

BENTOGROUT®

REMEDIAL WATERPROOFING INJECTION GROUT

DESCRIPTION

BENTOGROUT is a high-solids grout consisting of a proprietary blend of bentonite and polymers formulated for sealing water leaks in existing below-ground structures. BENTOGROUT is pumped in a fluid state adjacent to the exterior of the structure where it sets into a gelatinous state forming a waterproofing barrier. BENTOGROUT can be used to seal leaks in concrete, masonry block, brick, and stone foundations.

Installation is fast and easy. Simply mix BENTOGROUT with water and pump it adjacent to the exterior of the building. There it solidifies and expands slightly to form a waterproofing barrier. It can be pumped from above-ground outside the structure without excavating or from the interior of the structure through drilled holes in the walls or slabs. Limited jobsite space is required for injection.

Unlike many remedial waterproofing products that are applied as a surface treatment to the interior of the foundation, BENTOGROUT is applied to the exterior of the building where it stops the water before it can penetrate the structure and further corrode the reinforcing steel. The thick BENTOGROUT barrier covers the exterior surface of the structure filling voids in the adjacent soil and bridging over small cracks in the concrete. Also, BENTOGROUT has the ability to self-seal if the structure settles and therefore its performance is not limited by future hair-line cracking in the concrete. BENTOGROUT does not shrink or dry out in sub-surface soil formations and is not affected by freeze/thaw cycling. It remains flexible, maintains a putty-like consistency over time and retains a swell potential to seal itself off. And since BENTOGROUT primarily consists of natural minerals it is friendly to the environment and will last the life of the structure.

APPLICATIONS

- Foundation walls
- Foundation slabs
- Tunnels
- Sheet piling interlock
- Concrete and masonry foundation walls
- Manholes
- Utility vaults

PACKAGING

BENTOGROUT is packaged in 25 kg, multi-wall bags; 40 bags per pallet. Store in a dry, moderate temperature location.

PREPARATION

Locate and mark all below-ground electrical, sewer and mechanical service lines prior to injection operations. A successful operation requires the installation to occur without mechanical failure of the BENTOGROUT mixing/pumping equipment. Ensure that all required materials are available and in working condition prior to beginning the application. If pumping from the interior of the building, drilling operations should be completed prior to mixing BENTOGROUT.

Exterior Injection Head: The applicator will need to fabricate an "Injection Head" to connect the pump hose to the injection pipe. An example of this "Injection Head" assembly is pictured below. Figure 1 illustrates an Injection Head assembly with a quick disconnect fitting, shut off valve, three way tee and end cap. On the bottom of the three way tee is the injection pipe (length to be determined by project depth requirements; typically 2,4 m–3,0 m). The Injection Head will also serve as a leverage device to hold onto when the applicator is inserting the injection pipe into the soil substrate.

Mix Water: Use only clean water; approximately 53 litres. BENTOGROUT mixes best in cool water with a pH between 8 and 10. High temperature water can accelerate the set up time of the grout.

Equipment: CETCO recommends the use of the CETCO BENTOGROUT Pump and Mixer as the equipment is designed specifically for BENTOGROUT. Use mixing equipment capable of producing continuous shear and agitation movement. CETCO BENTOGROUT Equipment is comprised of progressive cavity pumps with vertical paddle and horizontal ribbon blender type mixers. It is not recommended to use a piston style pump due to the high spikes in back-pressure generated.

Caution: Pumping any material under pressure can cause lifting or movement of adjacent structures.



CETCO BENTOGROUT Pump, Mixer and Accessories

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The CETCO BENTOGROUT Pump and Mixer are separate wheel mounted units that weigh 77 kg and 95 kg respectively; each are ran by 1 HP electric motors (Figure 2). The CETCO BENTOGROUT Pump consists of a rotor-stator ribbon pump that is capable of pumping a consistent 11 litres per minute and has a 68 litres hopper. The CETCO BENTOGROUT Mixer is able to mix a 25 kg bag of BENTOGROUT in approx. 8 minutes with its three mixing paddles and has a mixing capacity of 83 litres. Both units are completely electric and only require a 120 V, 15 AMP current (standard GFI outlet). For information or to purchase the CETCO BENTOGROUT Pump, Mixer and accessories, contact your local CETCO sales representative.

Pumping Pressures: BENTOGROUT is typically pumped at pressures of 0,7 to 5,5 bar. Since there are many jobsite variables, actual pumping pressure will vary. Variables may include, amount of water added to BENTOGROUT, pump hose diameter and length, resistance at hose-head, substrate material and compaction, etc. For example, in large void areas the pumping pressure may only be 0,7 bar, but as soon as back pressures form the pressure may spike to 7,0 to 14 bar. Watch the pumping pressure closely while installing the BENTOGROUT. Backoff as the pressure increases. Additionally, a crew member may be stationed inside the structure to monitor the injection. This is especially important with masonry block foundations.

Pump Hose: A 25 mm diameter pump hose with a minimum 14 bar pressure rating is recommended. The pump hose should be as short as possible without adversely limiting operations. The longer the hose and the more turns it makes, the greater the pumping pressure decrease at the place of injection.

INSTALLATION

Mixing Instructions: Add 53 litres of fresh water to a motorized mixer and then add a single 25 kg bag of dry BENTOGROUT to the water. Thoroughly mix for approximately 5–8 minutes until even “oatmeal” consistency. BENTOGROUT remains pumpable and placeable for 45 minutes after being mixed. After mixing, if pumping is stopped or suspended, use a CETCO ByPass Assembly to redirect the material back into the pump hopper to recycle BENTOGROUT during a suspended period. Do not allow mixed BENTOGROUT to stand in hose. It will set up and clog the hose; flush water through equipment if there is a stop in use for 20 minutes or longer.

Coverage Rate: Typical installation thickness of BENTOGROUT is 12 mm or greater. Coverage rates will be affected by injection depth, void areas, soil compaction, material spread, etc. A 25 kg bag of BENTOGROUT yields 0.06 cubic metres of grout. Estimating a 12 mm thick coverage rate without any void spaces, a 25 kg bag should cover approximately 4,6 sq m. Actual results will vary with each project.

Surface Injection From Exterior of Building:

Use 10–19 mm diameter heavy wall steel pipe as injection pipe for BENTOGROUT placement. Cut the pipe tip at a 45° angle to aid in sinking of the injection pipe.

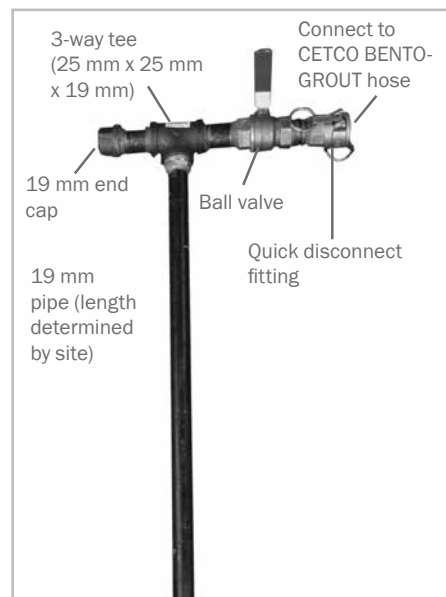


Figure 1: Single Connection Injection Head Assembly

A single pipe can be repeatedly inserted and removed, or numerous pipes can be inserted and then all injected through in sequence.

Insert injection pipe as close as possible to the foundation wall at 0,6 m–1,2 m on centre and push pipe down to the top of the footing or the desired depth. Use a “Tile Rod” or long drill bit to start the first few feet of the injection hole.



Figure 2: CETCO pump and mixer with electric 1HP motor

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With a Single Connection Injection Head, use the grout as a drilling medium to assist with sinking the pipe (see Figure 1). For deep depths, it may be necessary to use scaffolding to operate from when first inserting a long pipe.

After sinking the injection pipe to the desired depth, pump BENTOGROUT until it extrudes out at ground or substantial back pressure is achieved. (Caution: Be careful not to inject BENTOGROUT into sub-surface drainage tile.) Continue to pump BENTOGROUT while slowly removing injection pipe. Then move to adjacent injection point and continue process; Injection points are typically 0,6 m to 1,2 m on centre. Cohesive soil conditions will require closer placed injection points while non-cohesive soils may only need injection points placed 1,2 m apart. After the outside of the wall is injected with BENTOGROUT, a second round of injections can take place between previously injected holes to ensure outside is completely coated.

Interior Injection Through Slab or Wall:

Use a 38 mm diameter bit to drill a 150 mm deep starter hole in the concrete (to set CETCO Injection Packer). From 150 mm depth continue drilling through the remaining thickness of the concrete with a 19–25 mm diameter drill bit. Once hole is drilled, insert CETCO Injection Packer with the red rubber gasket completely placed into the 38 mm hole section, then tighten and firmly set Injection Packer with the handle. Install Injection Packer with ball valve in the closed position. Then hook up the CETCO Pressure Gauge and the CETCO Injection Hose to the Injection Packer. Drill the bottom row of wall injection holes as close to the wall/slab joint as possible 1,2 m on centre. Drill the second row 1,2 m up and offset 0,6 m from the bottom row. Drill subsequent rows (as required) in the same pattern to the previous row: 1,2 m up and offset 0,6 m (creating a diamond pattern).

For interior wall injections, begin grout injection at the lowest injection point on the wall and then work upwards. A minimum of two holes should be drilled – one for grout injection and the other for pressure release. Prior to pumping BENTOGROUT, open the ball valve of the Injection Packer and adjacent Injection Packer(s). Then pump BENTOGROUT through Injection Packer until BENTOGROUT begins to flow out of adjacent Injection Packers (with ball valve in open position) or substantial backpressure is achieved. When BENTOGROUT is observed to be flowing out of adjacent CETCO Injection Packers, successful BENTOGROUT flow between Packers has been achieved (void is being filled). Close ball valve of adjacent Injection Packer that BENTOGROUT is flowing out and continue to pump in same Injection Packer until pressure spikes or BENTOGROUT flow stops. Then move to adjacent injection packers and continue same process. Inject BENTOGROUT through each Injection Packer; including adjacent packers with previous BENTOGROUT return flow. Caution: pumping material under pressure can cause lifting or movement of the structure.

After BENTOGROUT injection, leave the CETCO Injection Packers set in the drilled holes for a minimum 24 hours to allow BENTOGROUT to setup. If required, BENTOGROUT can be typically be injected through the same injection points again the next day. Remove the Injection Packer and plug hole with a non-shrink hydraulic cement patch product. Finish interior wall surface per project requirements.

An alternative interior injection method is to use a Single Connection Injection Head (Photo 1) with a short 200 mm heavy wall steel injection pipe for BENTOGROUT placement. Injection pipe tip may require a rubber gasket to provide a tight seal for pump operations.

Clean Up: Clean application tools and mixing equipment with water immediately after use. Remove any excess BENTOGROUT from ground surface. Caution mixed BENTOGROUT is slippery.

Precautions: It is mandatory that the user take the following precautionary measures to protect workers and the public. Avoid inhalation of powder dust. Ensure adequate ventilation. Avoid contact with eyes. Wear protective eye wear at all times. Flush eyes with water if contact occurs. Additional precautions, safety information and first aid treatments are contained on the Material Safety Data Sheet.

Limitations: BENTOGROUT is not designed to bridge cracks or gaps larger than 3 mm. Interior surface cracks greater than 3 mm should be surface sealed with cement based patching material to prevent grout extrusion into the structure. BENTOGROUT is not designed as a structural patch. BENTOGROUT is not recommended for above ground or applications that do not provide proper confinement. BENTOGROUT is not suitable for sealing expansion joints.



Mixing BENTOGROUT in CETCO mixer

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INTERIOR SURFACE GROUT INJECTION: BENTOGROUT is applied to the inside of the building without excavating the site



INTERIOR THROUGH WALL APPLICATION: BENTOGROUT injected to the exterior of a manhole through pre-drilled holes using a short injection wand



EXTERIOR MASONRY WALL APPLICATION: Inject BENTOGROUT along the exterior of a foundation wall at 600 mm on centre intervals



STRUCTURAL SLAB APPLICATION: Inject BENTOGROUT under an existing slab to provide waterproofing and fill void areas

TECHNICAL DATA DRY MATERIAL PROPERTIES

PROPERTY	TYPICAL VALUE
Bulk Density	881 kg/m ³
Specific Gravity	2,5 gm/cm ³
Bonded Moisture Content	12%

TECHNICAL DATA FINAL SET MATERIAL PROPERTIES

PROPERTY	TYPICAL VALUE
Permeability (ASTM D5084)	5,2 x 10 ⁻⁸ cm/sec
Mud Weight	1,22 kg/litre
Cone Penetrometer (24 hours)	44 mm
Yield per Bag	0,06 m ³