SPECIFICATION GUIDELINE FOR PIPELINE PACKER INJECTION PRE-REHABILITATION GROUTING

Master Specification
Section 33 01 30.61t
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Disclaimer:

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BACKGROUND AND USE

NASSCO offers two master specification for Pressure Testing and Packer Injection Grouting, commonly referred to as Sewer Grouting or Test and Seal. These two specifications, while similar, accomplish two different purposes and have very different implementation requirements and performance expectations. These two specifications are:

- ***Section 33 01 30.61 – Pipeline Packer Injection Capital Grouting***
- ***Section 33 01 30.61t – Pipeline Packer Injection Pre-Rehabilitation Grouting***

Pressure testing and packer injection grouting, more colloquially referred to as *sewer grouting* or *test and seal* require significant expertise to implement, and these specifications are intended to be used by specifying engineers, implemented by grout technicians, and overseen by inspectors with the appropriate expertise. These specifications were prepared by industry professionals from the Infiltration Control Grouting Committee of NASSCO (ICGC) and were peer reviewed by industry professionals with experience in testing and sealing programs. This specification is not meant for access structure or large pipe diameter conduit grouting that requires drilling and/or ports for the application of the grout product. This specification is not applicable to grouting of annulus in between carrier and casing pipes associated with trenchless buried installations.

Packer injection grouting is used to reduce the infiltration within the pipeline, seal annular space between close fit liners and host pipes at lateral connections, seal pipe joints that have failed the joint test criteria, stabilize defects, provide external pipe support by stabilizing soils outside the pipe and prevent further loss of pipe bedding into the pipe. Packer injection grouting shall be accomplished by pressure injection of chemical grout through existing pipe defects into the soils encompassing the exterior of pipe. Chemical grouts are designed to be injected into the soil surrounding the pipe to stabilize the soil or into the annular space between liners and host pipes to prevent leakage.

The procedures identified in this specification ***Section 33 01 30.61t – Pipeline Packer Injection Pre-Rehabilitation Grouting*** are those traditionally used for “Short-term Grouting” or “Pre-Rehabilitation Grouting”. These historic practices focused on placing a minimum amount of grout in the pipe gasket space and immediately outside the pipe defect and generally resulted in relatively short-lived water stopping.

A second specification for long-term grouting, known as Capital Grouting, is ***Section 33 01 30.61 – Pipeline Packer Injection Capital Grouting***. This specification provides pipe stabilization by creating a pipe cradle-like stability in the bedding and a volumetrically significant, long-term, water seal outside the pipe in the pipe bedding to eliminate or nearly eliminate all groundwater and rainfall induced infiltration entering a defect or leaking joint; this type of grouting, installed per the industry standard of care and these specifications, has an anticipated service life of 25 years or more.

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This technical specification has been prepared as a master specification using the Construction Specification Institute's MasterFormat organization and numbering system. It also contains multiple Notes to Specifier (NTS) to contact the specification authority (in this case, ICGC) when clarification or elaboration is needed. These NTS are contained in the Comments boxes on the right side of the page. In cases where there are well defined alternative approaches to specifying and/or implementing the work, these are embedded in the specification with **"OR"** clearly marking the required selection of one or the other. The availability and applicability of tools, techniques, and materials should be confirmed for each project.

Where more than one recommendation or philosophy is presented, user of this specification may assume one of two conditions. One, there are multiple methods, explanations, etc. to achieving the stated purpose. Or two, there are multiple varying opinions – each reasonably supported by experience and study – but no single conclusive case facts to promote or deny either opinion.

The recommended measurement and payment descriptions are intended to be used in concert with these specifications. These coordinated models bid items measurement and payment language and sample payment schedule are additionally provided to ensure grouting contractors are incentivized to focus on the most important aspects of this work: namely, pumping grout to the proper places in the proper shapes, concentrations, and volumes. This specification should be used in conjunction with the Grout Test and Seal section of the Pipeline Assessment Certification Program (PACP), latest version, for inspection and construction.

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Packer injection pre-rehabilitation grouting shall be used to reduce the infiltration within the pipeline to OWNER and CONTRACTOR-accepted levels prior to rehabilitation using other methods. Generally, Pipeline Assessment Certification Program (PACP) Infiltration Dripper (ID), Infiltration Runner (IR) and Infiltration Gusher (IG) observations need to be controlled prior to rehabilitation for most trenchless rehabilitation technologies.

B. Packer pre-rehabilitation injection grouting shall be accomplished by pressure injection of chemical grout into the soils outside the pipe. Grouts shall be designed to be injected into the pipe joint and soil surrounding the pipe to seal out groundwater until rehabilitation can be completed. This application will be through joints and penetrations from within the pipe (packer method) and through certain defects in the pipe wall in tandem with a closed-circuit television inspection system.

C. The various pipeline component items subject to these test and seal methods include:

1. Main Line Joint (MLJ) - joints in mainline segment connected to a manhole at each end. MLJ is defined by the "J" or Joint field in the Pipeline Assessment Certification Program (PACP) Details Section inspection form.

2. Lateral Tap Connection (LTC) – Tap connection of lateral to mainline sewer, including a defined length of lateral from the tap and any annular space that might be present between a liner and the host pipe in situations where the main line has been lined. LTC is defined within the Tap group of PACP. Appropriate descriptors and modifiers need to be applied per PACP definitions to further define the asset. The Manhole Assessment Certification Program (MACP) and Lateral Assessment Certification Program (LACP) define Tap differently than PACP. Consult a certified PACP/MACP/LACP user for information on providing the appropriate observation code for these applications.

3. Cured in Place Pipe Liner Annular Space Tap (AST) – Annular space opening at tap cut between liner and host pipe in situations where the main line has been lined. AST is defined within the Tap group of PACP. Appropriate descriptors need to be applied per PACP definitions to further define the asset. MACP and LACP define Tap differently than PACP. Consult a certified PACP/MACP/LACP user for information on providing the appropriate observation code for these applications.

4. Laterals Connected to Manholes (LCM) – Lateral pipe directly connected to and reached from manhole. LCM is defined within MACP. Consult a certified PACP/MACP/LACP user for information on providing the appropriate observation code for these applications.

5. Outside Drop Connections (ODC)[1] – Drop pipes connected to mainline sewer and manhole including a defined length of drop pipe from the main. ODC is defined within PACP as

Access Point observations. Appropriate descriptors and modifiers need to be applied per PACP definitions to further define the asset. MACP defines this observation differently. Consult a certified PACP/MACP user for information on providing the appropriate observation code for these applications.

6. Lateral Accessed from Cleanout (LACO)[2] – Lateral pipe reached through a cleanout. LACO is defined within LACP as an Access Point observation. Appropriate descriptors and modifiers need to be applied per LACP definitions to further define the asset. Consult a certified PACP/MACP user for information on providing the appropriate observation code for these applications.
7. Longitudinal Fracture Defects (LFD)[3] – Longitudinal or multiple fractures and crack within a pipe. LFD is defined within PACP/ LACP as a Structural observation. Appropriate descriptors and modifiers need to be applied to the observation to further define the asset. Consult a certified PACP/LACP user for information on providing the appropriate observation code for these applications.

D. Provide all labor, materials, tools, equipment and incidentals as shown, specified, and required for testing sewer pipe joints, taps, lateral pipe joints, and other features by hydraulically applying a positive pressure to the joints and monitoring the pressure in the void. The test medium shall be air.

E. Provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to grout mainline pipe joints, select defects in pipe body, joints in laterals connected to manholes, lateral tap connections, manhole outside drop connections, and lateral joints accessed through cleanouts using solution grouts using various packer injection grouting methods and tools.

1.2 REQUIREMENTS

A. Contract requires work in active sewers. Follow all federal, state, and local requirements for safety in confined spaces.

B. Conduct worker safety training within one year of start of work that includes reviewing the hazards associated with hoses, pumps, tanks, couplers, compressors, bottles, motors, and all other related application apparatus. Additional safety considerations including safely handling, mixing, and transporting of chemical grouts should be provided by the grout manufacturer/supplier, and should include safe operating practices and procedures, appropriate personal protective equipment (PPE) for the various grouting operations, and proper storage, transportation, mixing, and disposal of grouts, additives, and their associated containers.

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1.3 RELATED SECTIONS[4]

A. Section 33 01 30.16, Television Inspection of Sewers.

B. Section 33 01 30.41, Cleaning of Sewers.

C. Section 33 01 30.43, Removal of Protruding Service Connections.

D. Section 33 01 72, Cured in Place Pipe Lining.

E. Section 33 01 72u, Cured in Place Pipe Lining – UV.

F. Section 33 01 72.v, Spiral Wound PVC Panel Pipe Lining.

1.4 QUALIFICATIONS (TO BE DETERMINED BY ENGINEER)

1.5 SUBMITTALS

A. Documentation of grouting safety training of all field staff.

B. Equipment operating procedures and systems.

C. Grout information:

1. Third party testing grout component chemical composition, including primary chemical percentages.
2. Grout mixture ratio (including additives).
3. Procedure for adjusting grout gel time during initial preparation.
4. Procedures for adjusting grout gel time as temperature changes.
5. Curves of grout gel time versus temperature.
6. Instructions for addition of components.
7. Safety Data Sheets.

D. Equipment operating procedures and systems to be used, including manufacturer's literature on grout pumps (including pump curve demonstrating compliance with required pumping rates), operating pressures, packers, skins, packer mounted gauges, pressure readings on screen, and lateral blockage clearing equipment.

E. Packer to pipe void volume between the packers and host pipe and maximum packer end element inflation pressure when new.

F. Documentation of Joint Testing Observations in accordance with Section 33 01 30.16, Television Inspection of Sewers or in accordance with Grout and Seal codes and reporting per

PACP Manual, latest version is a Television Inspection of Sewers specification is not included in the project manual..

G. List and corresponding digital images, in accordance with Paragraph 3.3, of lateral taps containing roots or other obstructive conditions.

H. Upon completion of grouting each segment, submit to ENGINEER a report showing the following data for each item tested, grouted or attempted to be grouted.

1. Location of the pipeline segment/lateral address in which the testing was done.
2. Stationing.
3. Location of any items not tested and the reason for not testing.
4. Time, date, and temperature.
5. Grout mixture formulation, including additives.
6. End seal pipe-packer contact pressure and seal pressure.
7. Test pressure achieved and the duration of test maintained for each item passing the air test.
8. End-of-hoses pump rates.
9. In situ packer pumping rate
10. Gel time(s) from cup testing.
11. Quantity of grout used to seal each item.
12. Step grouting practice, including pump on and off cycle times and volumes, if applicable.
13. Post-grout pressure test results.
14. Regrouting and retesting giving above data as required.
15. Video recording cross-reference index.

I. Documentation of Post-Construction Inspection in accordance with Section 33 01 30.16, Television Inspection of Sewers or in accordance with Grout and Seal codes and reporting per PACP Manual, latest version is a Television Inspection of Sewers specification is not included in the project manual.

1.6 REFERENCE STANDARDS[5]

A. National Association of Sewer Service Companies (NASSCO) prepared *Pipeline Assessment and Certification Program (PACP)* Reference Manual, latest version.

PART 2 - PRODUCTS

2.1 TESTING EQUIPMENT& GROUTING EQUIPMENT

A. The basic equipment shall consist of a remotely operated television camera capable of pan and tilt, testing and grouting devices (referred to hereafter as packers), grout preparation tanks (Tank A –Base Chemical and Additives and Tank B – Oxidizer Only) and monitoring equipment. The equipment shall be constructed in such a way as to provide means for introducing air under pressure into the void area created by the expanded ends of the packer and a means for continuously measuring the actual static pressure of the test medium and grout within the void area only. Packers shall be expanded by air pressure.

B. All packers shall be fitted with a void pressure sensor (either a transducer or gauge) mounted on the packer. If using a void gauge as the pressure sensor, the maximum top range shall be 15 psi and readable using the television camera. There can be no check valve between the void space and the pressure sensor. Packer void pressure shall be shown either on-screen or captured on-video. The air test gauge in the control panel in the studio may not be used for air testing or post-grouting pressure confirmation because the length of hose and the presence of check valves renders this technique unreliable and inaccurate at pressures below 12 psi.

C. Grout control panel shall have gauges for monitoring packer element pressure. Packer element pressure gauges shall have a range of 0-60 psi.

D. LTC and AST packers shall consist of inflatable mainline end elements and a lateral grouting sock and plug that creates a void area extending beyond the tap or drop connection. Whenever possible, use a lateral sock sized to match the diameter of the lateral being grouted. Effective sealing length shall be[6] __ feet, unless required by transition or pipe configuration less than this, otherwise indicated on the plans, or as directed by ENGINEER. Where the lateral or drop is capped, utilize alternate lateral grouting plug or equipment sized appropriately for the capped lateral. If the lateral transitions from 6” to 4” in diameter within the view of the mainline camera and less than 2 feet from the tap, use a 4” lateral grouting plug. Maintain a variety of lengths of lateral grouting plugs and adjust length of lateral grout plug as required.

E. LCM, LACO, ODC, and LFD packers shall consist of a flexible push-pull-type packer. LCM, LACO, and LFD packers shall be sized for the diameter and pipe joint spacing found in the field, have void spaces commensurate with their duty, and be acceptable to the ENGINEER. The packer shall be able to test the items specified and be able to negotiate fittings associated with the pipe construction. If the lateral contains a transition, CONTRACTOR may change out diameters of push packer or grout using a smaller diameter packer but no relief for excess residual grout will be provided nor payment for the extra wasted grout.

F. Packers operating in concrete, iron, or steel pipe shall obtain air tight seals against surfaces characterized as PACP SAV and as PACP SAP with protrusion less than[7] 3/32" using proper packer diameter as determined against actual pipe diameter so long the pipe maintains a near circular geometry using either special skins or by grouting the packer in place. Pipes with mushroom shapes due to chemical attack or invert loss due to erosion are generally not sealable with remote packers.

G. Grouting equipment shall consist of the packer, hoses, and pumping systems capable of supplying an uninterrupted flow of sealing materials to completely fill the voids

H. A tiger tail, boot, or downhole roller, manhole frame roller, and truck step grid plate or pavement tail or slide are required to protect hoses from chafing.

I. Equipment for cleaning lateral blockages shall be present on-site while any grouting work is being conducted.

2.2 GROUTS - GENERAL

A. All grout materials must have the following characteristics:

1. While being injected, the grout must be able to react /perform in the presence of water (groundwater).
2. The ability to increase grout mix viscosity, density, and gel strength by increased concentration of constituents or the use of approved additives.
3. The cured grout must withstand submergence in water without degradation.
4. The resultant grout formation must be homogeneous and prevent the passage of water (infiltration) through the pipe joint.
5. The cured grout should be chemically stable and resistant to organics found in sewage.
6. Residual grout shall be easily removable from the sewer line to prevent blockage of the sewage flow.
7. Cause no upset of treatment or pumping system downstream of the grouting location.

B. Handle, mix, and store grout in accordance with the manufacturer's recommendations. The materials shall be delivered to the site in unopened original manufacturer's containers.

C. Provide appropriate protective measures to ensure that the grout components and the chemicals produced in mixing are under the control of the CONTRACTOR always and are not available to unauthorized personnel.

D. All grout materials used shall meet the following minimum application requirements:

1. All component materials shall be transportable by common carriers.

2. Packing of component materials shall be compatible with field storage requirements.
3. Grout components shall be packed in such a fashion as to provide for maximum worker safety when handling the materials and minimize spillage when preparing for use.
4. Gel initiation shall take place at the point of injection/repair.
5. Cleanup shall be done in accordance with the manufacturer recommendations.

2.3 CHEMICAL GROUTS

A. Acrylamide based grout shall have the following characteristics:

1. A minimum of 10% acrylamide base material by weight in the total grout mix. A higher concentration of acrylamide base material is recommended where needed to offset dilution during injection.
2. The ability to tolerate some dilution and react in moving water during injection.
3. A viscosity of approximately 2 centipoises, which can be increased with approved additives.
4. A controllable reaction time from 10 seconds to 2 minutes.
5. A reaction (curing) that produces a homogenous, chemically stable, non-biodegradable, firm, flexible gel.
6. The ability to increase mix viscosity, density, and gel strength by increased concentrations of the mix constituents or by the use of approved additives.

B. Acrylate base grout shall have the following characteristics:

1. A minimum of 10% acrylate base material by weight in the total grout mix.
2. The ability to tolerate some dilution and react in moving water during injection.
3. A viscosity of approximately 1-3 centipoise, which can be increased with approved additives.
4. A controllable reaction time from 10 seconds to 2 minutes.
5. A reaction (curing) that produces a homogenous, chemically stable, non-biodegradable, firm, flexible gel.
6. The ability to increase mix viscosity, density, and gel strength by the use of approved additives.

2.4 ADDITIVES

A. At the CONTRACTOR'S discretion and according to field conditions, additives may be selected and used within the manufacturers recommended quantities.

B. Gel Time Modifier - A gel time extending agent may be used in accordance with the manufacturer's recommendations to extend gel time as necessary.

PART 3 - EXECUTION

3.1 CONTROL TESTS

A. Packer Tests - Demonstrate the acceptable performance of packers in the presence of the ENGINEER by conducting demonstration tests.

1. Conduct this test weekly. For pipe less than or equal to 18 inches in diameter, provide a straight pipe of appropriate diameters and ovality and sufficient length to test MLJ, LTC, LACO, LFD, and LCM packers of appropriate. The test cylinder shall be equipped with a void release valve to exercise a controlled release of pressurized air to test the packer under both sound and leaking conditions. The test cylinder shall also be equipped with both a local pressure gauge (0-30 psi) and a connection to the packer test control center/studio; these shall both indicate the pressure in the packer void space.

   a. With release valve sealed, inflate packer until it contacts the pipe; record this packer-pipe contact pressure. Inflated packer to 15 psi greater than the packer-pipe contact pressure. Generate a void pressure of 10 psi. The equipment shall hold at this test pressure for a period of 60 seconds with a pressure drop of less than 1 psi.

   b. If above test is passed, crack the release to simulate a very small leak. After ~20 seconds, seal the release and confirm that a pressure drop has occurred and that the local gauge is within ±1.0 psi of the reading in the control center/studio.

2. Conduct this test every segment for MLJ and LTC packers, and every 5th lateral for LCM and LACO packers. After entering each pipeline segment with the MLJ and LTC packer, but prior to the commencement of testing, position the packer on a section of sound sewer pipe between pipe joints, and perform a test. The equipment shall hold a 10-psi test pressure for a period of 30 seconds with a pressure drop of less than 1 psi. In the event of a failed test, repair any defective equipment and re-test to verify proper operation of all equipment at no additional compensation. Should it be found that the barrel of the sewer pipe will not allow valid in situ barrel test requirements due to corrosion or other barrel defects, then the performance testing shall be waived or modified as determined by the ENGINEER. LFD packers do not need to do this test.

3. If air testing equipment cannot be performed successfully, repair or otherwise modify air test equipment and repeat the tests until the results are satisfactory to the ENGINEER.

The in-situ barrel test may be required at any other time during the performance of testing work if the ENGINEER suspects the testing equipment is not functioning properly.

B. Pump Tests

1. At the start of the job and once monthly or every 1000 gallons of grout pumped, whichever is more frequent, pump grout in uninterrupted flow for full 5 minutes to demonstrate the pumping system can operated continuously at a minimum 3 gpm rate and deliver a minimum of 9 gallons within 3 minutes.
2. At the beginning of each day prior to application of grout, perform a pump test to determine if equal ratios are being pumped from the grout component tanks at the proper rates and to measure pump rates. Pump 1 gallon of grout from each tank into two separate volumetric measuring containers. Take corrective action if unequal quantities are being pumped. Repeat the pump test until equal quantities are pumped from the grout tanks. Record the amount of time required to pump the two gallons and, when using air pumps, count the pump strokes to confirm the number of pump strokes required to achieve the delivery rate.

C. In situ Pumping Capacity Tests – Once inside the pipe and pumping grout through the packer into the first defect of the segment, record the in-situ pumping rate delivered, and modify the grout gel time as appropriate. Check in situ pumping rate each time the packer is reconnected to the hoses.

D. Grout Gel Time Tests - Perform a grout gel test in the presence of the ENGINEER to determine the grout mixture gel time. If packer is not in the pipe, recycle into the respective tanks or properly dispose any grout remaining in the hoses. Run mixers for a minimum of 1 minute, then allow entrained air to release from the grout tanks a minimum of 5 minutes before collecting grout samples in disposable cups. Ensure equal portions of Tank A and Tank B are collected prior to mixing. If foam is present on surface of tank, collect sample from below the foam. Determine gel time by taking cup samples from each tank:

1. Prior to grouting each day.
2. Prior to grouting when a different gel time is required.
3. When new batches of grout are mixed.
4. When the temperature of the solutions in either of the tanks have changed by more than 5°F from the previous gel test.

3.2 PIPE PREPARATION

A. Prior to the application of the chemical grouting materials, inspect the sewer designated to receive the chemical grouting to confirm it is ready for testing and sealing.

3.3 GENERAL PRE-TEST AND GROUT REQUIREMENTS

A. For any segment, LTC, LCM, LFD, or LACO that CONTRACTOR, OWNER, or ENGINEER believes has issues compromising the ability to cost-effectively grout or achieve the project's longevity effectiveness goals, ENGINEER will review the Pre-Construction Inspection and direct CONTRACTOR as to which MLJs, LTCs, ODCs, LCMs, LFDs, and LACOs are to be (a) tested and grouted without further cleaning, (b) plugged, (c) otherwise repaired, (d) additionally cleaned, or (e) to receive no further rehabilitation.

B. Confirm the inside diameter of the mainline and lateral pipes to be tested and apply the appropriate packer.

C. Confirm with ENGINEER the length of sock to be used for LTCs and ASTs.

D. Confirm with ENGINEER where LFDs are to be conducted and what length LFD to utilize.

E. Confirm with ENGINEER what packer end element pressure to utilize for MLJ work where defects originate at joints.

F. Confirm with ENGINEER what root removal must be achieved prior to grouting.

G. Confirm the inside diameter of the mainline and lateral pipes to be tested and apply the appropriate packer.

H. During testing and sealing, provide sewer flow control to provide unimpeded view of the packer.

I. Perform testing and grouting only in the presence of or with the knowledge and concurrence of the ENGINEER. Modify grouting procedures only at the concurrence of ENGINEER.

J. Record the testing procedure and grouting in accordance with Section 33 01 30.16, Television Inspection of Sewers. The recording shall show the location of the item and the test pressure in subtitles. Grouting and testing shall be incorporated on the same recording. Specifically note all defects and taps and ensure footage counter is accurate throughout testing and grouting.

3.4 GROUT PREPARATION

A. Follow the manufacturer's recommendations for the mixing and safety procedures.

B. Add gel time extending agent or cool the grout component tanks and/or hoses as necessary to compensate for changes in temperature in grout component tanks or hoses resulting from changes in ambient conditions. The addition of dilution water to extend gel times is only acceptable using the B (non-grout) tank so that the resulting grout still achieves minimum base material concentrations.

C. During the grouting process, the Grouting Technician shall monitor the grout component tanks to make sure that proper ratios are being pumped. If unequal levels are noted in the tanks, repeat the pump test as described above and correct any defective equipment.

D. Gel times shall be calculated using the following formula unless field conditions dictate otherwise. Any alterations of the gel time formula shall be approved by the ENGINEER.

$$Gel\ Time = \left(\frac{Volume\ of\ Pipe/Packer Void\ Space\ (gal)}{Pumping\ Rate (gpm)} \right) \left(\frac{60\,\text{sec}}{1\,\text{min}} \right) + 20\,\text{sec}(+/-5\,\text{sec})$$

Packer/Pipe void shall be defined as the volume between the inflated packer and the inside pipe wall when the packer is inflated per manufacturer recommendations.

For example: an 8" pipe with a packer void space of 0.3 gallons and a 3 gpm pumping rate would provide

$$Gel\ Time = \left(\frac{.3(gal)}{3(gpm)} \right) \left(\frac{60\,\text{sec}}{1\,\text{min}} \right) + (20\,\text{sec}) = 26\,\text{sec}(+/-5\,\text{sec})$$

3.5 TESTING AND GROUTING DEFECTS

A. Testing and grouting will not be required on pipe exhibiting the following conditions or characteristics. Provide ENGINEER with digital image and intention not to grout any such defect.

1. Longitudinal, spiral, or multiple fractures, as classified by PACP, unless specifically shown or specified or directed by ENGINEER to be grouted via LFD grouting.[8]
2. Broken or partially collapsed pipe, as classified by PACP.
3. Sections of the pipe without defects between joints.
4. Any section of pipe that is scheduled for replacement or other work involving excavation or new connections.
5. Any sections of pipe or joints that are in such poor structural condition that in the judgment of ENGINEER or CONTRACTOR, significant structural damage of the pipe would occur as a result of the pressure test.

B. Attempt to test and, if needed and possible, grout any joint separated less than 1-inch or any angular or offset joint.

C. Do not test, but do grout, all circumferential cracks and fractures, visibly leaking joints, and joint with visible defects.

D. Grout all LFDs or other defects as specified or as directed by ENGINEER.

E. Do not test or grout any other pipe defects unless so specified or shown or directed by ENGINEER to do so.

F. Any visually structurally undamaged joint that structurally cracks, fractures, breaks, or collapses during testing and grouting that are documented on video to have been done under normal pressure conditions shall be the OWNER's responsibility and cost to repair. Promptly repair any other sewer damage resulting from the CONTRACTOR's operations at no additional compensation.

G. Any visually structurally defective joint that collapses during low pressure MLJ grouting that are documented on video to have been done under proper low pressure grouting conditions shall be the OWNER's responsibility and cost to repair. Promptly repair any other sewer damage resulting from the CONTRACTOR's operations at no additional compensation.

H. Test and seal manhole outside drop connection joints using a push packer appropriately sized for diameter and length of outside drop pipe. Test and seal as much of the outside drop connection from the main to the manhole as practical using ODC packer.

I. Position packers over joints or defects by means of a closed-circuit television camera in the line.

J. For each joint/lateral/defect tested/grouted, record exact location and volume of grout placed.

K. For each segment or lateral, record ambient temperature, grout tank temperature, gel set test time, and packer inflation pressure.

L. Specifically identify each tap and break location on the grout report to aid in properly locating joints during warranty testing.

3.6 JOINT TESTING PROCEDURES

A. Joint testing pressure shall be equal to 0.5 psi per vertical foot of pipe depth plus 3 psi; however, test pressure shall not exceed 12 psi without the approval of the ENGINEER. Control test equipment to ensure the specified test pressure is not exceeded by more than 2 psi.

1. If void pressure gauge is not working or not visible/readable and less than 1/3rd the remaining items to test remain, CONTRACTOR may complete segment using panel gauge, but test pressures shall be increased by 5 psi and test time by 5 seconds (to overcome the check valves and regulators in the plumbing). No additional work may be conducted beyond this until the void pressure gauge is working properly.

B. Test joints on LCMs to a location[9] ## feet up the lateral or to the cleanout, whichever comes first. If there is a transition in the laterals connected to manholes, test the transition. Direct visual observation and measured cable lengths shall be used to position the lateral packer for laterals directly connected to manholes.

C. Do not test joints with visible longitudinal, spiral, or multiple fractures or cracks or where the packer cannot be seated because of tap connection. Note reason for not testing on the log.

D. Individually test each MLJ, LACO, ODC, and LCM joints at the above-specified pressure (and retest after sealing) in accordance with the following procedure:

1. The packer shall be positioned within the pipe in such a manner as to straddle the joint to be tested. If uncertain, pump small amount of grout to confirm the void space is properly located (spitting) before inflating the packer.

2. The packer ends shall be expanded to isolate the joint from the remainder of the pipe and create a void area between the packer and the pipe joint. The ends of the testing device shall be expanded against the pipe with sufficient inflation pressure to contain the air within the void without leakage past the expanded ends. Record end seal pipe-packer contact pressure and seal pressure used.

   a. Packer end seal pressures for visually sound VCP shall not be greater than 15 psi more than the required packer-pipe contact pressure.

   b. Packer end seal pressures for VCP with joint defects shall use low pressure MLJ techniques such that the end element pressures shall not be greater than 8 psi more than the required packer-pipe contact pressure.

   c. For rough surface pipe such as corroded concrete pipe[10], use grout to seal the leaks around the packer end if airtight seal cannot be achieved. Gel time may be reduced to half the normally specified time under these circumstances with the approval of ENGINEER. The CONTRACTOR shall be paid the unit price for grout to seal the packer unless ENGINEER determines that the sewer was inadequately cleaned, or the packer is not performing properly but will not be paid the unit price for joint grouting for this activity.

E. Upon completing the testing of each individual joint, the packer shall be deflated with the void pressure meter continuing to display void pressure. Should the void pressure meter fail to drop to +/- 1 psi, clean the test equipment of residual grout material or make the necessary equipment repairs to provide for an accurate void pressure reading.

3.7 LTC TESTING PROCEDURE

A. Lateral connection joint testing pressure shall be equal to 0.5 psi per vertical foot of pipe depth plus 3 psi; however, test pressure shall not exceed 10 psi nor lower than 6 psi without approval of the ENGINEER.

B. Air testing LTCs shall be accomplished by isolating the area to be tested with the packer and by applying positive pressure into the isolated void area. A pan and tilt camera shall be used to position the lateral packer. The 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 be located within the void area and will accurately and continuously transmit void pressure readout to the control panel or pressure gauge viewable with CCTV camera.

C. The test procedure will consist of applying air pressure into each isolated void area. A sensing unit shall be located within the void area and will accurately transmit continuous pressure readout to the control panel. Air shall then be slowly introduced into the void area until a pressure equal to the required test pressure is observed on the pressure monitoring equipment.

D. After the void pressure is observed to be equal to or greater than the required test pressure, the air flow shall be stopped. If the void pressure decays by more than 1.0 psi within 20 seconds, the LTC will have failed the test and shall be sealed. If the void is over pressurized and the void pressure decays, the 20 second period shall begin once the test pressure is achieved.

E. After completing the air test for each individual LTC specified herein, deflate the packer, with the void pressure meter continuing to display void pressure. If the void pressure does not drop to ±1 psi, clean the test equipment of residual grout material or make the necessary equipment adjustments to provide for an accurate void pressure reading.

F. For laterals capped less than two feet from the main, CONTRACTOR may use a mainline packer to test the lateral tap.

G. Length of lateral to be tested shall be as shown or indicated.

3.8 GROUTING

A. Grout all MLJ, LTC, LCM and LACO joints that failed the pressure test, that are visibly leaking at a rate classified as ID (dripper) or greater by PACP, or that have fracture, crack, or chipped joint defects originating at the joint and terminating within 8 inches of the joint by the packer injection method. Grout all LFDs or other pipe defects specified or directed without testing. Generally, this shall be accomplished by forcing grout through a system of pumps and hoses into and through the joints of the sewer from the packer within the sewer pipe. Jetting or driving pipes from the surface shall not be allowed.

B. When grouting VCP joints with defects originating at the joint, use a low pressure technique whereby the end elements are inflated to only 7 psi above pipe-packer contact pressure.

C. After each time pumping grout at one of the above items, if the void space pressure drops faster than the allowable rate at the defined target test pressures, then continue pumping grout in accordance with these procedures. If the void space pressure does not drop, deflate the packer, purge air test line/valve, then reinflate and retest at target test pressure.

D. When using grout to seat the packer, retest as above except do not deflate the packer first.

E. If the item fails this air test, repeat the grouting procedure at no additional cost to OWNER. Repeat this sequence of air testing, grouting, and subsequent air testing until either the item is sealed or it is determined that the grout consumption is too high. The final determination to stop subsequent attempts to seal an item will be made jointly between OWNER and CONTRACTOR.

F. Remove excess grout from pipe and laterals. Excess grout shall be defined as a thickness of grout that given its location, size and geometry, could cause a blockage. Flush or push forward to the next downstream manhole, remove from the sewer system, and properly dispose of excess grout.

3.9 DOCUMENTATION

A. Record grouting in conjunction with the testing. Record the void pressure drop continuously on video and in writing immediately before sealing, and immediately after grouting. After the packer is deflated and moved, record on video the visual inspection of the joint.

3.10 POST-CONSTRUCTION INSPECTION

A. Conduct Post-Construction Inspection of all pipe, taps, and laterals tested and/or grouted in accordance with Section 33 01 30.16, Television Inspection of Sewers. Remove from the pipe wall and bottom any excess grout. Collect and remove from the sewer all excess grout removed from the pipe wall.[11]

PART 4 - MEASUREMENT AND PAYMENT

SECTION 33 01 30.61.t
PIPELINE PACKER INJECTION PRE-REHABILITATION GROUTING

4.1 DESCRIPTION

A. The items listed below beginning with Article 4.4, refer to and are the same pay items listed in the Schedule of Prices. They constitute all of the pay items for the completion of the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory services, including all other items not specifically named in specific bid item descriptions but which are needed for the prosecution of the Work and to meet all other requirements of the Agreement. Compensation for all such services, things and materials shall be included in the prices stipulated for the pay items listed herein.

B. Each lump sum and unit bid price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

C. The Contractor shall receive and accept the compensation provided in the Schedule of Prices and the Contract as full payment for furnishing all materials, labor, tools, and equipment for performing all operations necessary to complete the Work under the Contract, and also in full payment for all loss or damages arising from the nature of the Work, or from any discrepancy between the actual quantities of Work and quantities herein estimated by the OWNER.

D. The prices stated in the Schedule of Prices include all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the Work as shown on the Drawings and specified herein. The basis of payment for an item shown in the Schedule of Prices shall be in accordance with the description of that item in this Section.

E. The Contractor's attention is called to the fact that the unit prices for the various items of Work are intended to establish a total price for completing the Work in its entirety. Should the Contractor feel that the cost for any item of Work has not been defined by a Schedule of Prices payment item, he shall include the cost for that Work in some other applicable Bid Item, so that his Proposal for the project reflects his total price for completing the Work in its entirety.

F. Unless specifically included in a Bid Item, the cost of dewatering, safety, regulatory compliance, normal bypass pumping, maintenance of traffic, restoration, environmental protection including construction entrances, inspections, testing, and other work not specified but required to complete the Work as specified will not be separately paid for but shall be considered as incidental to other Bid Items and included in the prices bid for them.

G. As noted in the individual Specifications, payment for certain Items may be reducd in lieu of required remedial efforts if defects in the Work are observed or if the Work fails to pass the required performance criteria.

H. Abbreviations and acrynoms are defined in the pertinent specifications.

4.2 ESTIMATE OF QUANTITIES

B. Estimated quantities for unit price pay items, as listed in the Schedule of Prices, are approximate only and are included solely for the purpose of establishing pay basis. OWNER does not expressly or by implication agree that the nature of the materials encountered below the surface of the ground or the actual quantities of material encountered or required will correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity or Bid Item as OWNER may deem necessary. CONTRACTOR or OWNER will not be entitled to any adjustment in a unit bid price as a result of any change in an estimated quantity and agrees to accept the aforesaid unit bid prices as complete and total compensation for any additions or deductions caused by a variation in quantities as a result of more accurate measurement or by changes or alterations in the Work ordered by OWNER.

4.3 ALTERATIONS

A. OWNER reserves the right to change the Work under the Contract, whenever any conditions or obstructions are met that render such changes desirable or necessary. All such alterations shall be paid for under the total lump sum bid or at a unit price bid for these items of Work, except as follows.

1. In case such alterations made the Work less expensive to the Contractor, a proper deduction shall be made from the Contract prices and the Contractor shall have no claim on this account for damages or for anticipated profits on the Work.
2. In case such alterations make the Work more expensive, a proper addition shall be made to the Contract prices.

4.4 BID ITEMS

A. Bid Items 1 - 4: Preparatory Sewer Cleaning and Pre-Test CCTV Inspection.[12]

1. Measurement: The quantity for these Items will be the linear feet of sewer pipes cleaned and inspected from center of manhole to center of manhole measured by wheel or tape on the ground surface horizontally along the centerline of the pipe cleaned for each respective diameter of pipe.
2. Payment: This payment shall only be made once for any given pipe segment, regardless of the number of preparatory cleanings required to complete the various inspections and rehabilitation work, unless a physical obstruction or lack of two manholes prevents the complete inspection, in which case partial payment will be made once for the partial inspection and full payment will be made once the obstruction is removed or the manhole is located. The unit price for this Item will be full compensation for providing

all labor, materials, disposal, equipment, tools, and incidentals for all aspects of preparatory sewer cleaning and inspection.

B. Bid Items 5, 7, 9, 11, 13, 15,17,19, and 21: Testing of MLJs

1. Measurement: The quantity for this Item will be the number of MLJs tested by each respective diameter. If packers covering multiple joints are used, payment will be based on the number of joints tested multiplied by 75%.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of testing MLJs. Visual observation of actively running water from leaking joints and circumferential defect, whether tested or not, shall be paid under these Bid Items. Payment for testing MLJs following chemical sealing is included under Packer Injection Grouting Items 6, 8, 10 12, 14, 16, 18, 20, and 22.

C. Bid Items 6, 8, 10 12, 14, 16, 18, 20, and 22: Grouting of MLJs.

1. Measurement: The quantity for this Item will be the number of MLJs or circumferential defects chemically sealed by each respective diameter. If packers covering multiple joints are used, payment will be based on the number of joints grouted multiplied by 75%.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials (except grout), equipment, tools, and incidentals for all aspects of chemically sealing MLJs. No price differentiation is made for grouting technique used. The minimum price for this line item is $## per joint.[13] Payment for grout is under Item 38.

D. Bid Item 23: Pre-Construction Cleaning, Root Removal, Pre-testing CCTV Inspection, Post-grouting Cleaning, and Post-grouting CCTV of LCMs

1. Measurement: The quantity for this Item will be the number of LCMs that are cleaned and televised.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of cleaning, root removal, and CCTV of LCMs. Payment will only be made once for each lateral, regardless of the number of preparatory and post-grouting cleanings required to complete the rehabilitation and inspect the LCM.

E. Bid Item 24: Testing LCM joints

1. Measurement & Payment: The quantity for this Item will be the number of LCM joints tested. If packers covering multiple joints are used, payment will be based on the number of joints grouted multiplied by 75%.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of testing LCM joints. Visual

observation of actively running water from leaking joints and circumferential defect, whether tested or not, shall be paid under these Bid Items. Payment for testing LCM joints following chemical sealing is included under Grouting LCM Joints Item 25.

F. Bid Item 25: Grouting LCM joints

1. Measurement & Payment: The quantity for this Item will be the number of LCM joints grouted. If packers covering multiple joints are used, payment will be based on the number of joints grouted multiplied by 75%.
2. Payment: The unit price for this Item will be full compensation for providing all labor, materials (except grout), equipment, tools, and incidentals for all aspects of testing and grouting of LCMs. No price differentiation is made for grouting technique used. The minimum price for this line item is $## per joint.[14] Payment for grout is under Item 38.

G. Bid Item 26, and 28: Testing of LTCs

1. Measurement: The quantity for this Item will be the number of LTCs tested by each respective sock length and pipe diameter.
2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of testing of LTCs.

H. Bid Item 27, 29: Chemical Sealing LTCs

1. Measurement: The quantity for this Item will be the number of LTCs grouted by each respective sock length.
2. Payment: The unit price for this Item will be full compensation for providing all labor, materials (except grout), equipment, tools, post-construction CCTV and incidentals for all aspects of grouting of LTCs. No price differentiation is made for grouting technique used. The minimum price for this line item is $### per LTC.[15] Payment for grout is under Item 38.

I. Bid Item 30: LTC Cleaning/Root Removal

1. Measurement: The quantity for this Item will be the number of LTCs that have no cleanouts, are authorized for root removal by OWNER, and whose roots are successfully removed by Contractor.
2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of removing roots from LTCs without cleanouts. No payment shall be made for unsuccessful cleaning/root removal attempts.

J. Bid Item 31: Locating, Opening, Cleaning, Pre-Construction CCTV Inspection, Post-Grouting Cleaning, Post-Construction CCTV Inspection, and Restoring 4” and 6” LACOs without obstructions

1. Measurement: The quantity for this Item will be the number of LACOs with sweeps or clear opening tees (i.e., without obstruction) that are located, uncovered to depth of 18", opened, cleaned including root removal if required prior to grouting, CCTV inspected prior to grouting, cleaned after grouting, CCTV inspected after grouting, and restored to existing conditions, including capping and reburial, as appropriate.
2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of locating, opening, cleaning, including root removal if required, prior to grouting, pre-grouting CCTV inspection, cleaning after grouting, post grouting CCTV inspection, and restoring the cleanout and surrounding disturbance for LACOs without obstruction. Payment will only be made once for each lateral, regardless of the number of preparatory and post-grouting cleanings and inspections required to complete the Work.

K. Bid Item 32: Test Joints on 4" and 6" LACOs without obstructions

1. Measurement: The quantity for this Item will be the number of joints actually tested on LACOs without obstructions.
2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of testing LACO without obstruction joints.

L. Bid Item 33: Locating, Opening, Cleaning, Pre-Construction CCTV Inspection, Post-Grouting Cleaning, Post-Construction CCTV Inspection, and Restoring 4" and 6" LACOs with obstructions

1. Measurement: The quantity for this Item will be the number of LACOs with non-sweep turns or non-clear opening tees (i.e., with obstruction) which require the use of pull-in techniques from the manhole to insert the packer and camera that are located, opened, cleaned, including root removal if required, prior to grouting, CCTV inspected prior to grouting, cleaned after grouting, CCTV inspected after grouting, and restored.
2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of locating, opening, cleaning, including root removal if required, prior to grouting, pre-grouting CCTV inspection, cleaning after grouting, post grouting CCTV inspection, and restoring the cleanout and surrounding disturbance for LACOs with obstruction. Payment will only be made once for each lateral, regardless of the number of preparatory cleanings and inspections required to complete the Work.

M. Bid Item 34: Test Joints on 4" and 6" LACOs with obstructions

1. Measurement: The quantity for this Item will be the number of joints actually tested on LACOs with obstructions.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of testing LACO with obstruction joints.

N. Bid Item 35: Grout Joints on 4" and 6" LACO

1. Measurement: The quantity for this Item will be the number of LACOs grouted. No price differentiation is made for grouting technique used.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials (except grout), equipment, tools, and incidentals for all aspects of grouting LACO joints. The minimum price for this line item is $## per LTC.[16] Payment for grout is under Item 38.

O. Bid Item 36: LFD Grout Segment Setup

1. Measurement: The quantity for this Item will be the number of 8"-12" diameter manhole to manhole segments where an LFD packer is used.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals to insert the LFD packer into an 8"-12" diameter pipe segment, regardless of the pipe diameter, joint spacing, or number of LFDs to be grouted on a given segment. If a more than one manhole to manhole segment is addressed using a single packer insertion, payment will be made for each segment. Payment will only be made once for LFD setup regardless of the actual number of times the packer is inserted and removed within a given segment.

P. Bid Item 37: LFD Grouting

1. Measurement: The quantity for this Item will be the number of 8"-12" diameter LFDs grouted by each respective joint length.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials (except grout), equipment, tools, post-construction CCTV and incidentals for all aspects of LFD grouting using long sock packers. Payment for grout is under Item 38. Payment will only be made once for grouting of fractures within pipe joint to pipe joint span regardless of the number of fractures grouted within the span.

Q. Bid Item 38: Grout

1. Measurement: The quantity for this Item will be the number of gallons of grout used for sealing MLJs, ODCs, LTCs, LCMs, LFDs, and LACOS (including void space grout -- except for multi-joint MJL packers and LTC packers where an undersized sock is used in a lateral (e.g., 4" sock in a 6" lateral), in which case the void space volume will be subtracted from the volume of grout measured for payment), and manholes injection grouting.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals not included in Items 6, 8, 10, 12, 14, 16, 18, 20, 22, 25, 27, 29, 35, 37, 67, and 68 required for all aspects of grouting. The price for this line item has been set by the OWNER at $## per gallon.[17]

R. Bid Item 39: Removal of Protruding Laterals

1. Measurement: The quantity for this Item will be the number of protruding laterals removed.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of removing protruding laterals.

S. Bid Item 40: Plugging of Inactive Laterals Connected to Manhole:

1. Measurement: The quantity for this Item will be the actual number of laterals directly connected to manholes plugged.

2. Payment: The unit price for this Item will be full compensation for providing all labor, materials, equipment, tools, and incidentals for all aspects of plugging inactive laterals directly connected to manhole.

T. Bid Item 41: 4" or 6" Bypass Pumping

1. Measurement: The quantity for this Item shall be the number of 12-hour days that a particular sewer main is bypass pumped using a 4" or 6" pump and productive inspection, cleaning, or rehabilitation work, as determined by OWNER, is achieved.

2. Payment: The unit price for this item will be full compensation for providing all labor, materials, equipment, tools and incidentals required to complete all aspects of bypass pumping including up to 800 ft. of lay flat discharge hose and 80' of suction piping. No additional compensation will be provided for installation or removal of the pumping system. No additional compensation will be provided for plugging or bypass pumping for flows less than 250 gallons per minute.

U. Bid Item 42: Post Construction Mainline Cleaning and CCTV Inspection

1. Measurement: The quantity for this Item shall be the length of sewer main in linear feet cleaned and inspected during Post-Construction Mainline Cleaning and CCTV Inspection. For each pipe segment inspected, the quantity will be the same as what was measured under Items 1-4.

2. Payment: The unit price for this item will be full compensation for providing all labor, materials, equipment, tools, and incidentals required to complete all aspects of cleanings and inspections. This payment shall only be made once for any given pipe

segment. No additional compensation will be provided for repairs and post-repair inspections completed during the Post-Construction Inspection.

V. Bid Item A1: Contingency Allowance

1. Measurement & Payment: A mandatory contingency allowance has been established in the Schedule of Prices. All Bidders shall include this allowance in their Bid. CONTRACTOR shall present a cost and additional time proposal for any additional related work requested by OWNER or for increasing unit price quantities. The proposal must be approved by the OWNER prior to release of any general contingency monies.

W. Bid Item A2: Open Cut Excavated Point Repair Contingency Allowance

1. Measurement & Payment: CONTRACTOR shall present a cost and additional time proposal for any additional related work requested by OWNER for open cut pipeline replacement work. The proposal must be approved by the OWNER prior to release of any allowance monies. If the actual cost for such work is less or greater than that indicated on the Schedule of Prices, the allowance amount for this item will be adjusted accordingly, based on the actual costs. The final amount for the allowance shall be adjusted based on the actual approved expenditures.

X. Bid Item A3: Sewer Solids Disposal Allowance

1. Measurement & Payment: CONTRACTOR shall present a cost and additional time proposal for storage, transportation, and disposal of sewer solids removed from sewers and landfilled at Richland Waste Management Landfill. The proposal must be approved by the OWNER prior to release of any allowance monies. If the actual cost for such work is less or greater than that indicated on the Schedule of Prices, the allowance amount for this item will be adjusted accordingly, based on the actual costs. The final amount for the allowance shall be adjusted based on the actual approved expenditures.

Y. Bid Item M1: Mobilization

1. Measurement& Payment: The lump sum for this Item will be full compensation for providing initial services and facilities required to mobilize for and commence with the Work under this Project. Payment for mobilization will be made in two equal payments over the first two pay applications OR as a percentage equal to the amount of pay request, without retainage, divided by[18] $_____. Payment for this item will be made only once.

+ + END OF SECTION + +

SECTION 33 01 30.61.t
PIPELINE PACKER INJECTION PRE-REHABILITATION GROUTING

End Notes / Notes to Specifier:

1. ODC grouting is a developing approach. It requires special equipment and process knowledge to reliably execute.

2. LACO grouting is a specialized approach. It requires special equipment and process knowledge to reliably execute.

3. LFD grouting is a specialized approach. It requires special equipment and process knowledge to reliably execute.

4. While there are currently no NASSCO master spec format guidance specifications for these, NASSCO specification do exist to support this work. The requirements for these activities should be included in any project specification for grouting, especially CCTV and cleaning. Add other sections as needed to complete the work.

This example uses Master Format numbering specifications as examples only. References to this made throughout this specification are indictive of places where these cross-referenced requirements should be included in an actual project manual.

5. ASTMs are not reference here as they are not referenced anywhere in the spec. This is standard spec writing protocol.

6. Establish length based on project objectives, site conditions, and tap configuration. Standard lengths are 4'-8'. Pricing increases significantly with risk to 12'. After 12', you are doing ultralong LTC (up to 30'), which dramatically increases cleaning and grouting risks, and therefore costs. If cleanout exist, it is generally more cost effective to do a 4'-6' LTC and then LACO from cleanout back to the main.

ICGC to develop recommendations on risk vs. length of LTCs

7. Check with manufacturer's latest packer capabilities.

8. LFD grouting requires special equipment and process knowledge to reliably execute.

9. To be set by ENGINEER

10. Typically, SAP coded pipe can be test and sealed. Typical packers can usually seal with surface projections less than 3/32nd".

11. Include only if Owner wants a completely unobstructed view of the pipe after rehab.

12. Consider if each of these items warrants a break out bid item to cover either off road or significant highway control where there is a mix of access obstacles that markedly changes the cost of the work.

13. Contractors may attempt penny this line item in favor of loading their pricing into the more knowable quantity of testing. When they do this, it becomes a disincentive to grouting and to grouting properly. A minimum price ensures disincentives to pumping grout are removed by ensuring there is a reasonable revenue attached to this time-consuming work. In reality, grouting costs ~3x as much as testing.
Suggested pricing for this item is $15 per joint for 8" pipes.

14. Contractors may attempt penny this line item in favor of loading their pricing into the more knowable quantity of testing. When they do this, it becomes a disincentive to grouting and to grouting properly. A minimum price ensures disincentives to pumping grout are removed by ensuring there is a reasonable revenue attached to this time-consuming work. In reality, grouting costs ~3x as much as testing.
Suggested pricing for this item is $10 per joint for 8" pipes.

15. Contractors may attempt to penny this line item in favor of loading their pricing into the more knowable quantity of testing. When they do this, it becomes a disincentive to grouting and to grouting properly. A minimum price ensures disincentives to pumping grout are removed by ensuring there is a reasonable revenue attached to this time-consuming work. In reality, grouting costs ~3x as much as testing.
Suggested pricing for this item is $125 per tap for 8' sock.

16. Contractors may attempt to penny this line item in favor of loading their pricing into the more knowable quantity of testing. When they do this, it becomes a disincentive to grouting and to grouting properly. A minimum price ensures disincentives to pumping grout are removed by ensuring there is a reasonable revenue attached to this time-consuming work. In reality, grouting costs ~3x as much as testing.
Suggested pricing for this item is $102 per joint.

17. Contractors may attempt to penny this line item and underuse grout typical of Maintenance Grouting techniques. A fixed price set 20% above the cost of materials, labor, and waste ensures this item is a money maker for the contractor and incentivizes the use of grout, which is the biggest contributor to long-term sealing and stability of the pipe.
Suggested pricing for this item is $10 per gallon.

18. This figure should vary based on the size of the project and if it is bonded or not. If bonded, then use the 50% paid over the first two progress payment requests. If the work is unbonded and there is a 5-10% retainage, make the dollar amount equal to the first 25% of the work to ensure contractor does the work. If the work is unbonded and there is no retainage, consider eliminating Mobilization altogether and making contractor's mobilization costs part of his unit prices (probably will be reflected in his Clean and CCTV prices).