

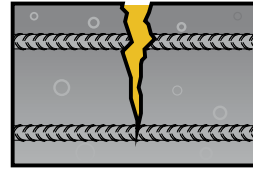
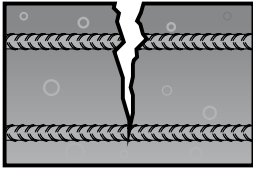
# **CRACK REPAIR** **AND CRACK INJECTION SYSTEMS**



# Why Repair Cracks?

Crack repair in general can have three objectives:

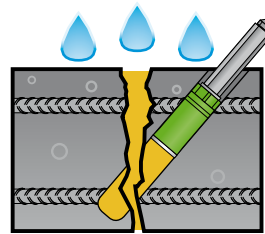
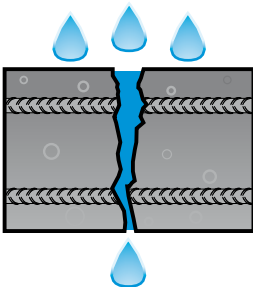
## Restoration of aesthetics



If cracks are only minor defects, they are simply repaired to restore the aesthetics of the building. Cracks in façades or other walls lead to buildings

appearing old or even shabby. Minor defect cracks can be repaired easily. It is often sufficient to close the cracks on the surface.

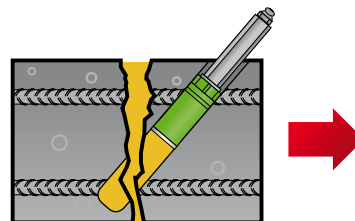
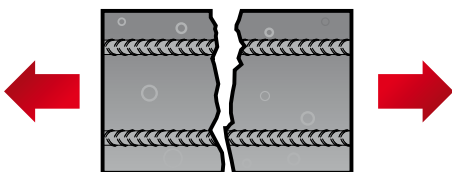
## Waterproofing



If moisture penetrates through the cracks, e.g. in basements, those cracks are likely to cause a limitation of the functionality of the building. This often happens with large concrete construction members, like tunnels or parking decks, especially if there are not enough expansion joints. If there are active leakages, those have to be

stopped first and foremost. Afterwards, the crack can be permanently sealed in its whole cross-section. By sealing moist or water-bearing cracks via injection, a further water ingress into the building can be stopped. Waterproofing of cracks is also done to prevent further corrosion of steel reinforcements.

## Structural repair



Cracks which threaten the stability of the building are often located in supporting construction members. They have to be repaired in order to restore the transmission of strength inside the construction member. An example for this is a crack on the deck of a concrete bridge. During the restoration of the load capacity of a concrete structure it is necessary to connect the flanks of

the crack so that a force transmission can again take place.

For this purpose, the crack is filled with a resin in its whole cross-section. After full cure, this resin reconnects the flanks of the crack. The cured resin has the resistance characteristics which are needed for the transmission of stresses.

### Typical areas of crack repair:

- basements
- tunnels
- façades
- construction joints
- parking decks
- bridges
- concrete floors
- wall / floor junctions

## How Do Cracks Occur?

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 compressive tensile cracks. There are many reasons which cause stresses in construction members. In most cases however, it is a combination of the following reasons:

### Stresses through load

If a load is applied to a construction member, stresses develop inside which transmit the load into the bearing 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. But 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.

### Stresses through shrinkage

Concrete shrinks during the curing process. Moreover, heat develops during the hydraulic reaction of the concrete. Both factors can,

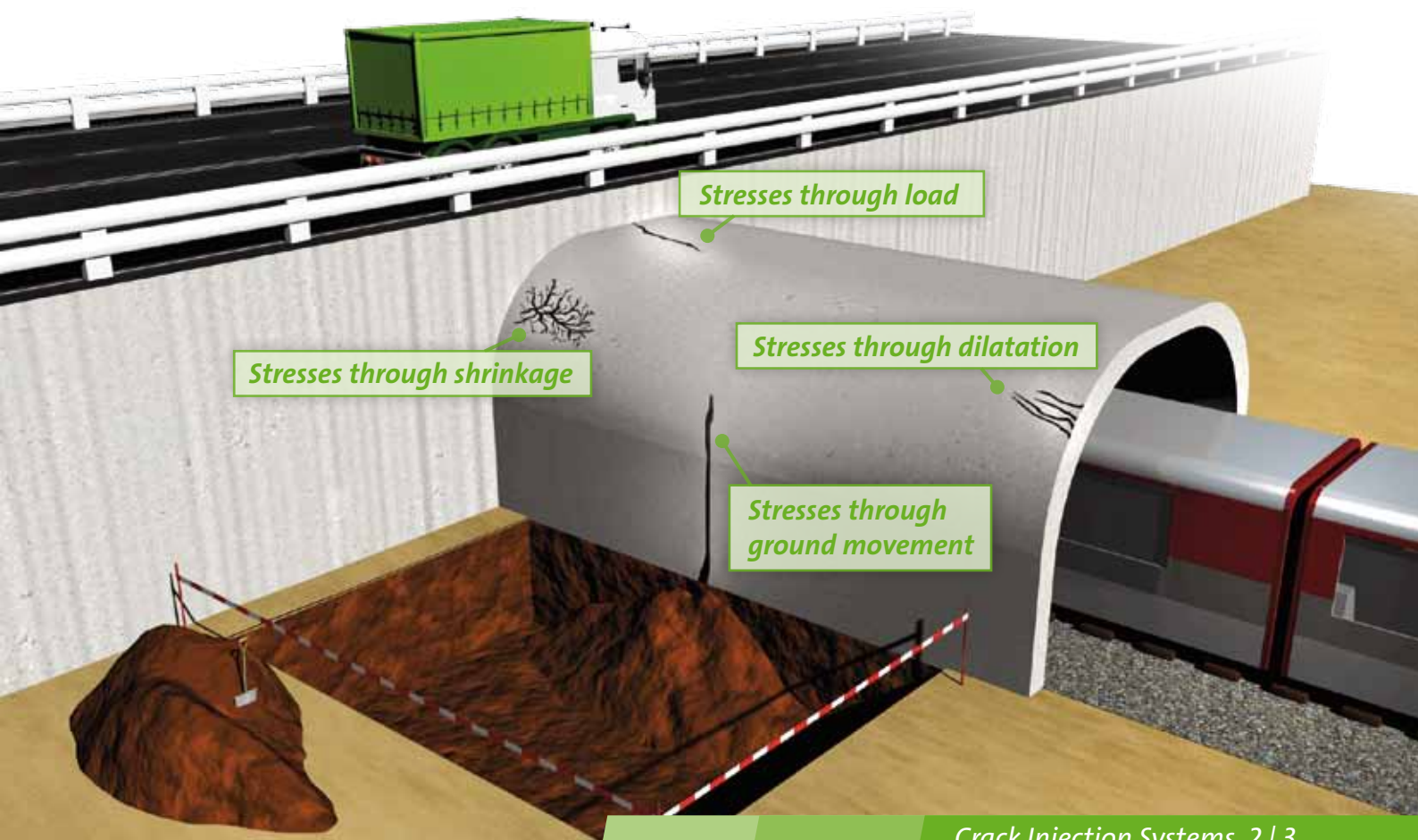
especially on long construction members, lead to strong interior stresses and hence to cracks. Usually, expansion joints help to avoid such cracks. If expansion joints do not exist or if they are not fully functional, stresses occur in the construction member. This can lead to cracks.

### 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.

### 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.



## How to Analyse Crack Movements?

Moving cracks are cracks where one of the flanks of the crack or both change their location. To analyse if a crack moves or not, a very simple and secure method can be used: 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 have to 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.

A moving crack can be sealed either elastically (in the case of waterproofing or aesthetic repair) or rigidly (in the case that restoration of the structural strength is required). When closing moving cracks rigidly, the appearance of a new crack close to the old crack must be prevented e.g. by eliminating the cause of the movement.



Gypsum mark

## KÖSTER Crack Injection Products

The standard KÖSTER product range contains seven injection resins which offer reliable solutions for any case of crack repair. User friendliness of the products and durability of the solutions were emphasized during the conception and the development of the products. KÖSTER injection materials can be divided into the following categories:



### Foam forming injection resins

Foam forming injection resins are systems which consist of a prepolymer and a catalyst.

The reaction time of the prepolymer in contact with water is accelerated radically by the addition of the catalyst. However, for the complete reaction of the material, contact with water in the crack is required in all cases.

KÖSTER IN 1 is a fast foaming water-stopping material. It is used to prepare moist or water-bearing cracks for the subsequent injection with a permanently sealing solid body injection resin. KÖSTER IN 1 has a short reaction time when exposed to water. It has a coarse pore structure into which resin can subsequently easily be injected. A sufficient amount of water in the crack is needed so that KÖSTER IN 1 can react completely.

KÖSTER IN 7 is a fast foaming water-stopping material as well. This material forms a perma-

nently elastic foam so that a subsequent injection with a solid body injection resin is not necessary.



### Solid body injection resins

These resins cure without exposure to water or moisture to solid bodies. The mechanical properties of the cured resins range from soft-elastic to hard and shock-resistant.

KÖSTER IN 2 is a resin for the elastic sealing of dry cracks and for water-bearing cracks which were injected with KÖSTER IN 1 beforehand. This medium-reactive resin has a low viscosity.

KÖSTER IN 3 is a polyurethane resin for closing and bridging cracks where structural strength is required. The resin provides a high tensile strength with the extreme adhesion of polyurethanes.

KÖSTER IN 4 is an elastic injection resin for fine cracks with a long pot life, a very low viscosity and a high elastic retraction. It is suitable for the injection of construction joints and hose injection.

KÖSTER IN 5 is an elastic injection resin for injection into moist cracks with long pot life, a low viscosity and a high elastic retraction. It is suitable for crack injection and hose injection.



### “All-round” injection resin

KÖSTER 2 IN 1 offers a combination of the product properties of the fast foaming injection resins and the product properties of the solid body resins. The formulation of this system with balanced catalysts allows the application as a foam forming water-stopping product when there



is water present in the crack and also as a solid body resin, when there is no water present in the crack.



### Micro Grout

KÖSTER Micro Grout is a high-grade injection mortar with high final compressive strength for injection in concrete and masonry, for grouting of rock, earth and masonry anchors as well as for filling voids, joints etc. It can also be used to solidify granular and/or sandy soils. The material does not settle during pot life and does not require special devices for the application such as e.g. a colloidal mixer.

## Field of Application

	IN 1	IN 2	IN 3	IN 4	IN 5	IN 7	2 IN 1	KB-Pox® IN	Micro Grout
Characteristics	Brittle foam, stops flowing water in cracks and seals and closes waterbearing and moist cracks	Elastic resin, seals and closes dry cracks and joints, second stage after IN 1	Rigid resin, seals, closes and bridges - where structural strength is required - dry cracks	Elastic resin, low viscosity, seals and closes very fine cracks	Elastic resin, seals and closes dry and moist cracks and joints	Elastic foam, stops flowing water in cracks and permanently seals and closes moist cracks	Two products in one: Elastic foam, stops flowing water in cracks and joints and elastic resin permanently seals and closes dry cracks and joints	Solvent-free, low viscosity epoxy resin for crack injection	Rigid, cementitious grout, seals and closes moist and dry cracks and voids
Water bearing crack	X					X	X		
Moist crack	X					X	X	X	X
Dry crack		X	X	X	X		X	X	X
Construction joint		X		X	X		X		
Solidifying granular soil			X		X				X
Filling voids				X	X			X	X

## Mechanical Characteristics

	IN 1	IN 2	IN 3	IN 4	IN 5	IN 7	2 IN 1	KB-Pox® IN	Micro Grout
Characteristics	hard brittle foam	elastic solid body resin	rigid, bridging - where structural strength is required, impact-resistant solid body resin	elastic solid body resin	elastic solid body resin	elastic solid body foam	elastic foam (in case of water contact); elastic solid body resin (in absence of water)	impact resistant solid resin	cement mortar with high final compressive strength
Fast foaming / water activated	X					X	X		
Solid resin		X	X	X	X		X	X	
Elastic sealing		X		X	X	X	X		
Rigid sealing			X					X	X
Hose injection				X	X		X		
One-product system		dry cracks	dry cracks	dry cracks	X	X	X	X	X

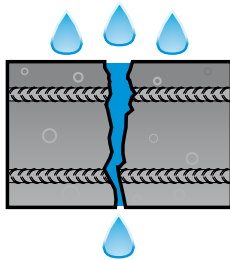
## Technical Data

	IN 1	IN 2	IN 3	IN 4	IN 5	IN 7	2 IN 1	KB-Pox® IN	Micro Grout
Pot life	> 20 days	30 min *	40 min *	3 h *	4 h *	> 10 days	45 min *	80 min *	100 min.
Reaction time	after water contact 0.5 - 2 min *	30 min *	40 min *	3 h *	4 h *	after water contact 0.5 - 2 min	after water contact 1 - 6 min without water contact 24 h	80 min *	100 min.

\* at 20 °C, 1 l mixed volume

## How to Repair Water-Bearing Cracks?

When repairing water-bearing cracks, first of all the water has to be stopped. Afterwards the crack has to be sealed permanently. If the flow of water is very strong, always first a fast expanding foam (e.g. KÖSTER IN 1) is injected and then immediately afterwards a solid body resin (e.g. KÖSTER IN 2). In all other cases the advanced new procedure which is described below can be used.



On construction sites it is often not easy to determine, if a certain crack is water-bearing or not. That makes it difficult to choose the right injection material for the job.

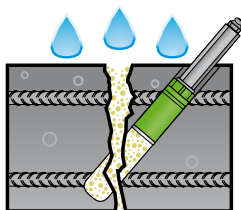
Thus, it would be ideal to have an injection resin that would form a foam in those areas where there is water in the crack and a solid body resin in those areas where there is no water in the crack. KÖSTER has developed such an injection material: KÖSTER 2 IN 1.

### One material, two effects

KÖSTER 2 IN 1 is a water-reactive polyurethane prepolymer. If the material comes into contact with water, it reacts to form a highly elastic foam. Under dry conditions, the material reacts to form an elastic solid body resin. KÖSTER 2 IN 1 thus unites two effects in one product. Using KÖSTER 2 IN 1, water-bearing cracks can be sealed permanently and safely with just one material.

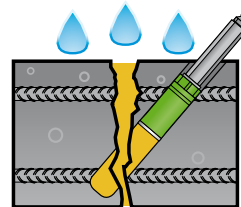
### Stopping the water

In the first stage, it forms a foam in the crack thereby stopping the flow of the water. The resin reacts with water and forms a foam, thereby highly expanding in volume. The foam uses up the water in the crack by reacting with it and displaces the water from the crack by expanding into the crack.



### Permanent sealing

In the second stage the same material is injected via the same packers. Now, since there is no more water in the crack, the material forms a solid body resin. KÖSTER 2 IN 1 remains elastic after reacting and is thus able to follow crack movements. This ensures that cracks are permanently sealed.



## KÖSTER 2 IN 1 Advantages

1. Only one product for water-bearing and for dry cracks instead of two.
2. Much easier application.
3. In contrast to conventional materials: KÖSTER 2 IN 1 will react, no matter if water is present or not.
4. In contrast to conventional solid body resins it stops water by forming a foam.
5. The foam is specially designed to make way for the solid body resin during the second stage injection. In the second stage injection, the crack is filled with a lasting and permanently elastic resin. Thus, failures are much less likely to occur.
6. Only one material is needed, so only one injection pump or no cleaning of the injection pump when changing materials is required (continuous working).
7. Easier calculation of consumption
8. Only one material to keep in stock and to bring to the construction site.
9. Free of solvents
10. Resistant to hydrolysis

## Crack Injection with KÖSTER 2 IN 1

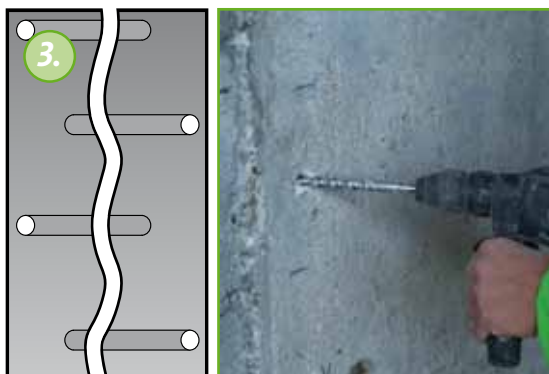
On the following pages, a general guideline for crack injection is specified. In the case on hand, the cracked bearing of a railroad bridge is injected. It depends on the width of the crack if it is necessary to close the mouth of the crack prior to the injection.



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



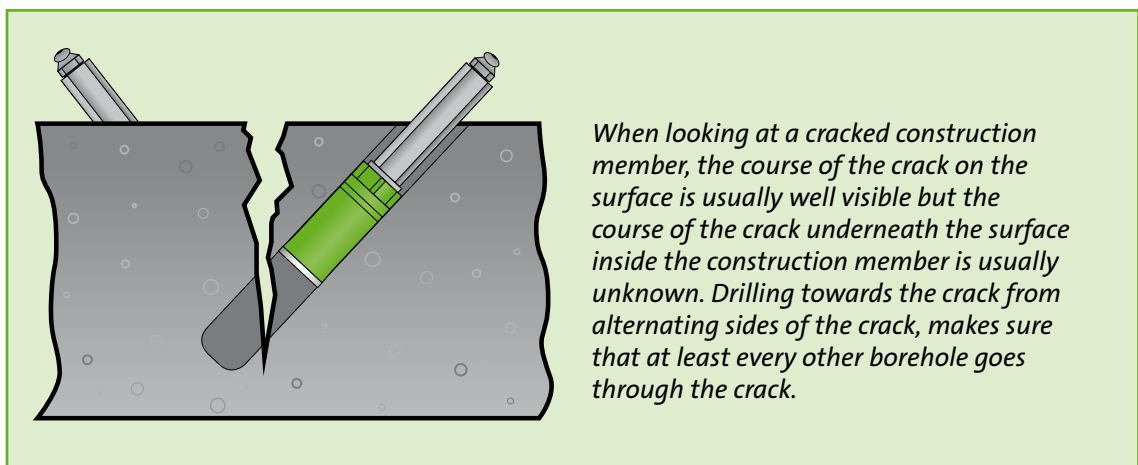
Mark the positions where the boreholes are going to be drilled. Boreholes are placed along the course of the crack on alternating sides at intervals of approx. 10 cm to 15 cm.



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.



When looking at a cracked construction member, the course of the crack on the surface is usually well visible but the course of the crack underneath the surface inside the construction member is usually unknown. Drilling towards the crack from alternating sides of the crack, makes sure that at least every other borehole goes through the crack.



*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. 5 minutes, depending on the surrounding temperature and humidity.*



*Install KÖSTER Superpackers in the boreholes leaving about every third borehole open.*



*Use a wrench to tighten the packer.*

9.

*If necessary, warm the A and B components of KÖSTER 2 IN 1 to room temperature (20 °C).*

10.

*First, fill the required amount of the A component into a clean bucket. Then, add the necessary amount of the B component. Thoroughly mix the A and B component in a mixing ratio of 1 : 1 (A : B) using a slowly rotating mixer until a homogeneous colour (free of streaks) is reached.*



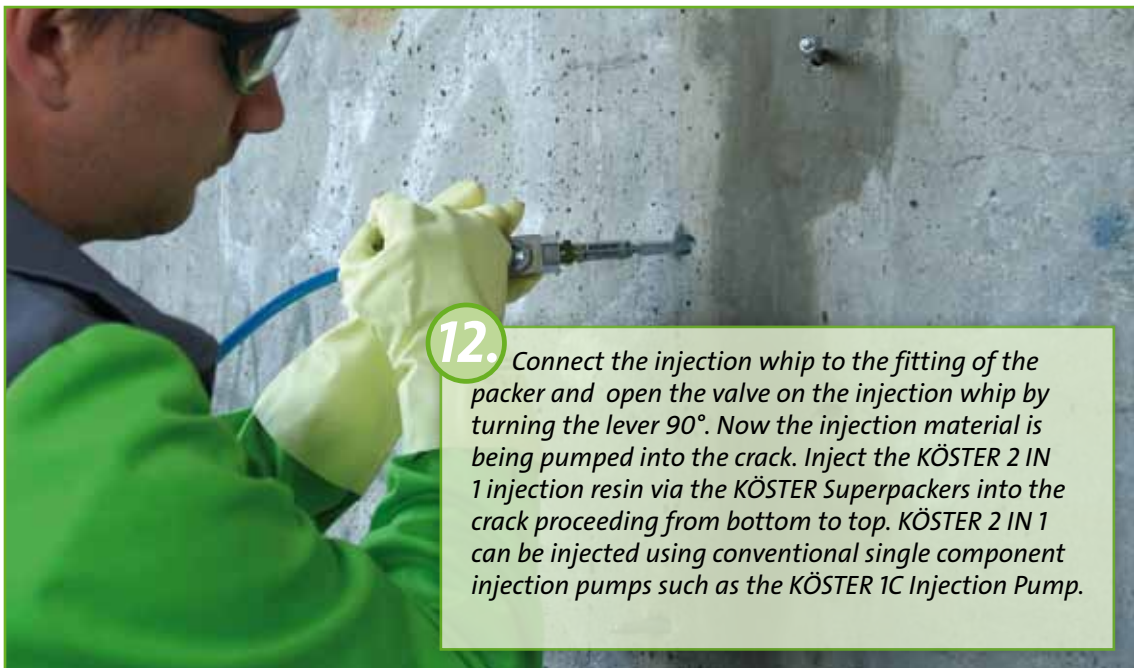
*A suited stirrer such as the KÖSTER Resin Stirrer in combination with a slow rotating mechanical mixing device is used to mix both components. The components are mixed until the material is homogenous.*





11.

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 up within the pot life.



12.

Connect the injection whip to the fitting of the packer and open the valve on the injection whip by turning the lever 90°. Now the injection material is being pumped into the crack. Inject the KÖSTER 2 IN 1 injection resin via the KÖSTER Superpackers into the crack proceeding from bottom to top. KÖSTER 2 IN 1 can be injected using conventional single component injection pumps such as the KÖSTER 1C Injection Pump.



13.

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

After full cure of the injection resin, remove the injection packers and close the boreholes with a mortar e. g. KÖSTER KB-Fix 5.

## How much material has to be injected into the crack?

It can only be indirectly determined if enough resin has been injected into the crack. The following three paragraphs describe the most frequently used ways to determine if enough material has been injected into the wall:



1. Prior to the injection, every third borehole is left open. When KÖSTER 2 IN 1 is injected via an injection packer, it can travel through the crack to the open borehole next to that injection packer. Enough material has been injected into that particular injection packer, when KÖSTER 2 IN 1 comes out of the next open borehole.

Then the injection is stopped and an injection packer is installed in the open borehole.

After that, the injection can be continued via the

### Attention:

Even the most experienced applicator can not look into the wall. Thus, it must always be taken into consideration that even with the most diligent application it is possible that due to inconsistencies inside the wall or other reasons it can become necessary to reinject at a later date.

next injection packer.

2. Another sign that the crack can not be filled further via a certain injection packer is that a counter-pressure develops in the crack. The increase in pressure is shown on the pressure gauge of the injection pump and less or no more material is being pumped into the crack via that particular injection port. Then the injection is interrupted and one can move on to the next injection packer.

3. Yet another and frequently occurring sign is that resin or foam comes out of the wall somewhere.



## Differences in the mode of injection between dry, moist and wet or waterbearing cracks:

In case of dry and moist cracks, KÖSTER 2 IN 1 is applied using single-stage injection. This means that all injection ports are injected once until the crack is filled.

In case of water bearing cracks, the injection is carried out in two stages:

1. Injection of KÖSTER 2 IN 1 until the resin is discharged as foam from the adjoining borehole or respectively from the mouth of the crack or until counter pressure develops.

2. Follow-up injection with KÖSTER 2 IN 1 within approx. 10 to 15 minutes of the preceding injection with KÖSTER 2 IN 1. The follow-up injection has to be carried out within the pot life of the ready mixed material.

## What to Keep in Mind when Choosing Injection Systems

### Injection Materials

- **Viscosity of the liquid material:** A low viscosity is needed to fill e.g. hairline cracks, a higher viscosity of the injection material is needed to seal wider cracks.
- **Elastically or rigidly reacting materials:** For moving cracks, an elastic or flexible injection material is required to waterproof the crack permanently. Rigid injection resins are used for injections to restore structural strength.
- **Foam or solid body resins:** Foams are used to stop active leakages, solid body resins are used for sealing a crack permanently. In most cases, the foam is applied as a first working step, afterwards the resin is injected.
- **Reaction time:** A short reaction time of the material is needed when sealing cracks with active leakages. If the crack is dry, the reaction time of the material may be longer.
- **Resistance against chemicals or alkalis:** Depending on the location of the crack, it may be necessary to use injection materials which are resistant to chemicals or alkalis.
- The injection material should under all circumstances be **non-corrosive** to reinforcement steel.



### Injection Packers

- Injection packers should offer the possibility to be installed and removed easily. In crack injections the working time of the personnel is the most important cost factor in comparison to the costs of material. In order to keep the costs low, an **easy application** is important.
- **Leak-tightness:** Injection resins or foams have curing times from a few seconds to several days. Because of this, it is very important that the packer seals the borehole tightly. Leaking injection packers during the curing time can lead to a failure of the waterproofing.
- **Safety:** Pressure injection of cracks is carried out with very high pressure, sometimes more than 100 bars. Unsecure packers can disengage and be catapulted out of the borehole like bullets. Thus, only high-quality products should be used.
- **Suitable packer for every type of application:** For low-pressure injections, plastic impact packers are suitable. They are low-priced and fast to mount. However, for high-pressure injections on the contrary, high-quality metal injection ports should be used. For horizontal cracks especially in large buildings, the KÖSTER Pressure Port is a very cost-effective and time saving solution.
- **Diameter, distance and depth of the boreholes:** The drilling of boreholes is one of the most time consuming steps of crack injection and is an important cost factor.



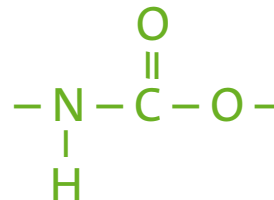
## Why Use Polyurethanes?

Polyurethanes can be designed to form a soft-elastic or flexible material but also to form a rigid material. 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.

The pot life of polyurethanes can also vary, making it possible to produce injection materials which have a suitable pot life even for warm climatic conditions.

Polyurethanes are cost-effective with regard to their capability and their width of application.



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 reinforcements which is an important advantage.

## KÖSTER Injection Packers

### KÖSTER Superpacker

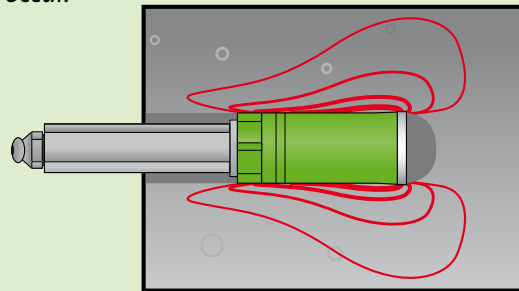
The KÖSTER Superpacker is a new and innovative product of KÖSTER BAUCHEMIE AG. The objectives during the development of this packer were to create a high quality packer, which is particularly safe and easy to install. The KÖSTER Superpacker guarantees an extremely high contact pressure to the borehole due to a cone-shaped center of the tightening mechanism.

Four fins and two ridges on the rubber gasket of the packer prevent rotation during tightening and thus facilitate optimal fixation of the packer in the borehole.





Tests show that the newly developed KÖSTER Superpacker has a much improved pullout

strength in comparison to conventional packers. This improves the work safety considerably.





The highest pressure to the borehole from tightening the packer is located deeper in the substrate than with conventional packers. Breakouts around the mouth of the borehole during tightening are therefore less likely to occur.



The following table gives an overview of the injection packers in the KÖSTER product range. Please contact our technical support for further information.

Product Picture	Name of Product	Field of Application	Measurements
	KÖSTER Superpacker	KÖSTER Superpackers are suitable for pressure injections. They are inserted into the borehole until the rubber piece of the packer is completely submerged in the borehole. Then, the rubber piece is pressed onto the walls of the borehole by tightening the packer so that the packer is installed tightly in the borehole.	13 x 115 mm 13 x 85 mm 10 x 115 mm 10 x 85 mm
	KÖSTER ONE-DAY-SITE Superpacker	The KÖSTER ONE-DAY-SITE Packer allows injection works to be completed in one day. Immediately after injecting, the part of the packer which protrudes from the wall can be unscrewed and removed. The inner part of the packer stays in the wall sealing the borehole so that no injection material can leak out, even under high pressure. After closing the borehole the work is done.	13 x 120 mm 13 x 90 mm
	KÖSTER Impact Packer 12	Injection packer with non-return valve for injecting resins. KÖSTER Impact Packers are made out of plastic and have a cone-shaped fitting. They are available with or without a ball-valve but in most cases impact packers with ball-valve are used. Usually, they are cut off shortly beneath the surface after the application; the remaining hole has to be closed afterwards.	12 x 70 mm
	KÖSTER Impact Packer 18 and KÖSTER Impact Packer 18 plus	KÖSTER Impact Packer 18: Plastic packer with cap without non-return valve for the low-pressure injection of grouts. KÖSTER Impact Packer 18 plus: Plastic packer with non-return valve for the injection of gel and cement based injection materials.	18 x 110 mm

## KÖSTER Injection Pumps

Product Picture	Name of Product	Description
	KÖSTER Hand Pump (with or without Manometer)	The KÖSTER Hand Pump is an injection tool for the injection of resins, for smaller works or for work areas difficult to access. The operating pressure is max. 100 bar, the output is 2-3 cm <sup>3</sup> per stroke. The KÖSTER Hand Pumps are suitable for all KÖSTER IN injection resins (foams and resins). It is delivered with or without manometer.
	KÖSTER 1C Injection Pump	The electrical KÖSTER 1C Injection Pump is suitable for injecting KÖSTER injection resins into cracks and voids. It is suitable for the injection KÖSTER IN injection resins (foams and resins).
	KÖSTER Foot Pump	Foot operated piston pump for injection of injection resins. Suitable for all KÖSTER IN injection resins (foams and solid body resins).
	KÖSTER Loka Pump	Manual membrane pump for pumping and injecting of KÖSTER Micro Grout.

## What You Should Know About 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 cannot be injected satisfactorily anymore. 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.

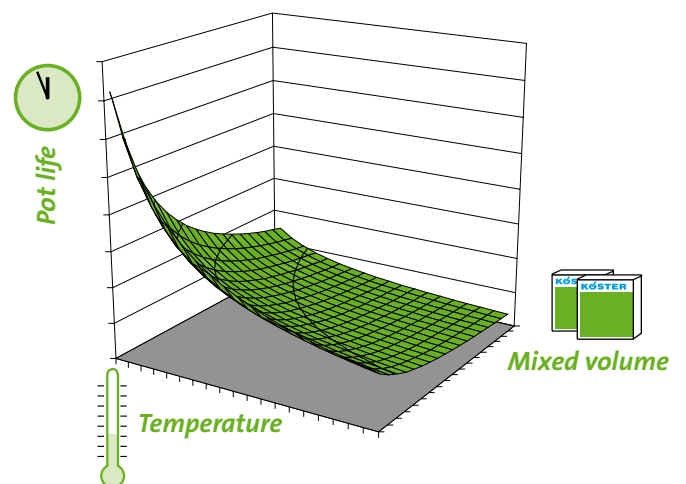
The pot life is influenced by the surrounding temperature and by the amount of material mixed at one time. It is usually measured at 20°C and a mixed volume of 1 litre. The pot life decreases very much at higher temperatures: a pot life of 30 minutes at 20°C (1 l) decreases to 20-25 minutes at 30°C (1 l). The volume mixed is very important as well because the exothermic reaction of the resin generates heat. The more material is mixed, the more heat is generated and the reaction time decreases further. A pot life of 30 minutes (at 20°C) with a mixed volume of 1 l decreases to about 23 minutes with a mixed volume of 5 l (at 20 °C). These examples are applicable for resins with medium reactivity.

With KÖSTER IN 5 KÖSTER offers a resin which allows a long time for application, even at high temperatures. KÖSTER IN 3 and KÖSTER IN 2 are available in a “HT”-version for high temperature climatic environments. In low temperature conditions the resins should be warmed to about 20°C before mixing.

The pot life is not necessarily comparable to the reaction time of the resin inside the crack. A water-reactive resin reacts faster inside the

crack due to the turbulences which occur during injection between resin and water which lead to a rapid reaction of the resin.

### Influence of temperature and mixed volume on pot life (schematic)



Two further terms which are important when talking about foams are “starting time” and “expansion time”. The starting time is the time which a foam forming resin needs after contact with water to begin to form a foam. The expansion time is the time in which the foam continues to form. Starting time and expansion time are crucial during waterproofing. Strong water leakages can only be stopped effectively if starting time and expansion time are very short, so that the injected material reacts before it is washed out of the crack by the water pressure. KÖSTER IN 7 and KÖSTER IN 1 are such fast foam forming injection resins.

# Technical Data

## KÖSTER IN 1 Injection Foam

### Technical data

- Mix viscosity at 25°C: approx. 300 mPa.s
- Volume expansion: max. 1:30
- Density of the mixture at 20 °C: approx. 1.1 kg / l
- Density of the fully cured foam: approx. 0.1 g / cm<sup>3</sup>
- Starting time: approx. 30 seconds
- Expansion time: approx. 60 seconds
- Non-sticky after: approx. 2 minutes
- Mixing ratio (by weight): 10 : 1 (A : B)
- Mixing ratio (by volume): 12 : 1 (A : B)

**Consumption:** Approx. 0.1 kg / l void

## KÖSTER IN 2 Injection Resin

### Technical data

- Mixing ratio by volume: Component A : B 2 : 1
- Mixing ratio by weight: Component A : B 5 : 3
- Viscosity (A + B component): approx. 200 mPa.s
- Pot life (20 °C, 1 l mixture): 30 min
- Shore-hardness D / DIN 53505: 25 – 35
- Application temperature: above + 5 °C
- Density (of the mixture): approx. 1.1 kg / l

**Consumption:** Approx. 1.1 kg / l void

## KÖSTER IN 3 Injection Resin

### Technical data

- Mixing ratio by volume Component A : B: 2 : 1
- Mixing ratio by weight Component A : B: 5 : 3
- Pot life (20 °C, 1 l mixture): (DIN EN 1504-5) 40 min
- Application temperature: above + 5 °C
- Viscosity (A+B component): (ISO 2555) approx. 200 mPa.s
- Density (of the mixture): (DIN 53479) 1.1 kg / l
- Compressive strength: > 80 N / mm<sup>2</sup>
- Adhesive tensile strength (Concrete): > 14 N/mm<sup>2</sup>
- Flexural tensile strength (after 7 d / 23 °C / 65 % rel. hum.): approx. 12 N/mm<sup>2</sup>

**Consumption:** Approx. 1.1 kg / l void

## KÖSTER IN 4 Injection Resin

### Technical data

- Mixing ratio by volume Component A : B: 1 : 1
- Pot life (20 °C, 1 l mixture): approx. 3 hours
- Application temperature: above + 5 °C
- Viscosity (A+B component): (ISO 2555)  
approx. 110 mPa.s (+ 8 °C)  
approx. 50 mPa.s (+ 21 °C)  
approx. 30 mPa.s (+ 30 °C)
- Modulus of elasticity (+ 20 °C): approx. 3.3 MPa
- Tensile strength in crack: approx. 0.8 MPa
- Tensile strength (+ 20 °C): approx. 0.9 MPa
- Elongation at highest tensile force: approx. 35 %

**Consumption:** Approx. 1.1 kg / l void

## KÖSTER IN 5 Injection Resin

### Technical data

- Mixing ratio by volume Comp. A : B: 1 : 1
- Mixing ratio by weight Comp. A : B: 1 : 1.1
- Viscosity (25 °C) Comp. A: approx. 65 mPa.s
- Viscosity (25 °C) Comp. B: approx. 90 mPa.s
- Flashpoint: > 200 °C
- Pot life (20 °C): approx. 4 hours
- Application temperature: above + 5 °C
- CE-certified according to DIN EN 1504-5

**Consumption:** Approx. 1.1 kg / l void

## KÖSTER IN 7 Injection Resin

### Technical data

- Mix viscosity at 25°C: approx. 300 mPa.s
- Volume expansion: max. 1:30
- Density of the mixture at 20 °C: approx. 1.1 kg / l
- Density of the fully cured foam: approx. 0.1 g / cm<sup>3</sup>
- Starting time: approx. 30 seconds
- Expansion time: approx. 60 seconds
- Non-sticky after: approx. 2 minutes
- Mixing ratio (by weight): 10 : 1 (A : B)
- Mixing ratio (by volume): 12 : 1 (A : B)

**Consumption:** Approx. 0.1 kg / l void

## KÖSTER 2 IN 1 Injection Resin

### Technical data

- Mixing viscosity at 25°C: (ISO 2555) approx. 250 mPa.s
- Volume increase at water contact: max. 1:20
- Density of the mixture at 20°C: (DIN53479) approx. 1.1 kg/l
- Spec. gravity of the cured foam: approx. 0.05-0.1 g/cm<sup>3</sup>
- Starting time at water contact: approx. 50 sec.
- Expansion time: approx. 180 sec.
- Non-sticky after: approx. 6 min.
- Pot life (20°C, 1 kg of mixture): (DIN EN 1504-5) 45 min.
- Reaction time without water contact (at 20°C): approx. 24 hrs.
- Mixing ratio (by weight): 1 : 1 (A : B)
- Mixing ratio (by volume): 1 : 1 (A : B)

**Consumption:** Approx. 0.1 kg/l void (foam)

Approx. 1.1 kg / l void (solid resin)

## KÖSTER Micro Grout 1C

### Technical data

- Compressive strength 28 days: > 60 N/mm<sup>2</sup>
- Pot life: approx. 100 min
- Grinding fineness (Blaine): > 5500 cm<sup>2</sup>/g

**Consumption:** Approx. 1.6 kg/l void

## Important Product Tests:

KÖSTER IN 1: Tested for use in cold drinking water environments for sealing of large and small areas

KÖSTER IN 2: Tested for use in cold drinking water environments for sealing of large and small areas

KÖSTER IN 3: Compressive strength > 80 N/mm<sup>2</sup>, tensile strength > 14 N/mm<sup>2</sup>

KÖSTER IN 5: CE-certified and tested according to DIN-EN 1504-5

## KÖSTER Product Range

- 1 External basement waterproofing
- 2 Internal basement waterproofing
- 3 Horizontal barriers/  
Restoration of masonry
- 4 Crack and hose injection
- 5 Concrete protection and repair
- 6 Sealing of expansion joints
- 7 Bathroom and wet room waterproofing
- 8 Mould control
- 9 Floor coatings
- 10 Façade protection
- 11 Balcony and terrace waterproofing
- 12 Roof waterproofing
- 13 Water tank and reservoir waterproofing



KÖSTER BAUCHEMIE AG develops, produces, and supplies a comprehensive range of special construction materials in the areas of water-proofing and concrete repair. Founded in 1982 in Germany, the KÖSTER Group consists meanwhile of 24 companies which are represented in more than 50 countries. It is our policy to offer construction materials of the highest quality, durability and general performance.



*Service you can depend on*

*With our service and distribution network in many countries world-wide we can offer you professional advice and technical support immediately and on the spot. Your required waterproofing materials can be delivered promptly and will protect your property efficiently and lastingly.*

*For further information, please contact:*

**KÖSTER**  
Waterproofing Systems



DEUTSCHE  
BAUCHEMIE



KÖSTER BAUCHEMIE AG | Dieselstraße 1–10 | D-26607 Aurich | Germany  
Phone: +49 (4941) 9709-0 | Fax: +49 (4941) 9709-40 | [info@koster.eu](mailto:info@koster.eu) | [www.koster.eu](http://www.koster.eu)