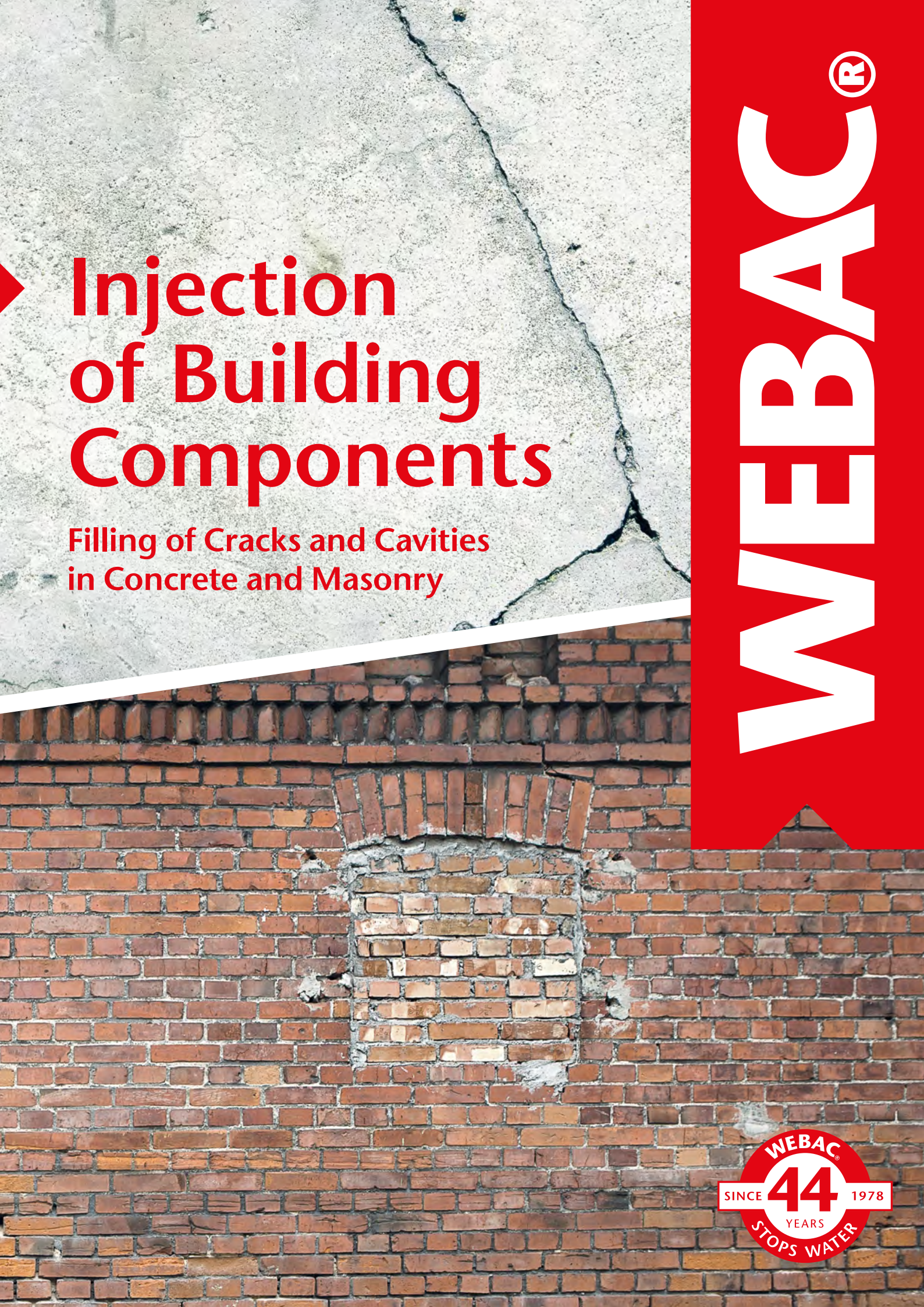
Injection of Building Components

Filling of Cracks and Cavities in Concrete and Masonry

WEBAC®



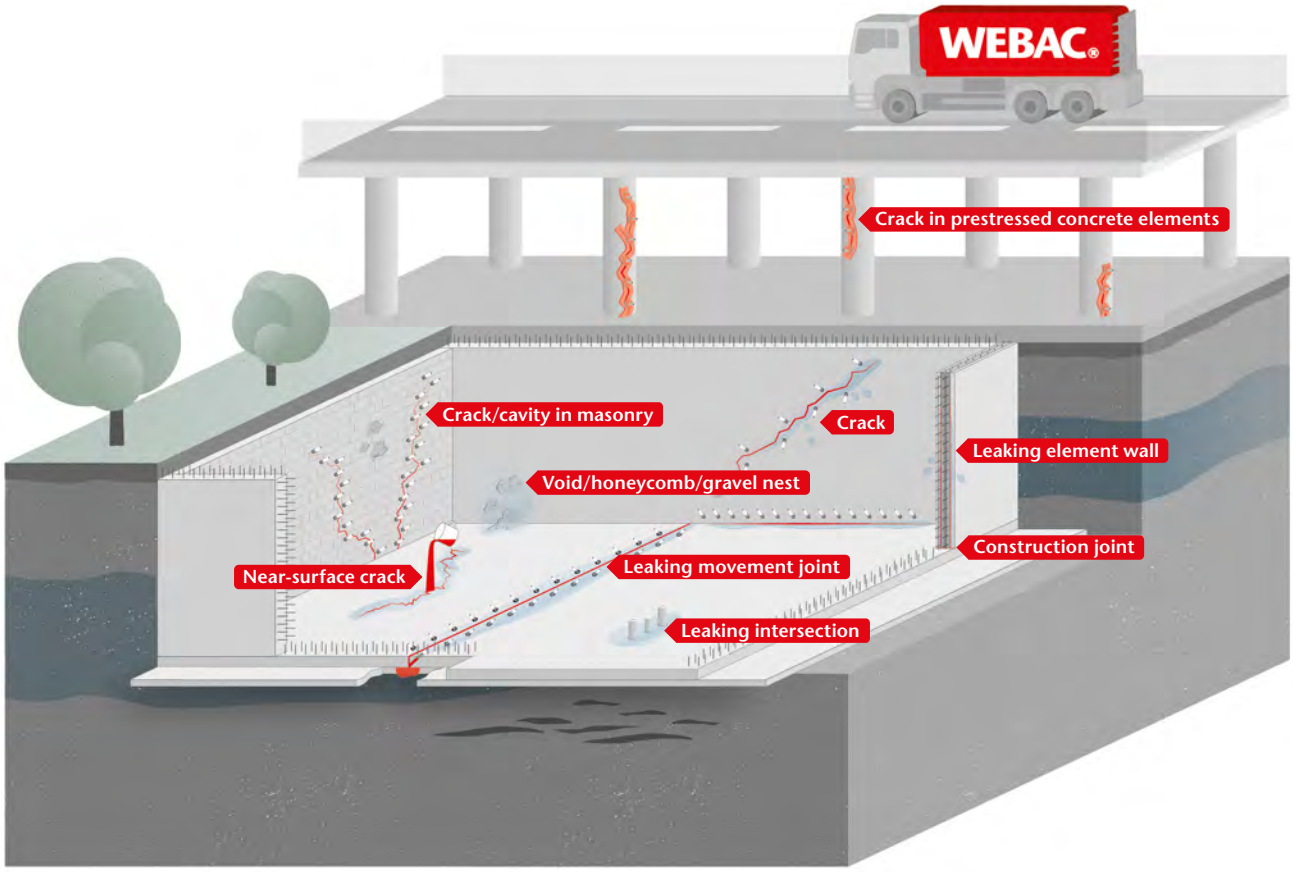
Contents

Cracks in Building Structures

Harmful substances (e.g. chlorides) can penetrate into the building component through cracks and cavities and thus damage the building substance and endanger the durability of structures.

Professional planning and the selection of a suitable injection system (material, machine, method), taking into account the applicable standards and the generally recognized rules of technology, are required for a successful repair measure. The use phase of the structures is thus extended and demolition or replacement construction is not necessary – this saves resources and ultimately benefits the environment.

Applications for crack filling materials

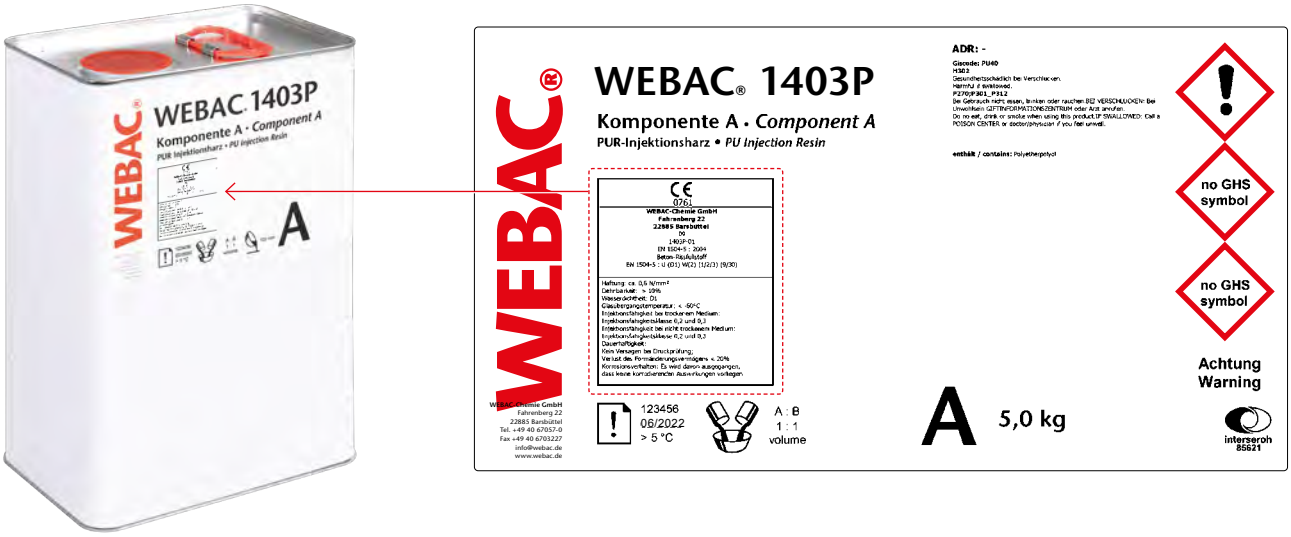


Meaning of the CE Mark

(according to DIN EN 1504-5)

According to the EU Construction Products Regulation (CPD), the CE marking of the construction product is necessary for placing it on the market. In this way, the manufacturer documents that he assumes responsibility for the conformity of the construction product with the performance specified in the performance declaration. This is important for the user of the product, as he can now check and prove the legal and technical usability of the product with the declaration of performance.

Example of CE marking of a crack filling material



Explanation of the CE classification

U(D1) → Flexible filling (watertight up to 2x10^5 Pa)

W(2) → Crack width 0.2 mm

(1/2/3) → Moisture condition of the crack: dry, damp, wet

(9/30) → Application range 9–30 °C

U Objectives
- **F** Structural filling
- **F1** Adhesive tensile strength > 2 N/mm²
- **F2** Adhesive tensile strength > 0.6 N/mm²
- **D** Flexible filling
- **D1** Waterproof at 2x10^5 Pa
- **D2** Waterproof at 7x10^5 Pa

W Crack width in tenths of a millimeter (1-2-3-5-8)

Moisture condition

1 dry **2** damp **3** wet **4** water-bearing

Note: Regional rules and guidelines must be observed!

Building Condition Analysis

For the sustainable rehabilitation of damaged structures, a comprehensive, structure-related rehabilitation concept is required. This building condition analysis serves to determine the actual condition and is the first and most important step on the way to a successful and sustainable rehabilitation.

DETERMINATION OF THE ACTUAL STATE (KEY DATA)

Project description

- Water level at the construction site
- Location of the construction site (surrounding area)
- Address/street name
- Weather dependence

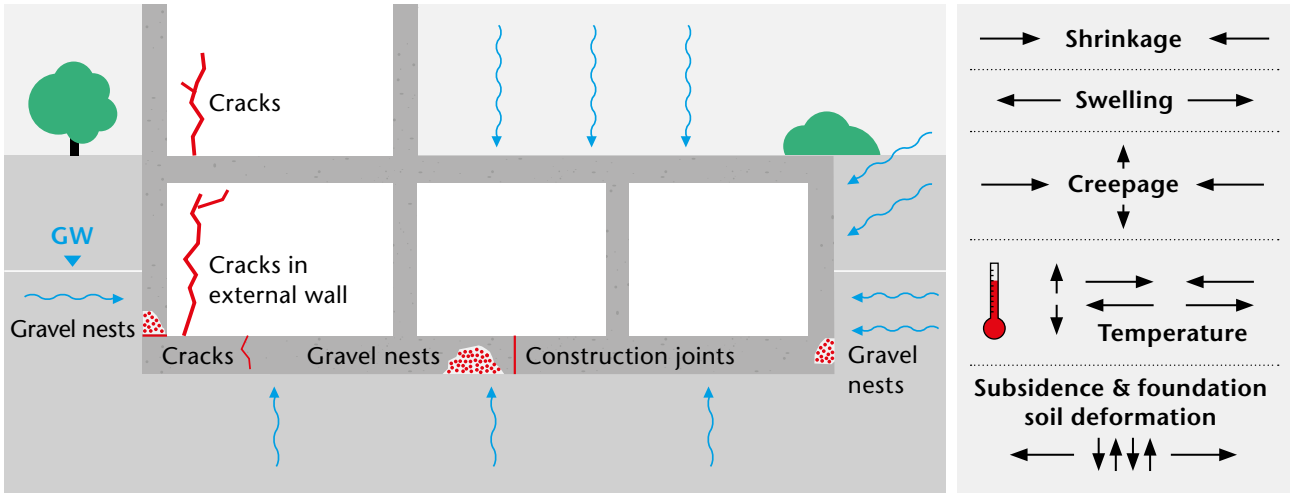
Building

- Wall structure
- Material
- Thickness of construction
- Existing waterproofing

Cause(s) of the moisture penetration

- Cracks and/or voids
- Soil or structural settlement
- Clogged/burst piping
- Missing/defective/weathered waterproofing layers

Types of crack and their causes



Possible concrete damage on existing buildings

Determination of the Actual Condition

Building Condition Analysis

Cracks often have different causes. These can result from the concrete properties or also from the concrete stress.

Related to concrete properties

- Hydration heat and cooling
- Shrinkage
- Creepage
- Swelling

Related to concrete stress

- Load
- Impeded deformations
- Temperature impacts
- Subsidence
- Foundation soil deformations
- Carbonation

However, these causes do not provide any information yet on whether the cracks are close to the surface or even separation cracks. Detailed information about the crack structure can only be obtained by drill core removal.

If the structure is not to be stressed by taking cores, it is also possible to choose an examination method that is gentle on the component. An X-ray or ultrasound examination of the structure can be used.

Drill core removal: Determination of voids, crack progression, moisture condition and contaminations

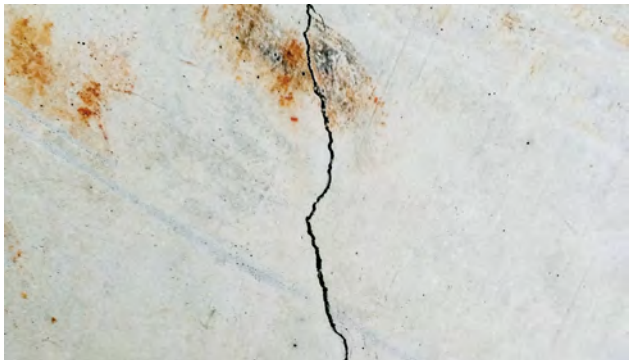
Building Condition Analysis

Moist conditions of cracks

Cracks can have different moisture conditions, ranging from dry to flowing water (see pictures).

These moisture conditions, as well as temperature conditions (component and material temperature), are an important factor in the selection of the appropriate filling material.

Dry



- Crack edges and component's surface visually dry, water access not possible
- Influence of crack/cavity area by water not detectable
- Water access possible but excluded for a sufficiently long time

Damp

- Color change caused by water (capillary water absorption) in crack or cavity area, but no water emergence
- Signs of very recent water emergence
- Crack/cavity visibly damp or matt damp

Wet

- Stagnant water visible in crack or visible in form of small drops in crack area
- Water trickling from crack area

Flowing water

- Water flows through crack or cavity in form of continuous water flow

Building Condition Analysis

Contamination and soiling of cracks

If water can penetrate cracks over a long period of time, contaminants such as oils or chlorides will also enter the structure this way. Sintering, which is visible on the surface, is also an indication of damp or wet cracks. These sinterings exert additional adhesion-reducing properties on the filling material, which, after an initially successful injection, can in the worst case lead to recirculation.

Sintering

Oils

Chalk efflorescence

Organic pollution

These pictures show different types of soiling that can be found like this or similar on construction sites. Successful crack repair basically depends on an adhesive bond taking place within the crack structure on the crack edges. For this purpose, adhesion-reducing substances, such as loose, crumbling parts or oils and greases, must be removed/flushed out of the crack before injection.

Cracks and Cavities in Masonry

Masonry (e.g. quarry stone/brick masonry) is also exposed to many influences during its use phase, which can lead to the formation of cracks and cavities. This damage can impair the usage properties, but also the structural stability of the component and must therefore also be restructured.

By filling the cavities and/or closing the cracks, the masonry structure is strengthened again.

Injection for structural support

Two concepts compete for the restoration of load-bearing capacity in masonry structures:

- The consolidation of the entire masonry structure in the damaged areas is carried out by area injection with injection resins that have a lower strength than the masonry stone to avoid secondary fractures in the stone substance.
- For the targeted formation of columns or beams relevant to the structure (stability anchors), injection resins of high strength are introduced in narrowly defined areas.

Injection with WEBAC® 1660

Injection with WEBAC® 4110

Product Range

Crack Filling Materials

Especially when cracks in concrete or masonry affect the stability of a structure, they have to be filled. WEBAC offers one of the most comprehensive and efficient product ranges for this purpose. Our products are suitable for the repair of various mineral building components at different crack widths, moisture conditions and application temperatures.

Depending on the intended repair target, special fillers are used.

CATEGORY D

Limited flexible crack filling materials

For the limited flexibility filling of cracks, structures are required which do not lead to fractures of the injection product even if the entire cracked surface is exposed to expansion and compression movements.

Examples of Products

PU Injection Resins

WEBAC® 155
WEBAC® 1403P
WEBAC® 1405
WEBAC® 1500

CATEGORY F

Structural bonding crack filling materials

For structural bonding (filling), mainly low-viscosity, solvent-free epoxy injection resins are used.

The good spreading and flow properties of these crack filling materials allow the injection of cracks with widths > 0.1 mm and penetration into the finest ramifications.

Structural strength can also be achieved with some specialized PU resins.

Examples of Products

PU Injection Resins

WEBAC® 1660

Epoxy Injection Resins

WEBAC® 4110
WEBAC® 4170T

CATEGORY S

Swelling fitted crack filling materials

Elastic and swellable acrylate gels are used to seal construction joints and to protect components against penetrating water or pollutants (e.g. chlorides).

These products are characterized by good penetration properties, high flank adhesion and adjustable reaction times.

Examples of Products

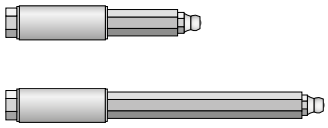
Acrylate Gels

WEBAC® 240 + Bseal I
WEBAC® 270

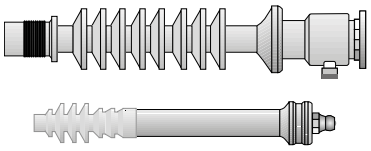
Product Range

Packers

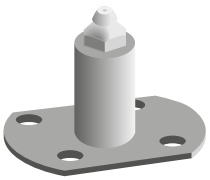
Injection packers are filler necks which connect the structural element to the injection pump during the injection process. They are available in different versions, depending on the required pressure, building component and the type of the injection material.



WEBAC® Mechanical Packers Type S



WEBAC® Hammer-in Packers



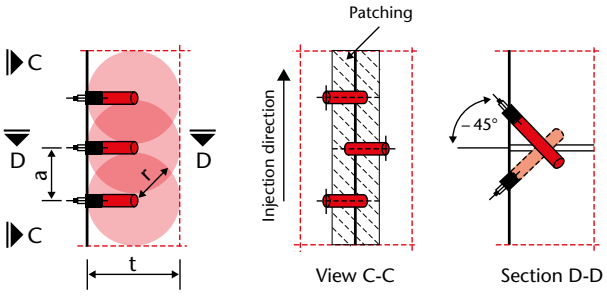
WEBAC® Surface Packers, plastic

Distances between injection packers

Mechanical Packers

The drill holes are usually made alternately on both sides of the crack, at a 45° angle so they cross the crack course in the middle of the structural building component.

The distance between the drill holes depends on the crack width, the thickness of the structural element, the temperature-related workable life and the viscosity of the material (reference value: thickness of the structural element/2).



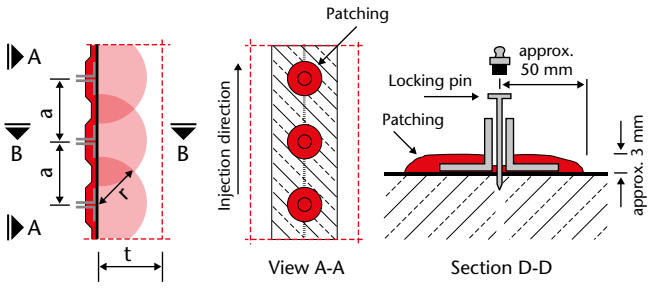
r Effective radius of a packer

t Construction element thickness

a = t/2 Distance between drill hole packers

Surface Packers

If no drill holes can be made into the structure (e.g. prestressed concrete, load-bearing reinforcements, listed buildings), surface packers must be used. These are placed, installed and glued directly onto the crack at the structural component's surface and tightly integrated in a patching. In so doing, the distance between the surface packers usually correspond to the thickness of the structural element.



r Effective radius of a packer

t Construction element thickness

a = t Distance between surface packers

THUMB RULE

Packer required for a 30 cm thick component:

Mechanical packers	approx. 6–7 pieces per meter
Surface packers	approx. 3–4 pieces per meter

Product Range

Pumps

WEBAC 1C pumps are universally applicable in a wide range of applications. They are suitable for professional use in crack injection, subsequent damp proof courses and injection hose grouting. WEBAC epoxy injection resins, PU injection resins and PU injection foam resins can be processed. WEBAC 1C pumps, like WEBAC 2C pumps, are optimized for the processing of these WEBAC products.

WEBAC® IP EasyPro (electric 1C high-pressure diaphragm pump)

WEBAC® IP 1K-F4 (electric 1C high-pressure piston pump)

WEBAC® IP 1K-F3 (pneumatic high-pressure piston pump)

WEBAC® HP 100

WEBAC® HP 250

WEBAC® HEP 1001

Injection pressure

Injection is carried out with an injection pressure adapted to the building component. This depends on the type of packer used (mechanical packer or surface packer) and the strength of the building component.

THUMB RULE

The **injection pressure** is the nominal value of the delivery pressure at which the injection product is delivered to the filler neck (packer).

$$\text{max. pressure} = \frac{\text{Concrete strength}}{3} \times 10 \text{ bar}$$

Example: C 20/25 = $\frac{25}{3}$ x 10 bar = 83.3 bar

Protective Equipment and First Aid

Personal protective equipment and safety measures

When handling and processing chemical products, risks and hazards can arise for your own health and the health of others.

Risks can be reduced and damage to health safely avoided by careful and conscientious work preparation and appropriate precautionary and protective measures.

To minimize the hazard potential for the user, knowledge of substance- and product-specific information is essential. Information on the substances used, including hazard and safety information and recommended personal protective equipment, can be found on the canister, in the Technical and Safety Data Sheets.

Based on this data, you can assess the risk for yourself and your colleagues. Take into account the typical contact routes such as inhalation, ingestion, as well as skin and eye contact and, if possible, take organizational protective measures in advance to reduce health hazards and thus contribute to safety on your construction site.

For example, ensure adequate ventilation when carrying out injection work in closed spaces. When handling chemical products, please wear suitable protective clothing with long trousers and long sleeves, protective gloves and goggles. Many construction sites also require safety shoes, high-visibility vest and helmet.

Observe general health and safety instructions on the construction site and keep escape and rescue routes clear. As a hygiene measure, be sure to wash your hands before breaks and at the end of work and ensure that the workplace is clean. Do not eat, drink or smoke during work.

Information and operating instructions for the safe handling of our products can be found in the in the GISCODES.

First Aid

- After inhalation, if the person feels dizzy or unwell, he/she is advised to get fresh air and contact a doctor or the Poison Control Center.
- After eye contact, remove any contact lenses and gently flush eyes with plenty of water for about 15 minutes and seek medical attention. Use eye wash if available.
- After skin contact, clean the affected area thoroughly with plenty of water. In case of extensive contact, use emergency shower if necessary. Do not use solvents or thinners. Remove contaminated clothing immediately.

Application

Injection via Mechanical Packers

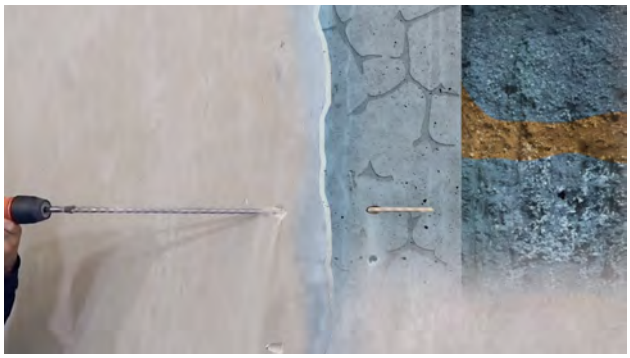


Fig. 1: Making drill holes

Fig. 2: Removing drill dust

Fig. 3: Installation of packers

Fig. 4: Patching of cracks

Fig. 5: Injection from bottom to top

Fig. 6: Removal of packers, removal of patching and post treatment of the crack

THUMB RULE

Material Consumption
for a 30 cm thick concrete component and a crack width of 1 mm

Crack Injection
Injection resin: approx. 0.7 kg per meter

Application

Injection via Surface Packers

Fig. 1: Cleaning of the surface

Fig. 2: Determining the surface packer spacing above the crack

Fig. 3: Placing of surface packers

Fig. 4: Patching and gluing of the surface packers

Fig. 5: Injection from bottom to top

Fig. 6: Removing the patching and packers

THUMB RULE

Material Consumption
for a 30 cm thick concrete component and a crack width of 1 mm

Structural bonding crack injection
Material requirement injection resin: approx. 0.5 kg per meter

Application

Impregnation

Fig. 1: Widen crack by recutting

Fig. 2: Remove dust completely

Fig. 3: Prepared crack before impregnation

Fig. 4: Crack impregnation with epoxy resin

Fig. 5: Filling of the crack after impregnation with quartz sand

Fig. 6: Crack after impregnation

THUMB RULE

Material Consumption
for a 30 cm thick concrete component and a crack width of 1 mm

Impregnation
Material requirement epoxy resin: approx. 0.6 kg per meter depending on the possible volume of the cracks/cavities and absorbency of the building component

Disposal

General notes on disposal

Product residues (liquid or paste-like) from the building products area are special waste and must therefore be disposed by an approved waste management company, in accordance with the legal regulations and the requirements of the local/regional authorities.

Information on suitable waste disposal facilities and disposal routes can be obtained by the waste owner from the competent authority or from the regional offices.

WEBAC®

WEBAC-Chemie GmbH
Fahrenberg 22
22885 Barsbuettel/Hamburg, Germany
Tel. +49 40 67057-0 · Fax +49 40 6703227
info@webac.de · www.webac.de
www.webac-grouts.com

We are an associate member in DBV

DEUTSCHE BAUCHEMIE

Responsible-Care