Curtain Injection

WEBAC®

Contents

This brochure deals with the post-construction surface sealing of structural components in ground contact by means of curtain injection. WEBAC injection gels are suitable for the post-construction sealing of inaccessible structural components in ground contact exposed to moisture without digging.

A sealing effect is obtained by putting into place a gel curtain behind the structure to be protected by means of pressure injection. The gel curtain durably prevents water and moisture from penetrating the building structure.

NOTE

Please observe all existing regulations and the instructions in the technical data sheets on the respective WEBAC products.

Should you have any queries or specific problems, please do not hesitate to contact us.

Sealing with Injection Gels

Buildings can be severely damaged by pressing water, fluctuations in the ground water level and surface water.

Damaged masonry

Leaks in structural components in ground contact such as e.g. masonry can be caused by lacking or inadequately designed external sealants, aging processes of existing sealants, fluctuating ground water levels or movements within the structural component.

Water penetrates through cavities, joints and defective building sealants and soaks the building structure. Climatic fluctuations, especially alternating frost and thaw, lead to further damage e.g. caused by surface spalling.

Traditional methods of subsequently sealing structural components with ground contact against moisture can be very complex. The surfaces to be sealed must be laid bare, which detrimentally affects the surrounding infrastructure.

The reconstruction work is particularly problematic if adjacent areas of the building site cannot be used properly because of their location or because they are highly frequented. In many cases, conventional exterior sealings cannot be put into place for structural reasons, for instance in the case of buildings with partial basements or leaking floor slabs. On the other hand, interior sealings only hide the problem and do not protect the structure.

Sealing methods using acrylate gels have become established. They make cost-effective solutions possible also with difficult reconstructions of buildings.

Applications

Surface sealings of structural components with ground contact

- Basements and partial basements
- Underground parking lots
- Floor slabs
- Abutments of bridges and wing walls
- Tunnel structures
- Sewer systems and shaft installations
- Foundation pits

Protection from slope water

- Retaining walls
- Buildings situated on a slope

Joint sealings

- Expansion joints, especially in defective sheets & tapes
- Connection joints between old and new buildings
- Tubbing joints
- Sewer connections

NOTE

In addition to the designation **acrylate gel**, the terms **hydro gel**, **polymer gel**, **hydro-structure gel** and **methyl acrylate** are also common in practice.

Damage Diagnosis

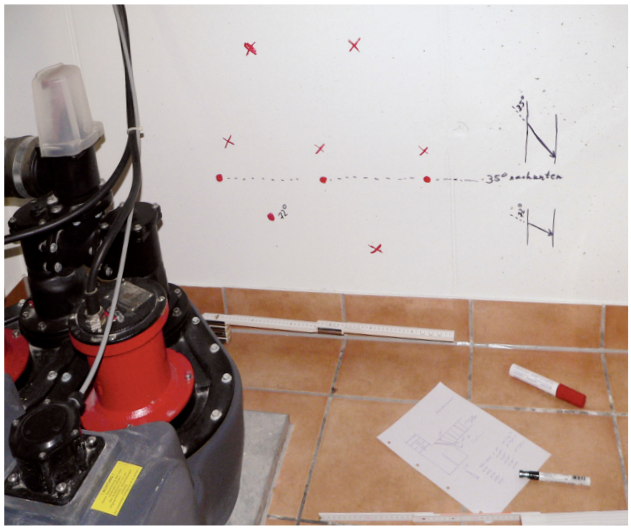
Building State Analysis

Prior to the injection procedure, an analysis of the condition of the building and the subsoil is required.

The resulting information on the moisture status, the adjacent soil layers and the salt contamination serve to determine the feasibility of the sealing measure, the spacing of the drill holes and the material consumption to be expected.

Especially during the reconstruction of traffic structures, careful and qualified planning by a professional planner is required. The planner must be able to prove on the basis of his work experience and/or references that he is familiar with expert sealing measures using gels and that he undergoes regular training in this special field.

It must be checked and assessed whether traditional restoration options are appropriate or modernization is required before implementing gel injections.



Professional planning
source: Deutscher Beton- und Bautechnik-Verein e.V.

Tasks of professional planning

- Identification of the causes of moisture penetration
- Core drilling if the wall structure of the structural component is not known
- Subsoil explorations directly at the building to determine the backfilling of the structure which provide information on the:
  - Void content of the soil to be injected with gel
  - Pore volume and pore structure
  - Grading curve
  - Water content
  - Permeability number
  - pH value
  - Soil structure (soil profile)
- Identification of the areas to be restored
- Material requirements in agreement with WEBAC
- Preparatory work, boundary conditions
- Instructions for use, e.g. spacing of drill holes, injection technology
- Effective range of sealing methods using gel
- Possible change of water routes during and after the reconstruction work
- Official authorizations, if applicable
- Calculation of costs

SEALING METHODS USING **GEL INJECTIONS**

... are special measures. They are used if:

- The surfaces cannot be laid bare due to the adjacent buildings or because the restoration area is highly frequented
- The surface to be sealed is no longer accessible
- The restoration area cannot be blocked due to traffic conditions
- A low-impact construction method is required
- The costs for the accompanying work (high soil covering, time-consuming foundation pit sheeting, by-passes, etc.) are disproportionally high

Products

Injection gels

- Are mostly 3C injection materials based on (poly) acrylate
- React to form a waterproof, solid elastic gel
- Are characterized by their very high elasticity and stability
- Remain dimensionally stable in water-vapor saturated atmospheres (soil moisture or equilibrium moisture content in the masonry). In case of climatic fluctuations, WEBAC Gels can reversibly absorb and discharge moisture
- Have a flow behavior comparable to that of water due to their low viscosity
- Are resistant to salt solutions, acids and bases typically found in buildings
- Adhere well to dry and wet mineral substrates
- Are resistant to alternating frost-thaw stress and resistant to frost down to –20 °C upon conclusion of the reaction
- Are free of organic solvents, acrylamide and N-methylolacrylamide
- Have a largely adjustable reaction time

Acrylic gel WEBAC® 240

WEBAC® 240 is an injection gel designed for making sealing surfaces (curtains) in foundation soil in direct contact with the structural component or within the existing building structure.

Due to the modified, polymer-reinforced components in the **WEBAC® 240** modular modular system, **WEBAC® 240 + Bseal I** is suitable for damaged sheet and foil sealings thanks to its excellent adhesion.

The likewise modified and polymer-reinforced component **WEBAC® 240 + Bseal II** is also suitable for use in case of leaking expansion joints.

Parameters*	WEBAC® 240	WEBAC® 240 + Bseal I	WEBAC® 240 + Bseal II	WEBAC® 240 Rapid
Modification by		Comp. Bseal I	Comp. Bseal II	Comp. A2 – rapid Comp. A3 – rapid
Mixing ratio	A : B = 1 : 1 parts by volume			
Viscosity of mixture, 23 °C	6 mPa·s	35 mPa·s	30 mPa·s	12 mPa·s
Reaction time**, 20 °C flowable · solid	**2 % B-concentration** 40 s · 75 s	**2 % B-concentration (dissolved) in Bseal I** 30 s – 50 s · 40 s – 60 s	**depending on the concentration of comp. B in Bseal II** 8 s – 170 s · 30 s – 250 s	5 s · 25 s
Properties	• Solid yet elastic • Swells upon contact with water • Strong increase in viscosity, therefore economical material consumption	• Polymer reinforced • Very strong adhesion • High dimensional stability • Slight swelling • Slight mass and volume loss during the drying process • Salt reduced	• Polymer reinforced • Very elastic, ductile without breaking • Long pot life • Slight swelling • Slight mass loss during drying process • Salt reduced • Adjustable reaction time	• Extremely fast gel formation • Solid consistency with high dimensional stability • Swells upon contact with water
Application range	• Curtain injection (National Technical Approval) • Backfilling of joints by means of gel injection	• Post-construction sealing of damaged web and foil sealings • Sealing of annular gaps and voids in tubbing constructions	• Sealing of annular gaps and voids in tubbing constructions • Curtain injection • Repair of defective sealings in areas with ground contact	• Instant gel • Low-temperature applications
Pump technology	**WEBAC® IP 2K-F1**			

* The given data are laboratory parameters and may deviate depending on the object and conditions on site.
** All data refer to manual mixture common on construction sites.

Products

Mixing of component A

- The containers of component A are provided according to the required mixing ratio
- Empty the smaller A2 container (and the A3 container, if applicable) completely into the larger A1 container
- Mix immediately while pouring until homogeneous

Mixing of component B

WEBAC® 240/WEBAC® 240 Rapid:

- Dissolve B powder concentrate in clean tap water in a clean canister identical to that of component A1 by intensive stirring (adapt the filling level of component B to that of component A)

WEBAC® 240 + Bseal I:

- Dissolve B powder concentrate in water (< 30 °C)
- Water ratio when mixing component B:
  - 2 % salt max. in at least 2 l water
- Add the solution to the container of comp. Bseal I and mix until homogeneous

WEBAC® 240 + Bseal II:

- Add the B powder concentrate to the container of component Bseal II and stir until it has fully dissolved

NOTE

Due to the high adhesive power of component B of **WEBAC® 240 + Bseal I** the sieve of the suction hose must be regularly checked for material residues and lumps and be subjected to intermediate cleaning at short intervals when applying large quantities. Upon completion of the injection process, the 2C pump must be thoroughly rinsed with plenty of water (at least 20 liters of fresh, clean water per component) to prevent clogging within the pump system and the suction hoses.

Coloring of injection gels

- WEBAC injection gels can be colored with **WEBAC® F200** to monitor the water displacement, the water's mixing with the gel, the material distribution and to detect any gel leakage
- To color the injection gel, mix the injection gel with approx. 1 % of the blue colorant **WEBAC® F200** (referring to component A)
- The color intensity of the blue gel will decrease gradually

Products

Injection pumps

WEBAC® IP 2K-F1

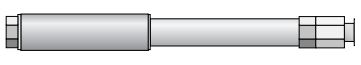
The compressed air-operated, 2C pump **WEBAC® IP 2K-F1** is used for the application of acrylate gels. The two injection material components are introduced to the mixing head via separate hoses. The actual mixing process takes place here with a static mixer.

A separate flush pump serves to clean the mixing head with water.
A compressor with an air volume of 300–400 l/min is required for operating the pump.

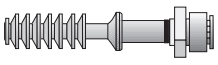
WEBAC® IP 2K-F1 pump is also available with a measuring unit for monitoring the flow rate and the pressure limit. The respective data can be evaluated and documented by laptop after use at the building site.

Injection packers

WEBAC® Mechanical Packers with button head fittings are used to inject WEBAC Acrylate Gels. The injection pump is connected to the packer via a slide coupling. Alternatively, **WEBAC® Hammer-in Packers** can be used if the structural component is solid enough. The packers are anchored by lamella arranged in a ring-shaped manner. In the case of masonry with a large number of voids or multi-shell masonry, the packers can be equipped with an extension to prevent the injection gel from flowing back into the masonry.



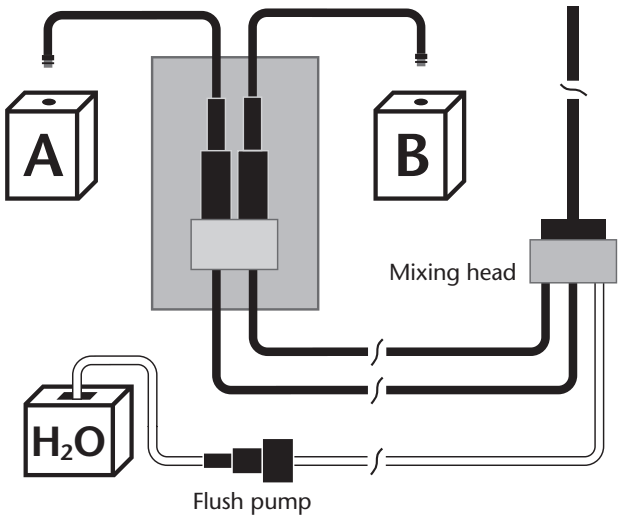
WEBAC® Mechanical Packer



WEBAC® Hammer-in Packer

WEBAC® Hammer-in Packer with extension

Scheme of an injection unit



Accessories

- Stirrer, stainless steel
- 3 empty containers for rinsing water, mixing component B and rinsing waste
- Compressor with an air volume of 300 – 400 l/min for operating the injection pump
- **WEBAC® F200** – contrast agent for coloring

Application

Sealing/Backfilling by Means of Curtain Injection

When sealing structures by means of gel injections, the structure is drilled through from the inside and a gel curtain is put into place behind the structure to be protected by carrying out a pressure injection (curtain injection). This new sealing level reduces the permeability of the subsoil, so that the structure can dry properly.

The evaluation of the building state analysis provides information on the feasibility of the sealing measure, the spacing of the drill holes and the material consumption to be expected. The drill holes are usually made staggered at a distance of 30–50 cm between the drill holes and the individual rows. The injection is carried out using suitable injection packers with button head fittings (**WEBAC® Mechanical Packers** Type R or **WEBAC® Hammer-in Packers** made of plastic). The button head fitting is installed on the packer to be injected at any given time, so that the emergence of material from the adjacent packers can be observed. Due to the short gel time of the material, injection takes place by means of a 2C pump (**WEBAC® IP 2K-F1**). Beginning with the bottom row of drill holes, the gel is injected into the adjacent soil areas. The injection procedure must be continued until the injection material emerges from the adjacent packers.

Positioning of packers on natural stone masonry

A sealing curtain with very good adhesion forms behind the structure. As WEBAC Injection Gels also penetrate cracks and macropore areas of the masonry, they also seal the interior of the structure. The reference value for the consumption rate is approx. 20–60 kg/m² (corresponding to approx. 10–30 kg of gel concentrate).

In the case of highly cohesive or highly dense soil, mainly the area between the structure and the adjacent soil is filled, so that the consumption rate is lower. When curtain injections into masonry are carried out, existing voids and cavities which may be connected to drill holes are also filled, so that the consumption rate may be higher in individual cases.

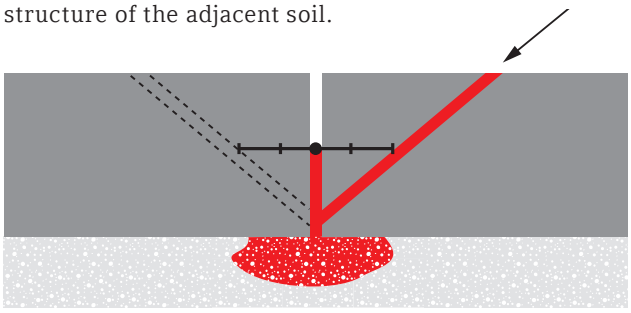
Gel emergence at adjacent packer

Sealing of building & expansion joints

Post-construction sealing of defective building and expansion joints is possible with low expenditure of time and cost by backfilling these by means of gel injections with acrylate gels. The injection material not only partially fills the joint gap, but a gel curtain forms in the adjacent soil at the same time which is capable of absorbing even large joint movements. This way internal joint tapes affected by lateral infiltration, for instance, can easily be repaired. This procedure is also especially suitable for the post-construction sealing of so-called "waterproof concrete tanking" if the installation of the planned joint sealings proves to be faulty.

Positioning of drill holes for sealing expansion joints

Drill holes are made into the sides of the expansion joints in such a way that the drill channels are positioned directly behind the internal joint tapes. During the injection process the material is injected into the adjacent soil by the injection pressure. The material consumption depends on the open joint volume and the structure of the adjacent soil.

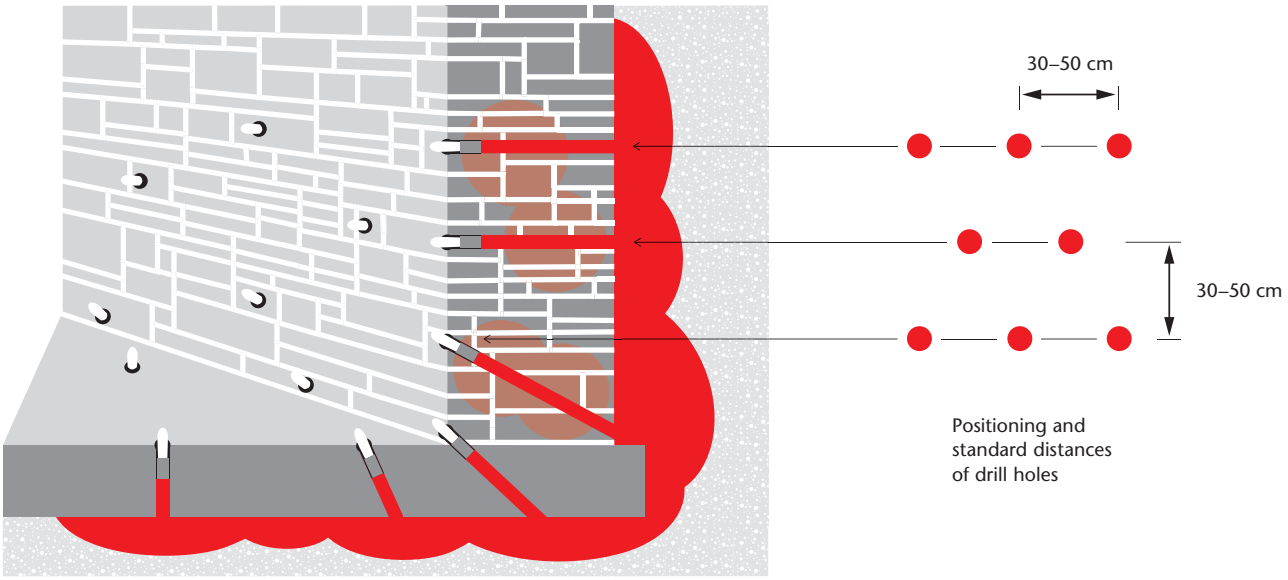


Schematic diagram of a post-construction expansion joint sealing measure

Application

Sealing/Backfilling by Means of Curtain Injection

Active principle of a curtain injection into masonry for making a sealing gel curtain in the ground



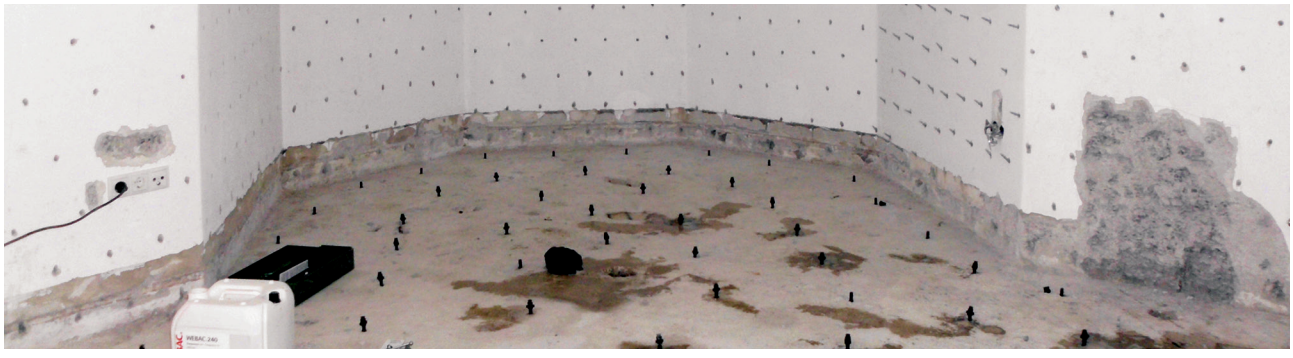
Positioning and standard distances of drill holes

Final work

Upon completion of the gel injection, remove the packers and remove all gel from the drill holes/drill hole walls down to approx. 10 cm depth. Then close the drill holes with suitable mineral building material. It may be necessary to implement accompanying measures. Provide adequate ventilation to ensure the exchange of damp air. If necessary, install condenser dryers / dehumidifiers in the rooms to prevent the formation of condensation water and to improve drying of the masonry. Salt deposits may form on the surface of structural components in buildings exposed to salt-related stress during the drying process. These must either be removed mechanically or absorbed by means of suitable restoration render systems.

Secondary injection

After sealing the existing water routes it may happen that new water routes form due to moisture permeation. In this case, secondary injections are required. Secondary injections are common practice as far as gel technology and other injections are concerned and do not represent any inherent deficiency.



Positioning of packers on wall and floor surfaces

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