forms.

QUALITY CONTROL BEFORE MONTHLY PAYMENT

Before payment of the monthly estimates, the engineer will select sections representing approximately 10% of the quantity of the sealed laterals. The selected sections shall be cleaned of residual grout with a hydraulic jet cleaner and the sealed laterals shall be air tested and resealed if necessary. If the failure rate exceeds 10%, an additional retest area of equivalent size shall be selected in which the sealed laterals shall be tested.

Additional testing will continue until failure rate of less than 10% is met. Should as much as 25% of Work be tested and fail to meet the 10% requirement, the contractor shall have to test and reseat the totality of the work. Laterals failing the test shall be resealed at the contractor's expense.

QUALITY ASSURANCE

The work of the contractor shall be warranted for a period of 12 months following substantial completion. At a time agreed to by the engineer (approximately 12 months after initial sealing and preferably during a period of high groundwater) the contractor shall do a videotaped CCTV inspection of the mainline with a pan & tilt camera. He

shall note the continuous flow of all the laterals and visible infiltrations from the sealed portions of the laterals. The previously sealed portions of the laterals showing infiltration shall be resealed at the contractor's expense.

For quality assurance, the engineer will select sections representing approximately 10% of the total Work. The selected sections shall be cleaned and the laterals air tested (same procedure as outlined above). Laterals failing the test shall be resealed at the contractor's expense.

LATERAL CONNECTION DATA REPORT

Job #: _____ City: _____
 Street: _____ Date of Inspection: ____ / ____ / ____
 Inspector: _____ Operator: _____

A) Location of Lateral Connection: # _____ of _____



Footage (from center of MH)	Street Address of Building Sewer	Clockwise reference	Angle to the main

B) Description:

Mainline pipe diameter: _____ inches Mainline pipe material: VCP, ACP, RCP, PVC, Other _____
 Lateral pipe diameter: _____ inches Lateral pipe material: VCP, ACP, RCP, PVC, Other _____
 Comments: _____

C) Condition of the Lateral:

Protruding: _____ (inch) Roots: _____ Debris: _____ (inches)
 Comments: _____

D) Infiltration/Inflow

Before sealing. Date: ____ / ____ / ____ % of diameter _____
 After sealing. Date: ____ / ____ / ____ % of diameter _____
 Comments: _____

E) Feasibility of sealing the required length: (_____ FEET)

Seating of the packer in the mainline: _____
 Inversion & seating of the lateral plug: _____
 Comments: _____

F) Corrections required to render sealing possible

Description: _____
 Cost: _____
 Comments & Owner's decision: _____

G) Air test date: ____ / ____ / ____ Result: _____

H) Sealing Date: ____ / ____ / ____ Type & Qty of Grout: _____

Grouting pressure at refusal (psi): _____ Gel time: _____ (seconds)
 List of additives: _____ Qty of Grout Approved for payment: _____ (us gal)
 Comments: _____

I) Control test. Date: ____ / ____ / ____ Result: _____

Comments: _____