MS-IN-IN5-07.23

Method Statement

KÖSTER IN 5

KÖSTER BAUCHEMIE AG // Dieselstraße 1-10 · D-26607 Aurich · Tel. 04941/9709-0 · info@koester.eu · www.koester.eu

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KÖSTER
Waterproofing Systems

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Waterproofing Systems

1 General information

1.1 Scope

This method statement is intended for use by developers, contractors and applicators as a general guideline for the application of the low viscosity 2 component PU injection resin KÖSTER IN 5.

While this document describes the tools, equipment, materials and process for preparing and installing the injection system product, it must be used and referred to, in combination with all other relevant technical information available for the products and their components.

1.2 Manufacturer

KÖSTER BAUCHEMIE AG
Dieselstraße 1-10 Tel. 04941/9709-0
D-26607 Aurich

info@koester.eu www.koester.eu

KÖSTER
Waterproofing Systems

1.3 Definitions

Corrosion

It is a natural process that converts a refined metal into a more chemically stable oxide. It is the gradual deterioration of materials (usually a metal) by chemical or electrochemical reaction with their environment.

Hose Injection

The material is pressed through the hose. If material comes out at the end, the hose is closed at the back and pressure builds up along its entire length. When the pressure is constant at approx. 80 bar for a few minutes, the injection can be stopped.

Pot life

The technical definition for the “pot life” of a resin is the time the resin takes to develop a viscosity of above 800 mPa.s. If the viscosity is above 800 mPa.s, the resin can no longer be satisfactorily injected.

The pot life of the material is important to the applicator, because it defines the time remaining for the injection of the material after it has been mixed properly. The pot life is influenced by the surrounding temperature and by the amount of material mixed at one time.

Polyurethane resin

Polyurethanes can be designed to form a soft elastic or flexible material such as a foam, but also to form a rigid material such as solid body resin. Both foams and solid body resins can be made of polyurethanes. Polyurethanes bond very well to dry and even to wet surfaces.

The surface adhesion is important during waterproofing and high-pressure injection. They produce less heat during the exothermic reaction than epoxy resins. Development of heat during the reaction of the injection material can cause stresses to the substrate. Polyurethanes are non-corrosive to steel reinforcement which is an important advantage to maintain the integrity of the structure.

Viscosity

Material property of liquids and gases. Viscosity describes the flow behavior of free-flowing substances. A low viscosity can be used to fill e.g. hairline cracks, a higher viscosity of the injection material is needed to seal wider cracks. The lower the viscosity, the higher the distribution.

Construction joint

A construction joint is formed when new concrete is poured against already set concrete. This joint is intentionally placed to divide and facilitate the construction process. Construction joints are typically found in large foundation slabs, wall/floor connections and columns, among others.

2 System description

2.1 System features

KÖSTER IN 5 is a solvent-free, low viscosity injection resin for permanently and elastically injecting, filling, and sealing cracks and construction joints.
KÖSTER IN 5 is a 2-component elastic PU injection resin, especially suitable for hose injection.

KÖSTER IN 5 does not react aggressively when coming into contact with steel or iron, so that a corrosion protection is achieved. Due to its slow reaction, the material can be processed for up to 4 hours.

2.2 Characteristics/Advantages

- Low viscosity for deeper penetration (at +25 °C approx. 70 mPa·s)
- Long pot life for hose injection
- Suitable on dry, moist, and wet cracks
- Elastic solid body resin with high elongation capacity
- CE-Certification according to DIN EN 1504-5

2.3 Main products and components

KÖSTER IN 5
2-component elastic PU injection resin, specially suitable for hose injection. For permanently and elastically sealing dry, moist and waterbearing cracks and joints in concrete. Very low viscosity (at + 25 °C approx. 70 mPa · s). Mixing ratio 1 : 1 by volume.

See online

2.4 Associated products

KÖSTER 1C Injection Pump

See online

KÖSTER PUR Cleaner

See online

KÖSTER Hand Pump without manometer

See online

KÖSTER Hand Pump with manometer

See online

KÖSTER One-Day-Site Packer 13 mm x 90 mm CH

See online

KÖSTER One-Day-Site Packer 13 mm x 120 mm CH

See online

KÖSTER One-Day-Site Packer 13 mm x 90 mm PH

See online

KÖSTER Superpacker 10 mm x 85 mm CH

See online

KÖSTER Packer 13 mm x 130 mm CH

See online

KÖSTER Superpacker 10 mm x 115 mm CH

See online

KÖSTER Superpacker 13 mm x 130 mm CH

See online

KÖSTER One-Day-Site Packer 13 mm x 120 mm PH

See online

KÖSTER Impact Packer 12 mm x 70 mm

See online

KÖSTER KB-Fix 5

See online

2.5 Associated literature

- Technical Data Sheet
- Product Flyer Injection Resins
- System brochure: Crack Repair and Crack Injection
- Fields of application for KÖSTER Injection Packers
- KÖSTER Injection matrix: Resins
- Waterproofing Report 1-2008
- Waterproofing report 2-2007 (Only German)
- Product Declaration of Performance IN 5

3 Tools and Equipment

3.1 Tools

Measuring tool

Trowel

Wire brush

Tools for packers

KÖSTER 13 mm drill bit for SDS Plus Chuck (Masonry)

Drill bit 14 mm SDS Plus (Concrete)

KÖSTER Resin Stirrer 75 mm / 100 mm

KÖSTER Drill Hole Cleaner

Mixing vessels

Measuring cup

3.2 Equipment

Driller

KÖSTER Hand Pump
without manometer

KÖSTER Hand Pump
with manometer

KÖSTER 1C
Injection Pump

3.3 Cleaning

Clean all tools and equipment immediately after use with KÖSTER PUR Cleaner. Cured and hardened material can only be removed mechanically.

4 Environmental, health and safety

4.1 Personal Protection Equipment (PPE)

The following is a short overview of Personal Protective Equipment and serves only as a guideline. Contractors and employers are responsible for meeting the occupational safety guidelines in their countries, states, and localities.

Eye protection
Employers must be sure that their employees wear appropriate eye and face protection and that the selected form of protection is appropriate to the work being performed and properly fits each worker exposed to the hazard.

Head protection
Employers must ensure that their employees wear head protection if any of the following apply: Objects might fall from above and strike them on the head; they might bump their heads against fixed objects, such as exposed pipes or beams; or there is a possibility of accidental head contact with electrical hazards.

Foot and leg protection
Employees who face possible foot or leg injuries from falling or rolling objects or from crushing or penetrating materials should wear protective footwear.

Hand protection
When selecting gloves to protect against exposure hazards, always check with the manufacturer or review the manufacturer's product literature to determine the gloves' effectiveness against specific workplace chemicals and conditions. Gloves commonly used are: Coated fabric gloves and chemical - and liquid - resistant gloves.

Hearing protection
Suitable hearing protection must be provided for the job environment.

4.2 Material safety & First Aid

Every KÖSTER product is labeled with specific information and symbols as to the related dangers. Please consult the respective Material Safety Data Sheet for specifics.

You can access the Material Safety Data Sheets by scanning the QR codes on the packagings.

If inhaled:
Provide fresh air. In case of breathing difficulties administer oxygen. Medical treatment necessary.

In case of contact with eyes:
If product gets into the eye, keep eyelid open and rinse immediately with large quantities of water, for at least 5 minutes. Subsequently consult an ophthalmologist. Remove contact lenses, if present and easy to do. Continue rinsing.

After ingestion:
If accidentally swallowed rinse the mouth with plenty of water (only if the person is conscious) and obtain immediate medical attention. Do NOT induce vomiting.

After contact with skin:
Take off immediately all contaminated clothing. Rinse skin with water/or shower. If skin irritation occurs, get medical advice/attention.

4.3 Waste disposal

Disposal recommendations
Do not allow to enter into surface water or drains. Dispose of waste according to applicable legislation.

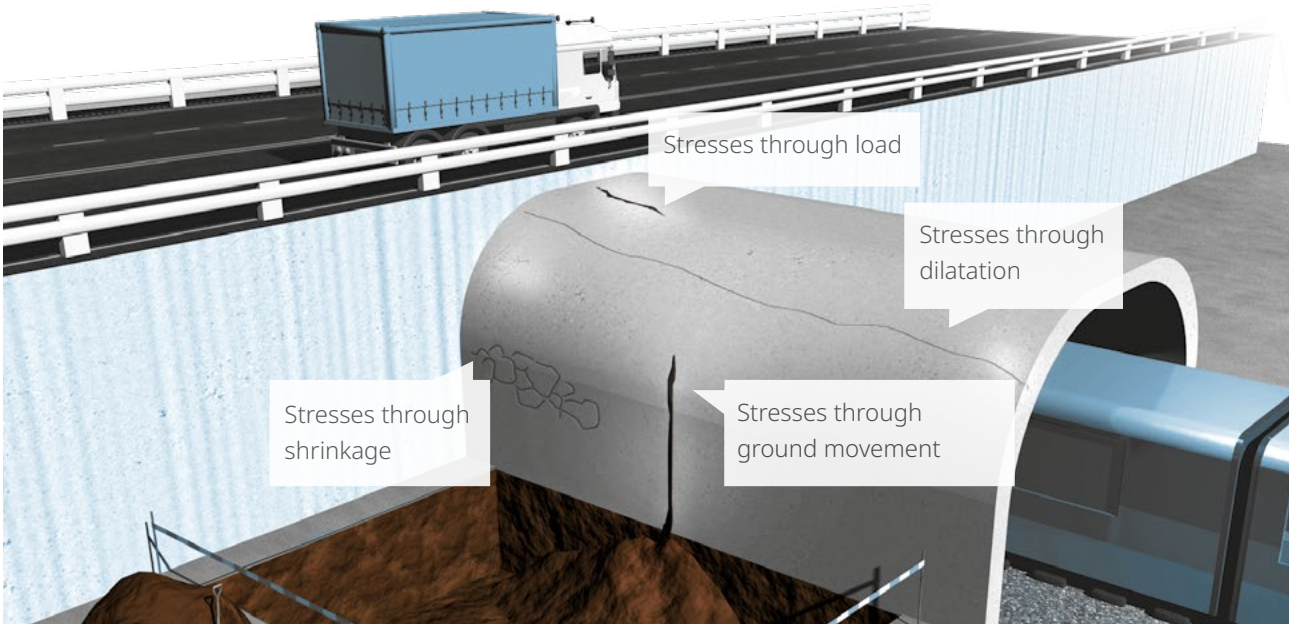
Contaminated packaging
Wash with water (cleaning agent). Completely emptied packages can be recycled.

Guidance on classification of waste according to EWC-Stat categories
List of Wastes Code -
Used product (080501)
WASTES FROM THE MANUFACTURE, FORMULATION, SUPPLY AND USE (MFSU) OF COATINGS (PAINTS, VARNISHES AND VITREOUS ENAMELS), ADHESIVES, SEALANTS AND PRINTING INKS; wastes not otherwise specified in 08; waste isocyanates; hazardous waste.

5 Crack details

5.1 How do cracks form?

A construction member cracks if stresses inside of it become larger than the resistance of the construction member. By cracking, the buildup of stresses is relieved. In comparison to the compressive strength, the tensile strength of concrete is quite low. This applies especially to fresh concrete. The most frequently encountered cracks are therefore tensile cracks and bending tensile cracks. There are many reasons which cause stresses in construction members. In most cases however, it is a combination of the following reasons:



5.1.1 Stresses through load

If a load is applied to a construction member, stresses develop inside which e.g. transmit the load into the foundation of the construction member. Loads which affect a building or construction member are e.g. vehicles crossing a bridge or even wind which impacts on a building. Also the self-weight of the construction member is a load which the construction member has to carry. If the load exceeds the load capacity of the construction member, cracks occur.

5.1.2 Stresses through shrinkage

Concrete shrinks during the curing process. Moreover, heat develops during the hydraulic reaction of the concrete. Both factors can, especially on long construction members, lead to strong interior stresses and hence to cracks. Usually, reinforcement and expansion joints help to avoid such cracks. If expansion joints do not exist or if they are not fully functional, stresses occur in the construction member. This can lead to cracks.

5.1.3 Stresses through ground movement

Stresses through ground movement occur through earthquakes, through setting of the building, through increases or decreases in the water table, through new construction sites in the vicinity, etc. Because of these movements, changes may occur during the load transfer from the building through the foundations into the supporting ground. These changes lead to stresses in the supporting and non-supporting construction members of the building which can lead to cracks.

5.1.4 Stresses through dilatation

Thermal impact, e.g. exposure to sunlight can warm up construction members. If building materials are warmed, they expand. If they are then cooled down, they shrink again. The movements which occur during warming up and cooling down cause stresses in the construction member and lead to cracks.

5.2 How to analyze crack movements?

A moving crack, is a crack where one of the flanks or both change their location.
In order to detect if the crack is moving (live crack) or not moving again (dead crack), we have to perform a simple Insite test.
A gypsum mark serves as a crack monitor. A bone-shaped layer of gypsum with a thickness of 10 mm is applied to the cracked surface. Gypsum marks must be numbered and dated. Moreover, the position and state of the installed gypsum marks is to be documented with drawings or photographs at regular intervals over a certain period of time.
The gypsum marks are frequently checked. If the mark is unbroken, the crack did not move. If the crack has moved, the gypsum mark will have cracked right over the crack in the substrate. Professional crack monitors measure and record the course of movements in the crack over time.

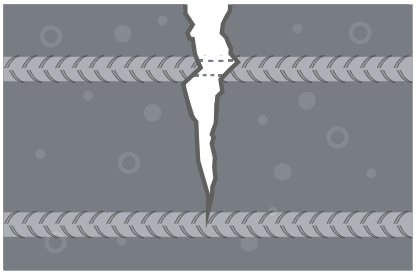
5.3 Reasons for injection

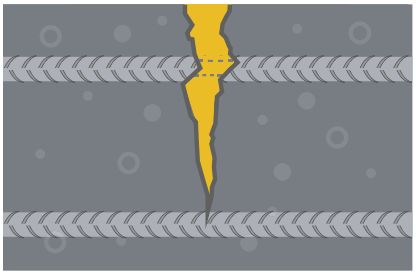
Cracked construction elements
Construction Elements like columns, slabs, beams ….etc. must be injected when cracked for the following reasons:

- Restoring the mechanical strengths of the construction element (compressive, tensile, flexure…etc) and therefore retaining the efficiency and performance of those elements.
- Preventing water/fluids leakage through the concrete.
- Preventing corrosion of the reinforcement steel bars inside the concrete element due to water and CO2 penetration through cracks.
- Retaining the element features and shape, to restore the initial Architectural design.

Preventive waterproofing

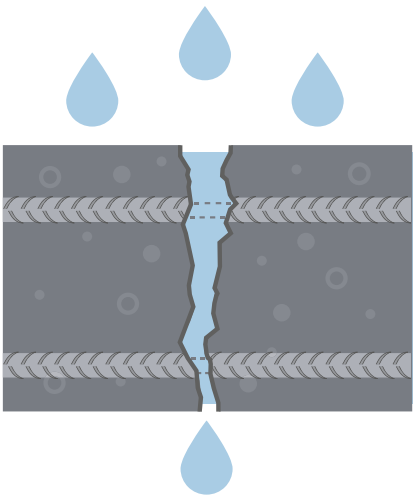
If cracks only represent minor defects, they are often repaired preventively in order to avoid further damage. This particularly includes corrosion prevention, the consequential damage of which (e.g. spalling of the concrete cover) later inevitably leads to higher renovation costs.

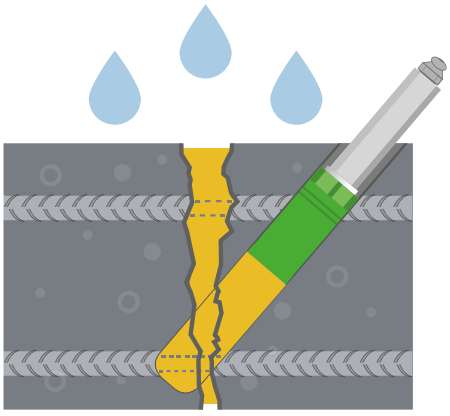




Waterproofing

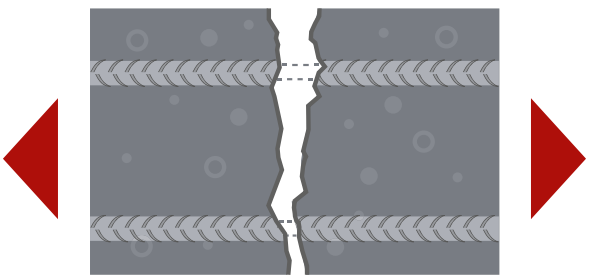
If the cracks represent a major deficiency, for example because water penetrates through cracks in basements, such cracks can limit the usability of the building. Penetrating water often causes consequential damage, for example corrosion of the reinforcement and restricted usability. In these cases, active water flow must first be stopped. The cracks are then permanently waterproofed over their entire cross-section. Cracks that still show movement must be filled with an elastic material that is able to absorb the movement of the building component such as KÖSTER 2 IN 1 or KÖSTER IN 5.

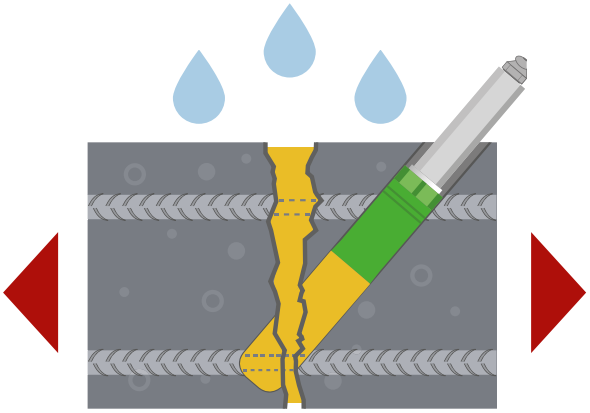




Elastic bonding or structural repair

Cracks that still show movement must be filled with an elastic material that is able to absorb the movement of the building component. Cracks which, on the other hand, are not subject to changes in the width can be connected structurally. Such cracks are injected with a rigid resin (KÖSTER KB-Pox IN) in order to restore the structural strength of the component. The here used Injection materials – regardless of their chemical concept - always have adhesive tensile values that exceed the tensile strength of healthy concrete (well over 1.5 N/mm^2). In this way, the integrity of the component is completely restored at this point.



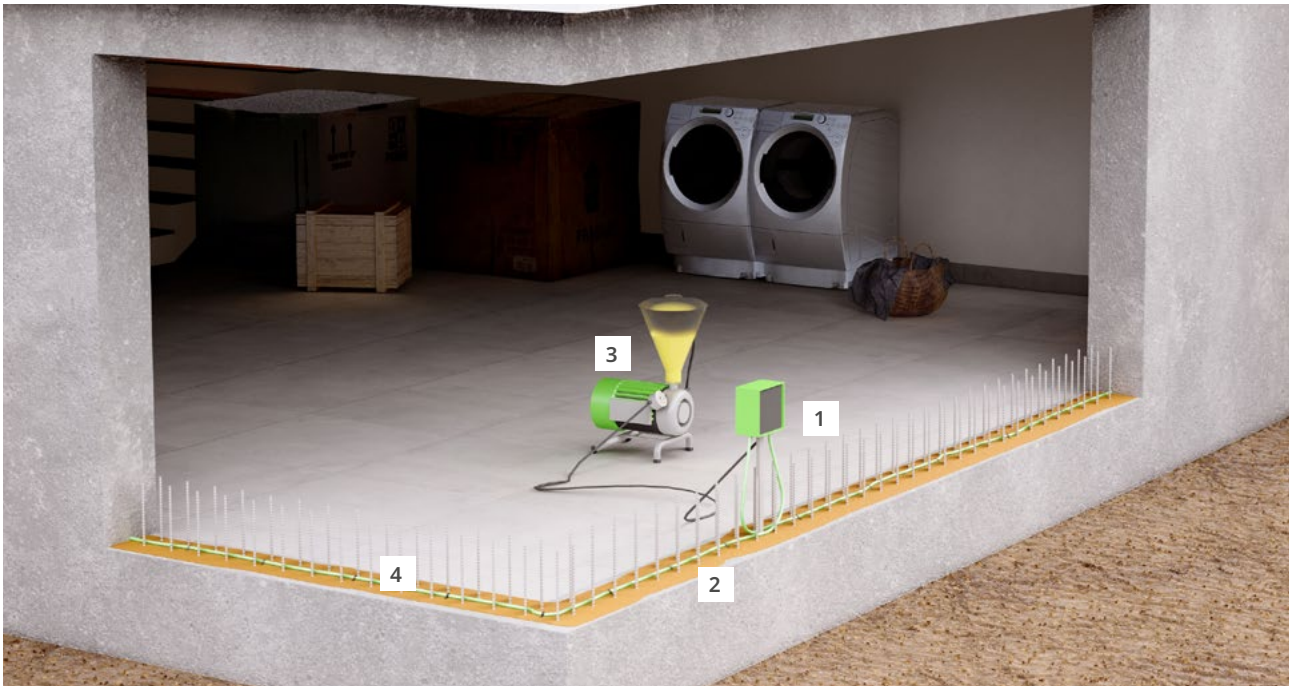


6 Fields of application

6.1 General examples

- Waterproofing of construction joints via an injection hose
- Permanently and elastically sealing dry, moist and wet cracks
- Waterproofing of wall/floor junctions (crack injection)
- For solidifying granular soils

6.2 Example for waterproofing of construction joints (Hose injection)



1. Injection hose unit
2. Injection resin — KÖSTER IN 5
3. Pump — KÖSTER 1C Injection Pump
4. Injection hose

Injection process:

Construction joints, especially in wall/wall and wall/floor junction, when installed underneath ground level, always need particular attention when it comes to waterproofing.

Defects in this area are common. Before pouring the concrete for the wall, injection hoses are installed in the construction joint. These hoses are usually perforated or slotted.

After the concrete has cured, an elastically curing resin is pressure injected into the injection hose. The joint is now permanently elastically sealed and waterproofed.

For the application via injection hose, KÖSTER IN 5 is the product of choice.

KÖSTER IN 5 is an EN 1504-5 certified resin with a low viscosity and an outstandingly long pot life, suitable for the injection into dry and moist cracks or joints. These two aspects are very important for the application so the product has enough time to enter the small and fine voids and doesn't start to react during the injection.
All KÖSTER injection resins can be installed with the KÖSTER 1C Injection Pump, or equivalent equipment, either through packers, or in the case of injection hoses, through special units placed on the walls.

6.3 Example: Elastic crack injection by pressure injection on dry or wet/moist cracks

1. Installing the packers	KÖSTER Packer 13 mm x 130 mm CH KÖSTER One-Day-Site Packer 13 mm x 120 mm CH
2. Injection resin	KÖSTER IN 5
3. Pump	KÖSTER 1C Injection Pump

Installation process:

If needed, open the crack in a V-shape 1 - 2 cm deep and remove loose particles and dust with a wire brush. Depending on the crack size and water conditions, it is preferred to seal it first with KÖSTER Injection Barrier or KÖSTER KB-Fix 5 (crack with widths smaller than 1 mmm may not required sealing on the surface).

Mark the positions where the boreholes are going to be drilled. Boreholes are placed along the course of the crack on alternating sides at intervals of approx. 10 - 15 cm. The holes are drilled toward the crack at an angle of approx. 45°. If possible the crack should be crossed by the borehole in the middle of the wall.

Clean the boreholes using pressurised air, KÖSTER Drill Hole Cleaner or clean water. Close the crack along its course with KÖSTER Injection Barrier or KÖSTER KB Fix 5. Closing the crack prevents injection material from prematurely flowing out of the crack during the injection.

Install KÖSTER Packers in the boreholes and tighten the packer by using a wrench.

Fill the required amount of the A component into a clean bucket. Then, add the B component. Thoroughly mix the A and B component in a mixing ratio by weight of 1:1 (A:B) using a slowly rotating mixer until a homogeneous color (free of streaks) is reached.

Prepare the pump for injection as recommended in the operating manual. Fill the mixed resin into the material hopper. The ready mixed material must be used within the pot life.

Connect the KÖSTER Grip Head to the fitting of the KÖSTER Packer and open the valve on the injection whip by turning the lever 90°. Inject the KÖSTER IN 5 injection resin via the KÖSTER Packers into the crack, proceeding from bottom to top.

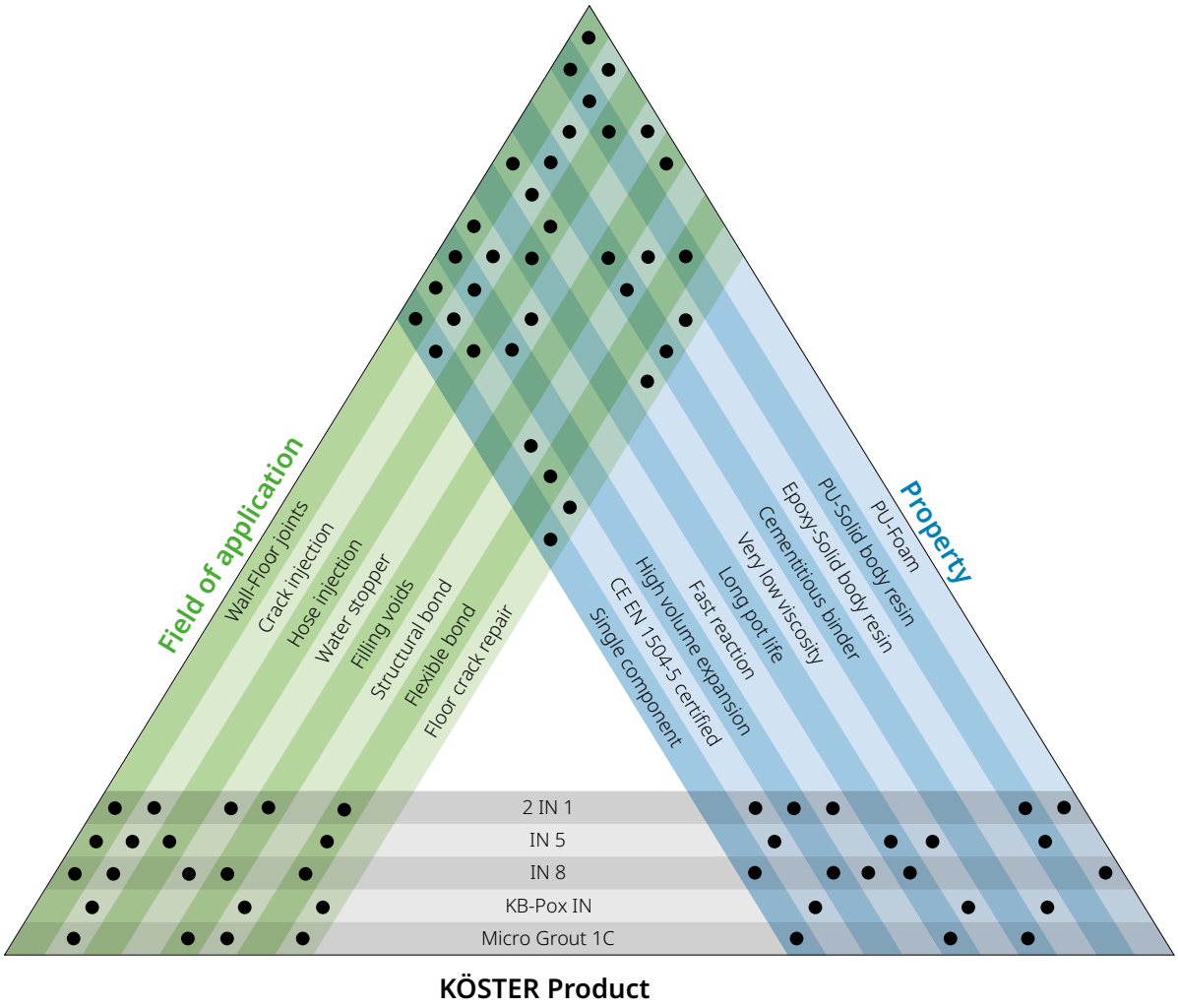
For example: For a wall, KÖSTER IN 5 is injected using conventional single component injection pumps such as the KÖSTER 1C Injection Pump.

After full cure of the injection resin, remove the injection packers and seal the boreholes with the KÖSTER KB-Fix 5. However, KÖSTER One-Day-Site Packer can be removed immediately after injection.

Clean the pump with the help of KÖSTER PUR Cleaner as recommended in the operating manual of the pump.

7 Injection matrix

To be able to choose from the wide range of KÖSTER Injection resins, this chart will lead to the right choice:



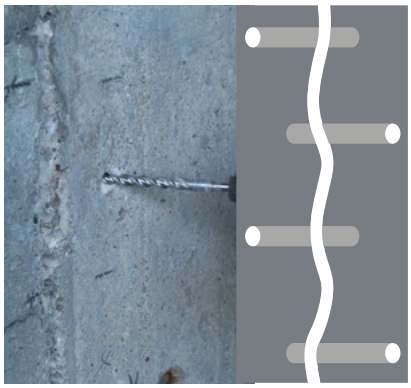
IMPORTANT
KÖSTER IN 5 is suitable for very small cracks and hose injections

8 Injection procedure

8.1 Crack preparation and packer installation

Open the crack in a V-shape 1 to 2 cm deep and remove loose particles and dust with a brush.

Mark the positions where the boreholes are going to be drilled. Boreholes are placed along the course of the crack on alternating sides at intervals of approx. 10 cm to 15 cm.



The holes are drilled toward the crack at an angle of approx. 45°. Clean the boreholes using pressurised air or water.

Clean the crack using a wire brush.

Pre-wet the crack.

Close the crack along its course with KÖSTER KB Fix 5. Closing the crack prevents injection material from prematurely flowing out of the crack during the injection. Setting time is approx. five minutes, depending on the surrounding temperature and humidity.

Install KÖSTER Superpackers in the boreholes leaving every third bore-hole open.

Use a wrench to tighten the packer.

8.2 Horizontal wall/floor junctions

The distance of the packers should be 10 to 15 cm.
For retroactive waterproofing of the wall/floor junction, the boreholes have to be drilled transecting the construction joint. The borehole should be drilled approximately into the middle of the construction joint.

8.3 Mixing of KÖSTER IN 5

The A and the B components are mixed in the given mixing ratio using a slowly rotating electrical mixer preferably equipped with a KÖSTER Resin Stirrer. The material must be mixed until it is streak free and homogeneous in appearance. The minimum application temperature is +5 °C, noting that high temperature will increase the reaction rate and reduce the pot life.

8.4 Introducing mixtures into injection pump

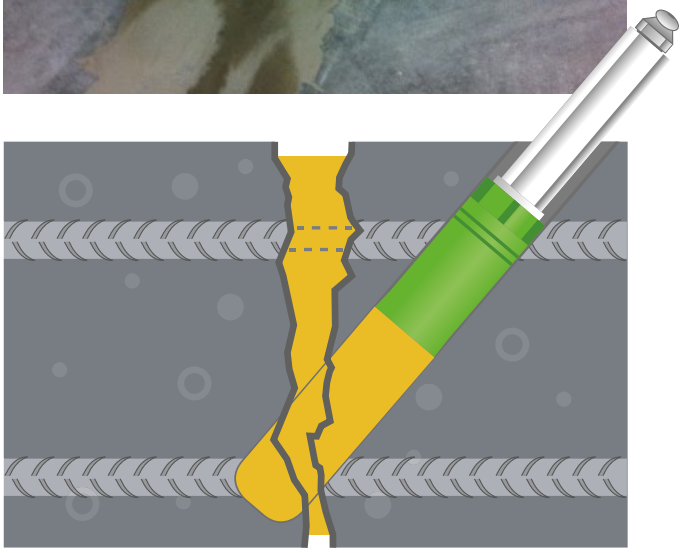
Mix both components to a ready for use injection material. After mixing, pour the mixture into the KÖSTER 1C Injection Pump hopper, taking into account that the pot life of the KÖSTER IN 5 is approx. 4 hours (+20 °C). When using a single component injection pump, no moisture may come into contact with the injection material during the application.
Close the lid of the hopper to reduce moisture contact with the material.

8.5 Injecting KÖSTER IN 5

8.5.1 Crack injection

Active water leaks are stopped through injection with KÖSTER IN 8. Dry, moist and wet cracks can then be sealed with the injection resin KÖSTER IN 5.

The injection is carried out using a customary injection device such as the KÖSTER 1C Injection Pump, from bottom to top along the course of the crack. In cases of moist cracks and joints, material is injected until bubble-free material leaks from the crack or adjacent packers.
Subsequent injections with KÖSTER IN 5 can only be carried out within the pot life of the material.
After the removal of the injection packers, the drill holes can be closed with KÖSTER KB-Fix 5.



8.5.2 Hose Injection

The injection hoses are installed in the middle of the wall in lengths of approximately 10 to 15 m. The minimum concrete cover must be 8 to 10 cm. The injection hoses must be in continuous contact with the concrete sub-strate.
The injection is carried out using customary low pressure injection systems in conjunction with suitable injection ports.

The injection hose is filled until material comes out of the other hose end. That end of the hose is then sealed and material is injected until the gauge pressure on the injection pump remains constant at approx. 80 bar. Sub-sequent injections with KÖSTER IN 5 can only be carried out within the pot life of the material.
Make sure to protect the surrounding work area from injection resin that may be discharged from the wall, packers, drill holes, etc.

8.6 Post injection process

After finishing the injection process and closing the holes, the substrate can be covered with a KÖSTER Restoration Plaster System, composed mainly of the KÖSTER Restoration Plaster Key, the KÖSTER Restoration Plaster and if a fine finish is desired, a KÖSTER Fine Plaster.

9 KÖSTER 1C Injection Pump

The recommended injection pump for KÖSTER IN 5 is the KÖSTER 1C Injection Pump.
This pump has the following features.

Characteristics	Value
Electrical connection	230 V/2.25 A/50 Hz
Operating pressure	0-200 bar
Delivery rate	max. 2.2 l/min
Capacity	6 l
Measurements h (with hopper)/w/l	44 (78)/30/50 cm

Included in the packaging

- 6 l material hopper
- 5 m high pressure material hose d=6 mm (inside)
- High pressure ball valve/mouth piece, M 10x1
- Manometer max. 200 bar
- Operating manual

After injection, the KÖSTER 1C Injection Pump must be cleaned using the KÖSTER PUR Cleaner.

Follow the indications given in the instruction manual of the pump for further details on the cleaning process.

10 General notes

10.1 Consumption rate

Approx. 1.1 kg/l void as injection material
From 400 g/m for hose injection

10.2 Packaging

10 kg combipackage, A = 4.55 kg, B = 5.45 kg
A:B = 1:1 by volume
A:B = 1:1.2 by weight

10.3 Material Storage

Store the material at temperatures between +10 °C and +30 °C. In originally sealed containers it can be stored for 12 months. After partial removal, the containers must be closed immediately (do not mix up the caps) and turned "upside down" once to seal the closures from the inside.

10.4 Limitations

- KÖSTER IN 5 Contains diisocyanate. When working with the material, work clothing that covers arms and legs or a protective suit must be worn. When working in confined spaces or in the "overhead area" hoods or covers must be worn. Wear suitable protective gloves (e.g., nitrile gloves) and protective goggles. When processing the material, pressure is created.
- Please do not stand directly behind Packer. When carrying out injection work, make sure to protect the surrounding work area from injection resin that may be discharged from the wall, packers, drill holes, etc.
- Due to water displacements, reinjections may be necessary to address localized areas.
- KÖSTER IN 5 is not suitable for wide moving joints with considerably high dynamic movements.
- Contains diisocyanate. According to EU chemicals legislation (REACH), Regulation 1907/2006, Annex XVII, training for commercial and industrial users on the safe use of diisocyanates is required for the use of this product from August 24, 2023.

11 Certifications

MPA Braunschweig, testing of physical characteristics according to the DIN EN 1504-5,

12 Legal disclaimer

This method statement reflects general cases with standard parameters. It is not suitable as a step-by-step guide for all and each waterproofing projects as the conditions on site at the moment of the application cannot be foreseen. It is solely the applicator's responsibility to decide on the actual procedure considering the specific situation on the construction site. In any case, KÖSTER's Terms of business are valid and can be viewed under www.koester.eu