SECTION 31 32 00.10
SOIL STABILIZATION BY PERMEATION GROUTING

Basis of Design: AP Fill 700 | Revision 1 | Issued 2026-09-24

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes stabilization of weak or loose soil at depth by permeation injection of single-component, water-activated, hydrophobic, closed-cell polyurethane resin through driven injection tubes in upward stages, binding the soil into a mass of soil and cured resin.

B. Section includes creation of a barrier in water-bearing soils to reduce water migration by the same method.

C. Work of this Section corrects loss of soil strength and bearing at depth. Completion is judged by placement of the design volume at each design depth or attainment of refusal.

D. Ground improvement with two-component structural foam, slab lifting, and void filling are specified separately.

1.2 RELATED REQUIREMENTS

A. Division 01 - Product Requirements, including controlled substitution procedures.

B. Division 01 - Quality Requirements.

C. Geotechnical report, where furnished.

D. Division 03 - Concrete, for repair of concrete surfaces at injection holes.

1.3 REFERENCES

A. ASTM International:

1. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
2. ASTM D756 - Standard Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions.
3. ASTM D1042 - Standard Test Method for Linear Dimensional Changes of Plastics.
4. ASTM D1310 - Standard Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus.
5. ASTM D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
6. ASTM D3505 - Standard Test Method for Density or Relative Density of Pure Liquid Chemicals.
7. ASTM D4878 - Standard Test Methods for Polyurethane Raw Materials: Determination of Viscosity of Polyols.

B. NSF International:

1. NSF/ANSI/CAN 61 - Drinking Water System Components: Health Effects.

1.4 PREINSTALLATION MEETINGS

A. Convene a preinstallation meeting before starting work of this Section. Review at minimum:

1. Current Technical Data Sheets and Safety Data Sheets for each product to be used.
2. The geotechnical report, where furnished, and confirmation that reported conditions match field conditions.
3. Results of utility location, ground penetrating radar, and dynamic cone penetrometer investigation under Article 3.1.

4. Injection grid spacing, design depths, and design volume per vertical foot.
5. The upward staging sequence under Article 3.4.
6. Catalyst selection and dosage for the temperature expected.
7. Method of volume metering and the injection record to be maintained.
8. Disposition of injection tubes on completion.
9. Ambient and material temperature limits.

1.5 ACTION SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data: Current Technical Data Sheet for each product and accessory to be used, including revision date.

C. Safety Data Sheet for each product and accessory to be delivered to the site.

D. Grouting Plan: Drawing showing treatment area, injection grid spacing, design depth at each point, design volume per vertical foot, staging sequence, no-drill zones, and utility locations.

E. Catalyst Schedule: Catalyst proposed, dosage by volume, and the published initial reaction and full rise at that dosage.

F. Where the work occurs within a drinking water source or its zone of influence, submit current NSF/ANSI/CAN 61 certification of the injected material.

1.6 INFORMATIONAL SUBMITTALS

A. Site Investigation Report: Results of utility location, and of ground penetrating radar and dynamic cone penetrometer investigation, including void locations, soil profile, and depth of the identified condition.

B. Injection Record: For each injection point and stage, depth, volume placed, catalyst percentage where used, pressure, wait time, and reason injection was stopped.

C. Abandoned Tube Record: Location of each abandoned tube and each tube that could not be extracted.

D. Installer Qualification: Evidence that the Installer satisfies Article 1.7.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall have completed Alchatek contractor training, or Alchatek Technical Service shall be present at the start of the work.

B. Utility Locate: Contact the applicable one-call utility locate service on every project before driving any tube or drilling any hole.

C. Safety Data Sheets: Personnel shall review the Safety Data Sheet for each product before handling or injecting.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in unopened original containers bearing the product name and manufacturer identification.

B. Store products between 50 and 80 deg F (10 and 26 deg C). Shelf life is 24 months in unopened containers stored within this temperature range.

C. Retain empty catalyst containers for disposal.

D. Dispose of surplus resin and catalyst in accordance with local regulations.

1.9 FIELD CONDITIONS

A. Soil Gradation: Single-component permeation grouting is optimal in soils with less than 10 percent fines passing the No. 200 sieve. Where site soils exceed this limit, report the condition before proceeding.

B. AP Fill 700 requires moisture to react. Soil shall be at least lightly moist. Where soil is dry, add water before injection.

C. Cold Weather, below 50 deg F (10 deg C): Resin thickens and pumps more slowly, the reaction slows, and frozen ground prevents penetration and may cause material to pool when the ground thaws.

1. Do not inject when the ground is frozen.
2. Warm resin and catalyst to 60 to 80 deg F (16 to 27 deg C).
3. Increase catalyst percentage, where catalyst is used, and extend wait times between staged injections.

D. Hot Weather, above 85 deg F (29 deg C): Resin reacts faster and may cure early, with risk of flash set, uncontrolled surfacing, lifting, and waste.

1. Reduce catalyst percentage, where catalyst is used.
2. Work in early morning or evening, use shorter injection bursts, monitor pressure closely, and store resin in shade.

E. High Humidity and Wet Conditions: Extend wait times between staged injections and monitor emergence closely.

F. Quantity of material is assessed on site and is influenced by the amount of water present, soil type, void content, and treatment depth.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Alchatek (www.alchatek.com).

B. Substitution of products from other manufacturers is governed by the controlled substitution procedures of Division 01.

2.2 BASIS-OF-DESIGN PRODUCT

A. Basis-of-Design Product: AP Fill 700.

B. Description: Single-component, water-activated, hydrophobic, low-viscosity, closed-cell, semi-rigid polyurethane injection resin. Water impermeable. Phthalate free. Set time adjustable to as fast as 20 seconds.

C. Catalyst: Alchatek Cat 106 or Alchatek Cat 107.

2.3 SUBSTITUTIONS

A. AP Fill 700 is the product specified for this Section.

B. A product proposed for substitution shall satisfy every requirement of Article 2.4 and shall be supported by current published technical data demonstrating compliance.

C. Where drinking water certification is required, a product not carrying NSF/ANSI/CAN 61 certification is not an acceptable substitution.

2.4 PERFORMANCE REQUIREMENTS

A. Injected material shall react and cure in the presence of water.

B. Injected material shall be closed cell and water impermeable in the cured state.

C. Injected material shall be injected as a single component.

D. Set time shall be adjustable by catalyst type and dosage.

E. Where the work occurs within a drinking water source or its zone of influence, injected material shall be NSF/ANSI/CAN 61 certified.

2.5 PRODUCT PROPERTIES

A. AP Fill 700, cured (Technical Data Sheet Rev. 5/19/2026):
   1. Tensile strength, ASTM D1623: 45 psi (310 kPa).
   2. Tensile elongation, ASTM D1623: 2.90 percent.
   3. Compressive strength (with fine sand), ASTM C39: 2,050 psi (14,100 kPa).
   4. Shrinkage, ASTM D1042 / D756: Negligible.
   5. Pre-activated mix viscosity: 120 cP (120 mPa-s).
   6. Certification: Certified by ALS Global to NSF/ANSI/CAN 61 for contact with drinking water.

B. Compressive strength is determined with fine sand and does not represent the resin alone or soils of other gradation.

C. Alchatek Cat 106, liquid:
   1. Viscosity at 77 deg F (25 deg C), ASTM D4878: 10 cP (10 mPa-s).
   2. Flash point, ASTM D1310: Greater than 210 deg F (99 deg C).
   3. Specific gravity, ASTM D3505: 0.97.

D. Alchatek Cat 107, liquid:
   1. Viscosity at 77 deg F (25 deg C), ASTM D4878: 10 cP (10 mPa-s).
   2. Flash point, ASTM D1310: Greater than 210 deg F (99 deg C).
   3. Specific gravity, ASTM D3505: 0.95.

E. Reaction with Alchatek Cat 106 (not recommended below 2 percent):
   1. 2 percent by volume: Initial reaction 25 seconds; full rise 1 minute 50 seconds.
   2. 5 percent by volume: Initial reaction 15 seconds; full rise 1 minute 27 seconds.
   3. 10 percent by volume: Initial reaction 8 seconds; full rise 30 seconds.

F. Reaction with Alchatek Cat 107 (not recommended below 5 percent):
   1. 5 percent by volume: Initial reaction 5 seconds; full rise 30 seconds.
   2. 7.5 percent by volume: Initial reaction 5 seconds; full rise 22 seconds.
   3. 10 percent by volume: Initial reaction 5 seconds; full rise 16 seconds.

G. Properties will vary depending on application conditions.

2.6 ACCESSORIES

A. Catalyst: Alchatek Cat 106 or Alchatek Cat 107.

B. Injection Tubing: 1/2 inch (13 mm) steel injection tubing, 10 or 20 foot lengths, with 1/4 inch (6 mm) carriage bolt drive tips.

C. Injection Fittings: Nut-and-ferrule compression fitting and button-head coupler.

D. Pump Flush: Alchatek Pump Flush.

E. Surface Protection: Alchatek Surface Guard 125.

F. Hole Patching: Concrete patch for concrete, cold patch for asphalt, epoxy for interior slabs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Locate utilities through the applicable one-call service on every project before driving any tube or drilling any hole.

B. Where available, review the geotechnical report and site plan and confirm against field conditions:
   1. Soil classification and bearing capacity.

2. Soil gradation, including percentage of fines passing the No. 200 sieve.
3. Groundwater depth and seasonal fluctuation.
4. Boring log locations and depths.
5. Site-specific hazards and restrictions.

C. Where a concrete slab, asphalt surface, or buried structure is present, investigate with ground penetrating radar to identify voids, utilities, reinforcing steel, and obstructions.

D. Investigate with a dynamic cone penetrometer to verify soil density and establish void locations, soil profile, and depth of the identified condition.

E. Measure the treatment area. Mark obstacles, utilities, no-drill zones, and likely emergence points such as edges, joints, and cracks. Identify equipment access.

F. Adjust the Grouting Plan where reported conditions do not match field conditions. Do not begin injection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Injection Grid: Lay out and mark injection points in a grid, numbered where work will be done in phases. Space points as follows:
1. Sand, loose fill, or voids: 18 inches.
2. Critical or engineered projects: 18 inches.
3. Stable, firm soils: 24 inches.

B. Drive Injection Tubes:
1. Use 1/2 inch (13 mm) steel injection tubing unless the project requires otherwise.
2. Insert a 1/4 inch (6 mm) carriage bolt into the tube tip and secure with light tape.
3. Drive the tube vertically at each marked point to the lowest design depth with a hammer drill or pneumatic driver.
4. Pre-drill through concrete or asphalt, through large rocks or obstructions, or where tubes must be angled to avoid marked utilities.

C. Release Drive Tip:
1. Lift the tube 1 to 2 inches and inject water down the tube to eject the tip. Confirm water flows from the tube.
2. Where the water method fails, knock out the tip with a punch rod.
3. Where the tip cannot be released, abandon and mark the tube and drive a replacement tube 6 to 12 inches away.

D. Surface Protection: Pre-spray injection points, joints, and exposed surfaces with Alchatek Surface Guard 125 and keep them wet during pumping. Cover finished slabs, building faces, and other vulnerable surfaces with plastic sheeting.

E. Inspect and test pump, hoses, gauges, and tubes for function and leaks before injection.

F. Personal Protection: Provide eye and face protection, chemical-resistant gloves, long sleeves and long pants, work boots, and safety vests. Provide respiratory protection in confined spaces.

3.3 MIXING

A. Batch mix resin and catalyst in small containers to limit waste.

B. Introduce catalyst by gravity flow from the container. Do not stir manually.

C. Do not use Alchatek Cat 106 below 2 percent or Alchatek Cat 107 below 5 percent by volume.

D. Mix only the quantity that can be placed within the full rise time for the dosage selected.

3.4 INSTALLATION

A. Injection Equipment:

1. Single-component injection pump suited to the resin in use, with a pressure gauge visible to the operator throughout injection.
2. Volume metering by flow meter or verified manual tracking.
3. Connection to the tube by nut-and-ferrule compression fitting and button-head coupler.
4. Pre-flush the pump with Alchatek Pump Flush at the start of each day so the pump is primed and free of moisture.

B. Upward Staging Sequence:
1. At each point, begin injection at the lowest design depth.
2. Inject approximately 1 gallon per vertical foot of treatment, adjusted per the Grouting Plan: 0.5 to 1 gallon per vertical foot in sandy soil with minimal voids, 1 to 1.5 gallons per vertical foot in loose fill with voids.
3. Raise the tube 1 foot and repeat, until the tube is 3 feet below the surface.
4. Use a slow, steady pump rate. Lower pressure and longer injection improve permeation and avoid fracturing the soil into grout lenses.
5. Wait 3 to 5 minutes between staged injections to allow material expansion.
6. Meter and record the volume placed at each stage.

C. Monitor continuously for pressure spikes indicating refusal or blockage, material breakthrough at nearby tubes, emergence at the ground surface, and movement of overlying construction.

D. Stop injection at a stage when:
1. The design volume has been placed.
2. The tube is within 1 foot of ground level.
3. Material surfaces at the ground or at adjacent points.
4. The tube reaches refusal and accepts no further material.

E. Where grout columns are narrow and leave unpermeated soil between points, apply resin more slowly to allow lateral spread.

F. Do not remove the injection gun until the foam has set.

3.5 FIELD QUALITY CONTROL

A. Verify by volume metering that the design volume has been placed at each design depth.

B. Record depth, volume, catalyst percentage where used, pressure, and wait time for each point and stage.

C. Record the location of each abandoned tube and each tube that could not be extracted.

D. Return to Service: AP Fill 700 is traffic ready in 1 hour.

3.6 CLEANING

A. Injection Tubes:
1. Standard projects: Tubes may remain in the ground.
2. Where a finished surface is required: Cut tubes flush with a saw or cutoff tool.
3. Roadways and DOT projects: Drive tubes 3 to 4 inches below the surface before patching, or cut as the Contract Documents require.

B. Clean injection holes of debris and patch with concrete patch in concrete, cold patch in asphalt, or epoxy in interior slabs. Match the surrounding finish.

C. Remove excess resin, foam, plastic sheeting, and debris from the site.

D. Flush the pump with Alchatek Pump Flush at the end of each day. Never rinse the pump with water.

E. Dispose of surplus resin and catalyst in accordance with local environmental regulations.

3.7 PROTECTION

A. Protect completed work from traffic until the return-to-service interval in Article 3.5 has elapsed.

B. Conduct a final walkthrough to confirm no injection point was missed, spillage has been removed, surface appearance is acceptable, and all tools and safety equipment are accounted for.

END OF SECTION 31 32 00.10