

Curtain Grouting

Acrylic Gels

Introduction:

This specification covers the sealing of construction elements with curtain injection method. Curtain injections fill the porosities of the ground.

The gel layer has direct or indirect contact with the ground and the ground water. Gels for curtain injection are in contact with ground water must be tested and approved. Gels used by Nordic Geo Support are tested in Germany by the „Allgemeinen Bauaufsichtlichen Zulassung“ class.

1) Preparation

Item	General Specification	Remarks
1.0	SCOPE This method statement covers the preparation and application of special products for waterproofing and consolidation of concrete structures via constitution of a waterproofing curtain between the element and the external ground.	Can be considered as a replacement of a defective waterproofing or as a new “in situ” waterproofing membrane installed via injection.
1.1	ADDITIONAL INFORMATION This method statement should be read in conjunction with the relevant technical data sheets (TDS), material safety data sheets (MSDS) and the manufacturer’s latest published literature.	See additional information
1.2	APPLICATORS Only those trained and/or certified by the manufacturer as being competent to execute the works described shall be employed.	Or with proven competence due to similar previous works.
1.3	EQUIPMENT The equipment to be used for application shall be in good working condition with manufacturer’s recommendations with regard to capacity / out-put and general specification.	Dual component airless pump type Minibooster 5U, with 6 to 10 bar operating pressure.
1.4	Other EQUIPMENT 1) slow speed heavy duty drill with mixing paddle attachment. 2) Sufficient drill bits (Ø10/12mm) 3) small painting trowels 4) steel float 5) steel scrapers 6) wire brushes 7) cold steel Chisel 8) 250mm X 20mm spatula 9) Hammer or mallet 10) Enough quantity of packers (*) 11) 50mm width masking tape 12) Rags and paper for cleaning 13) Wooden wedges (only in case of strong water inflows) 14) Complete toolbox	(*) as an indication consider 5 packer per square meter of wall +10%
1.5	Ensure that all needed support system supplies are available.	1. clean water 2. Cleaning agents for tools and equipment 3. Compressed air 4. electric Power

1) Preparation (Continued)

1.6	All materials shall be of approved quality as approved by Clients/Consultants. a) Resins b) Ancillary materials c) Consumables d) Connectors, spare parts and other necessary equipment	All TDS/MSDS shall be available on site. All materials shall be stored in secure areas and protected from extremes of weather. Sufficient cleaning solvent/surface sealer and primer (if needed) shall be available on site to carry out the scheduled works.
1.7	The applicator and the client shall agree to a schedule of works that minimize disturbance to other operations and allows unhindered and safe access to the areas to be injected.	e.g. traffic interruptions or other jobsite activities
1.8	Eventual cracks or joints to be pre-treated shall be wire brushed 25mm on either side of the crack to remove dust and other contaminants.	If necessary, vacuum clean the area.

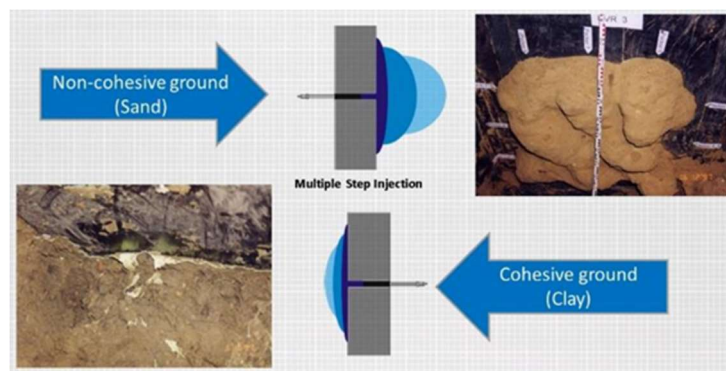
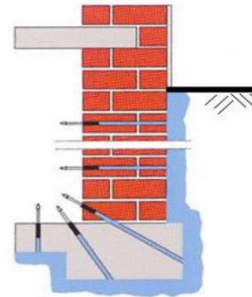
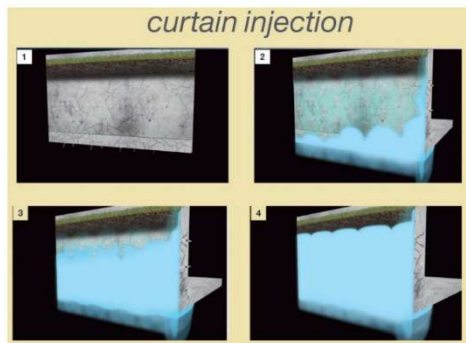
2) Curtain Injection by Injection of Acrylic Gels

Item	General Specification	Remarks
2.0	Ensure all materials/equipment are available on site before starting surface preparation.	a) Ecocryl (A1, A2, B and Retarder components) b) F300 surface sealer mortar c) Equipment and services listed in section 1
2.1	Drill $\varnothing 10\text{mm}$ ($\varnothing 12\text{mm}$) holes straight through the lining reaching the extrados within the external waterproofing (if any) for later insertion of $\varnothing 10\text{mm}$ ($\varnothing 12\text{mm}$) packers. Space the holes half the thickness of the lining to be waterproofed and, if possible, arranged on alternate mesh pattern (zig-zag).	Angle of drilling can vary due to rebar or any other obstruction. The holes must pass the entire lining thickness, in case of fear of further damaging the external waterproofing, stop drilling at thickness - 2cm and eventual drill through with a smaller drill bit or with the sole rotation (no hammering). Usually the spacing of drill holes lies between 250 to 500mm, 300mm being the most common spacing.
2.2	Mix the F300 mortar with the specified quantity of water by hand or trowel in small quantities and seal round the perimeter if there are wide cracks (> 5mm) and in visible gravel pockets or other major irregularities of the concrete.	Allow the mortar to set according to the producer's specification.
2.3	Mix the resin components of Ecocryl, a three-component plus retarder acrylic gel which is pumped and mixed in the ratio of 1:1 by volume. Components are pre-mixed putting the liquid phase A2 into the canister of the A1 component. On the other side dissolve the B2 component into 20 liters of water, add the retarder in the desired quantity to the "B" side. Agitate both sides in order to obtain a homogenous mixture.	Use only wooden or plastic tools for mixing! Metallic mixers can induce premature reaction (hardening) within the canisters! Pre-mixed components are stable for at least 6 hours and ready for injection. Retarder dosage depends on the temperature and desired retarding effect. For curtain injection a setting time of can be achieved indicatively with 600g of "B" and 400g of retarder (Verzögerer), see Table 1. at least 3 minutes is required. This can be achieved indicatively with 600g of "B" and 400g of retarder (Verzögerer), see Table 1.

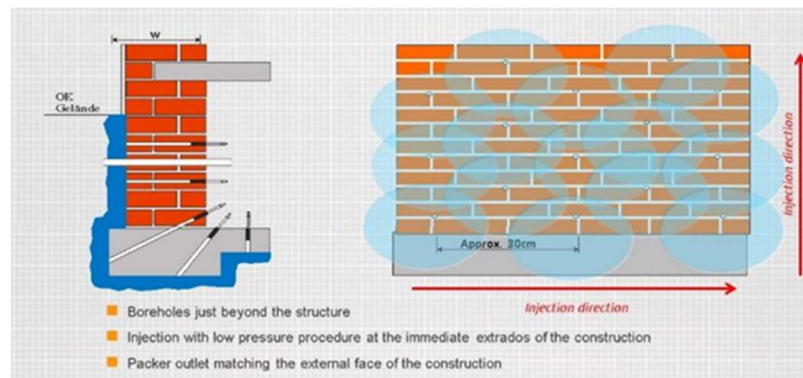
2) Curtain Injection by Injection of Acrylic Gels (Continued)

2.4	Place the packer in the lowest hole drilled	Injection usually is done by bottom to top, starting from lower holes to upper ones. Tighten manually until packer cannot be released by pull.
2.5	Use a dual component pump with lance and static mixer as a Minibooster 5U pneumatic driven pump.	Actual injection pressure shall not be superior to 3x the compressive strength of the concrete (e.g. 50 MPa concrete equal to an effective injection pressure of 150 bar). The injection rate at start shall be as low as possible (<1 l/min), increasing accordingly to the response of the structure.
2.6	Inject Ecocryl into the packer until: a) theoretical quantity per injection position is achieved b) no resin flows in c) backlash from the packer is noticed d) material starts to flow from the packer or hole next to injection position.	The first condition that applies. Theoretical quantity is established together with the surveillance engineer and is an indicative data that shall serve as reference during the injection process. With the injection of acrylic gels is possible to make three injection steps for each packer. In the first run usually the half of the theoretical amount is pumped, the second pass, if necessary is done with a further ¼ of the design quantity and eventually, if still needed, a third pass with the rest amount is done.
2.7	Stop Injection	By stopping the pump.
2.8	Clean the line and the packer	By flushing water and leaving the packer free for the next pass.
2.9	Move to the following hole and repeat items 2.6 to 2.9	Each injection position is to be injected in three steps.

Principle of curtain injection



Methacrylate Gels - Curtain injection grid



Material Specifications:

Table 1: Setting time in function of dosage of B component and Ecocryl Retarder

ECOCRYL - @20°C - 1000g of All							
	B (g)	100	200	400	600	800	1000
Verzögerer / Retarder (g)	0	0,93	0,55	0,40	0,30	0,28	0,25
	100	10,00	5,00	3,00	1,50	1,00	0,70
	200	20,00	10,00	4,00	2,00	1,50	1,00
	400	40,00	20,00	8,00	4,00	2,00	1,50
	600	60,00	30,00	11,00	6,00	3,00	2,00
	800	70,00	35,00	14,00	8,00	4,00	3,00
	1000	80,00	40,50	15,12	10,33	7,00	5,67

In 20 l of water on the "B" side Time given in minutes and decimal fractions

For further details in the materials please refer to the specific Technical and Material Safety Data Sheets (TDS and MSDS).