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Grouting Quality Assurance / Quality Control

Grouting is used in trenchless applications to stop infiltration, stabilize voids and fill the annular space between the host pipe and liner pipe. Although there are many different types of grouting materials, they may be generally classified into two groups: chemical and cementitious.

Cementitious grouting includes the injection of microfine cements and mixing of Portland, soil and/or fly ash with chemical grouts. These grout materials are injected to eliminate infiltration and stabilize soil voids. There are patented methods available. After a pipe has been renewed through re-lining, grout may be used to stabilize the liner by grouting the annular space remaining after insertion. These requirements vary by manufacturer, whose recommendations should be followed.

There are many other types of grouts, including:

- Hydrophilic Foams
- Hydrophilic Gels
- Hydrophobic Foams
- Hydroactive Grouts
- Chemically Activated Gels
- Epoxies
- Acrylamide
- Acrylate
- Urethane

Additionally, chemical grouts may utilize additives to change the performance of the grout. Accelerators will speed up the gel time of urethanes, dichlobenil additive will inhibit the growth of roots, tracer dye illustrates proper mixing and travel of the grout, ethylene glycol protects against drying out or freezing, Potassium Ferricyanide (KFe) will extend the gel time in acrylamides and acrylates. Before using any additive, verify recommendations and ratios with the grout manufacturer.

In general, the multi-component chemical grouts are injected or forced through the walls or defects of a structure. The grouts then expand or gel to fill voids, mix with the pipe bedding and surrounding soil. When mixed with the soil this gelled mass is no longer 10%

or 20% solids but more like 99% solids. The chemical grout effectively seals the leaks, fill voids and stabilize the ground around the structures.

Infiltration at lateral connections & lateral lines is and has been a problem for pipeline owners for years. Even the full length lining of mainlines does not stop these leaks. In fact, liners often increase the flow through lateral connections because they block entry through joints and breaks. As groundwater pressure increases, the flow will migrate to the lateral connections.

The key factors in grout selection include accessibility to the location being grouted, the viscosity of the grout enabling it to penetrate, adjustment of the set time to allow for the grout to migrate into all voids and not be swept away by active flows. Environmental conditions such as moisture content and temperature play an important part as well. Several industry standards are available for reference on the installation of grouts:

- ASTM F 2304-03 – Standard Practice for Rehabilitation of Sewers Using Chemical Grouting
- ASTM F 2454-05 - Standard Practice for Sealing Lateral Connections and Lines from the mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting
- ASTM F 2414-04 – Standard Practice for Sealing Sewer Manholes Using Chemical Grouting
- ANSI / NSF Standard 61 – Water System Components for potable water use

Although there are many opportunities to use grouting, their primary applications in underground “trenchless” applications include manholes, mainlines and laterals. The process steps are summarized as follows:

- Cleaning of the host structure must be adequate for seating a packer and/or inflatable sealing bladder
- Videotaped CCTV inspections of the mainline using pan & tilt cameras will normally be acceptable for sealing distances of up to 4 feet
- Longer sealing distances should be inspected with either a push camera (above ground access) or "satellite" camera (from the mainline sewer)
- Services protruding more than 5/8" into the mainline must be cut back to avoid interference with the test and seal equipment.

Manhole Grouting Process

- Test flow rate
- Preliminary inspection
- Verify ratio
- Test cure time
- Drill injection holes
- Inject grout

Mainline Grouting Process

- Test each joint
- Seal defective joints along the mainline of the pipe

- Move from manhole to manhole
- Grout is pumped through the hose bundle and mixes only when exiting the packer delivery ports

Lateral Injection Process

- Winch packer through the mainline
- Rotate to align launching tube and lateral plug with the service connection
- Inflate lateral grouting plug into the service lateral
- Inflate mainline sleeves
- Service connection and the first few feet of the service line are sealed (longer bladder lengths are available)
- Lateral packers for lateral connections up to 30 feet from mainline without homeowner access; requires CCTV and cleaning of lateral seal distance plus 10 feet.

OR

- Lateral sealed above the connection and the homeowner end using flexible packer introduced from the clean out or above ground access.

Inspection

After sealing operation is complete, sealing verification is performed visually utilizing CCTV. Documentation to be kept during testing and sealing includes identification of the line tested, pipe material, diameter and geographic location, location of each joint or service connection, test pressure used, pass or fail identification of joint, test pressure achieved and maintained for each joint passing, air temperature at time of testing, volume of grout placed per joint or service lateral connection, daily gel time checks, weekly equipment pressure test results and void pressure readouts. Mainline gel times generally should not be < 15 seconds with lateral gel times not less than < 25 seconds.

Specification Tips: Improper bidding with a high cost for joint testing and a “penny” for sealing can be mitigated by requiring a minimum bid price for sealing. Pay contractors for sealing by gallons of grout used, the Owner pays for use nothing more. Make sure Contractor receives Owner prior approval to exceed grout consumption standards.

Quality Assurance Plan

Follow good specifications

Samples available from manufacturer

NASSCO publications

Use CCTV inspection to verify cleanliness, condition and sealing

Test all joints within a section

Verify grout consumption

Compare with standard provided by manufacturer

Quality Control

Count pump strokes

14 strokes = 1 gallon grout pumped

Verify equal levels in grout tanks

1:1 mix ratio for materials

Maximum production per 8-hour day

125 joints in 8” main line

CCTV inspection verifying results
Contractor warranty
Re-test prior to end of warranty period

For Further Information on Grouting Please Visit



Booth 408



Booth 305



Booth 604



Booth 301

Janssen Process Company

Booth 119