SECTION 31 32 00.10
SOIL STABILIZATION BY PERMEATION GROUTING

Basis of Design: AP Soil 600 | 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, moisture-activated, hydrophobic, extra-low-viscosity polyurethane soil grout 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 D756 - Standard Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions.
2. ASTM D1042 - Standard Test Method for Linear Dimensional Changes of Plastics.
3. ASTM D2166 - Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.

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. Whether catalyst will be used and, if so, the dosage and resulting set time.
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, where catalyst is used: Dosage and the published set time 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 Soil 600 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 soil type, degree of saturation, soil compaction, target depth and diameter of treatment, and the presence of voids.

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 Soil 600.

B. Description: Single-component, moisture-activated, hydrophobic, extra-low-viscosity polyurethane soil grout. Encapsulates and strengthens loose soil. Watertight. Phthalate free.

C. Catalyst: Not required. Alchatek Cat 600 is optional where a faster set time is required.

2.3 SUBSTITUTIONS

A. AP Soil 600 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 be moisture activated and shall react and cure in the presence of water.

B. Injected material shall have viscosity low enough to permeate the treated soil rather than displace it.

C. Injected material shall encapsulate and bind the treated soil and shall be watertight when cured.

D. 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 Soil 600, cured (Technical Data Sheet Rev. 1/20/2026):
   1. Compressive strength (permeated in sand), ASTM D2166: 1,300 psi (8,960 kPa).
   2. Shear strength (permeated in sand), ASTM D2166: 665 psi (4,590 kPa).
   3. Shrinkage, ASTM D1042 / D756: Negligible.
   4. Pre-activated mix viscosity: 38 cP (38 mPa-s).
   5. Certification: Certified by ALS Global to NSF/ANSI/CAN 61 for contact with drinking water.

B. Set time with optional Alchatek Cat 600, per 5 gallons of resin:
   1. 0 percent (0 oz): 3 hours.

2. 0.5 percent (3.2 oz / 94 mL): 2 hours 30 minutes.
3. 1.0 percent (6.4 oz / 189 mL): 2 hours.
4. 1.5 percent (9.6 oz / 284 mL): 1 hour 20 minutes.
5. 2.0 percent (12.8 oz / 379 mL): 55 minutes.
6. 2.5 percent (16.0 oz / 473 mL): 30 minutes.
7. 3.0 percent (19.2 oz / 568 mL): 25 minutes.

C. Properties will vary depending on application conditions.

2.6 ACCESSORIES

A. Catalyst: Alchatek Cat 600, optional.

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. Perform baseline dynamic cone penetrometer testing to establish soil density, 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. Standard spacing for AP Soil 600, including sand, loose fill, voids, and critical or engineered projects: 18 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. AP Soil 600 requires no catalyst and is injected as supplied where the uncatalyzed set time is acceptable.

B. Where a faster set time is required, add Alchatek Cat 600 at the dosage published in Article 2.5 for the set time required.

C. Mix only the quantity that can be injected within the set time of the selected dosage.

D. Keep containers closed when not in use and keep water out of the resin.

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 Soil 600 reaches full cure in 24 hours.

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