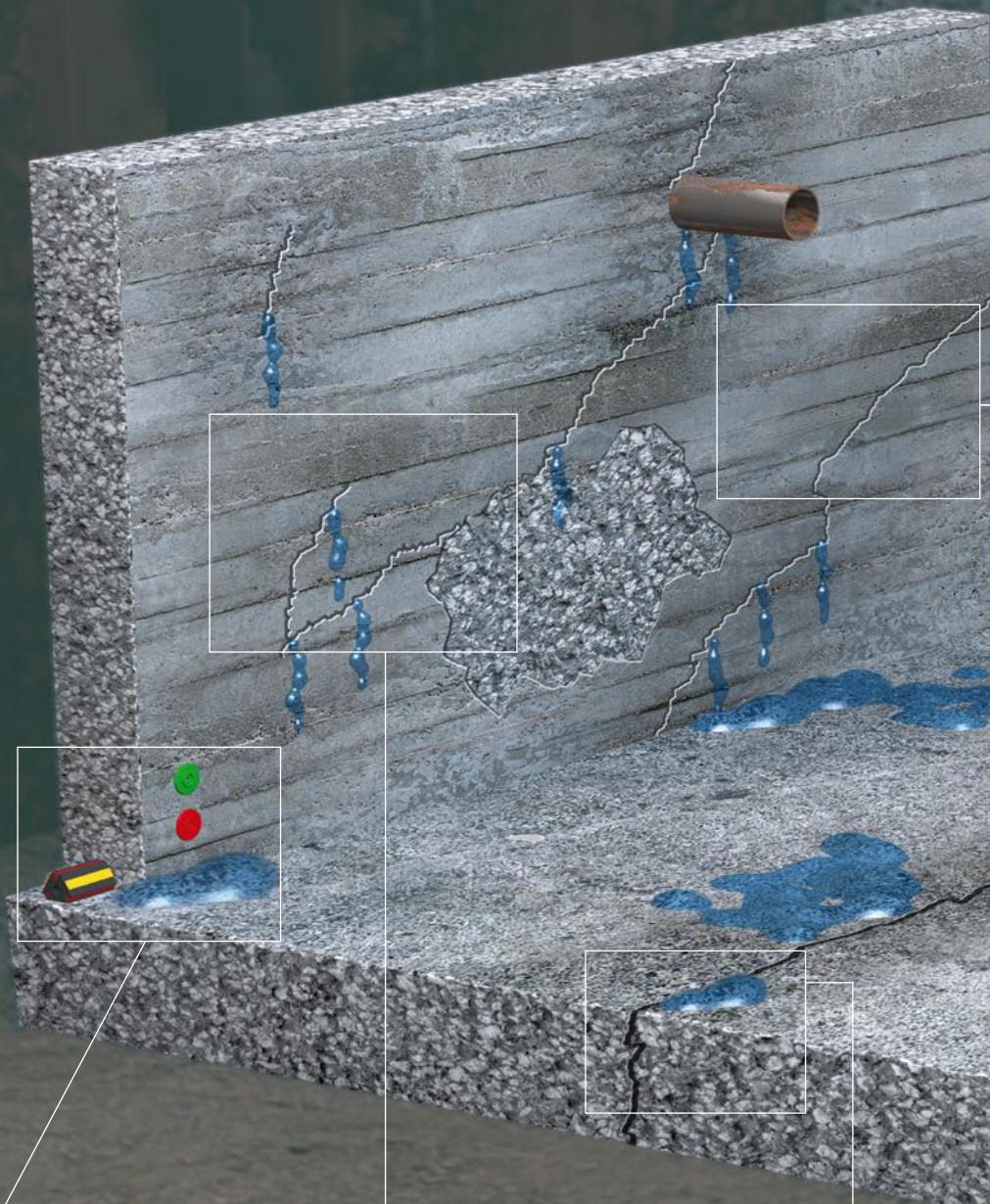


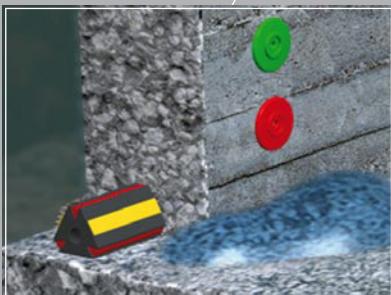


Sika® Injection Systems for Concrete Structures

Sika® Injection Systems for



Typical Problems in Concrete Structures



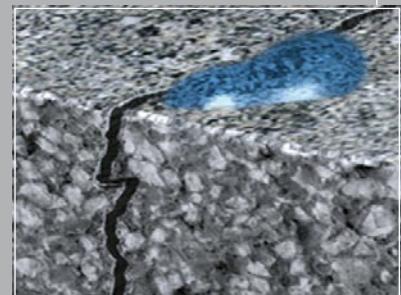
Waterproofing of Construction Joints

Sealing of construction joints in concrete structures



Surface Sealing of leaking Concrete Structures

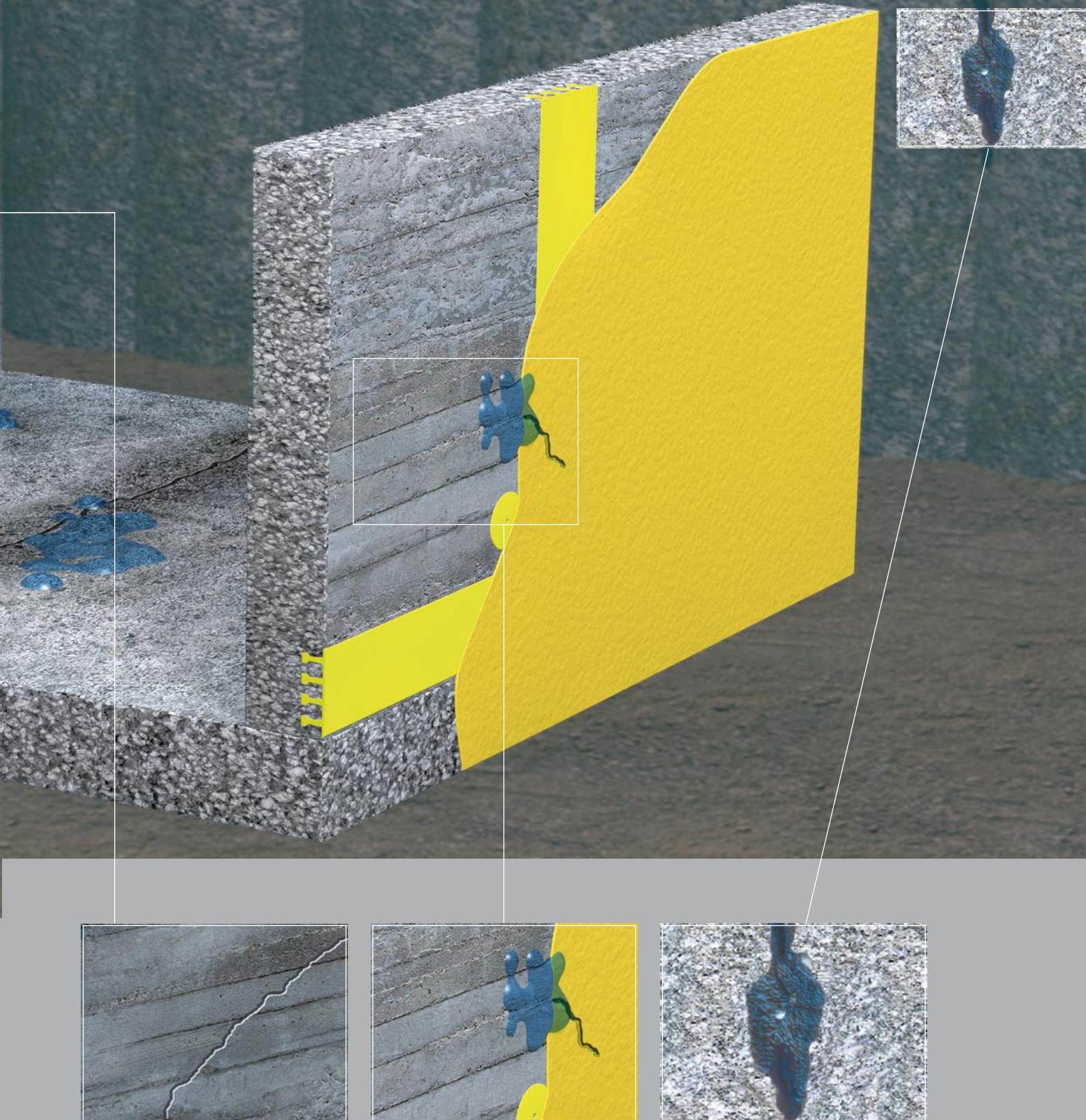
Remedial surface sealing by curtain injection of defects in underground building components.



Waterproofing of Cracks

Closing, sealing and flexible bridging of leaking cracks in new and existing structures.

Concrete Structures



Structural Crack of Void Repair

Bridging and filling of cracks and voids where structural strength is required.

Waterproofing of damaged Membranes

Repair by injection of damaged waterproofing membranes (single and double layer systems).

Waterproofing of Foundation Pits

Sealing of water-bearing cracks and joints in retaining walls of foundation pits.

The Sika® Injection Technology

Injection Material Parameters	Reasons	Injection System Requirements
Viscosity	<ul style="list-style-type: none"> ■ Better crack penetration due to low viscosity ■ Reduction of high injection pressure due to low viscosity 	<ul style="list-style-type: none"> ■ Different viscosities of injection resins for different crack widths (see table 1) ■ Low particle size of microfine binder for fine cracks
Expansion	<ul style="list-style-type: none"> ■ Better sealing result due to the self-injecting effect of expansion ■ Complete filling of fissures and voids ■ Low actual material consumption due to increased volume after expansion 	<ul style="list-style-type: none"> ■ Fast expansion ■ High foaming factor ■ Stable expansion with no shrinkage later during curing of the system ■ Temporary sealing due to high foaming factor
Reaction Time	<ul style="list-style-type: none"> ■ Short reaction times prevent washing out of the resin ■ Short waiting times during the works ■ Reaction only takes place when needed 	<ul style="list-style-type: none"> ■ Variable reaction times (see table 2) ■ No reaction takes place unless the resin is in direct contact with water or moisture
Potlife	<ul style="list-style-type: none"> ■ Long potlife means as pumpable as single component system 	<ul style="list-style-type: none"> ■ Variable potlife for different requirements (see table 3)
Flexibility	<ul style="list-style-type: none"> ■ Ability to accommodate limited movement 	<ul style="list-style-type: none"> ■ Long-term flexibility after curing ■ Permanent sealing
Adhesion/Bond	<ul style="list-style-type: none"> ■ Structural bonding of cracks ■ Better sealing due to good adhesion 	<ul style="list-style-type: none"> ■ Excellent adhesion ■ Full bond at contact surfaces ■ No shrinkage
Durability/Permanent Sealing	<ul style="list-style-type: none"> ■ High durability of the repaired structure ■ Little ageing ■ Permanent repair 	<ul style="list-style-type: none"> ■ No shrinkage with ageing ■ Long-term flexibility ■ Permanent sealing
Resistance	<ul style="list-style-type: none"> ■ High resistance to aggressive chemicals 	<ul style="list-style-type: none"> ■ Injection systems with high chemical resistance
Environmental Hazard/Toxicity	<ul style="list-style-type: none"> ■ Allows injection in ecologically sensitive environments ■ Non-toxic and non-hazardous in application 	<ul style="list-style-type: none"> ■ Solvent-free systems ■ Environmentally friendly raw materials ■ Systems tested for ground water contact



Sika's Injection Solution

Very low Viscosity

- Sika® Injection-201 RC
- Sika® Injection-201 CE
- Sika® Injection-29/-304/-305/-306

Low Viscosity

- Sika® Injection-101 RC/-105 RC
- Sikadur®-52 Injection
- Low Particle Size
- Sika® InjectoCEM-190

High and fast Expansion

- Sika® Injection-101 RC/-105 RC

Short and variable Reaction Times

- Sika® Injection-101 RC/-105 RC
- Sika® Injection-AC10/-AC20
- Sika® Injection-304/-305/-306

Long Potlife

- Sika® Injection-101 RC/-105 RC/-201 CE/-201 RC/-203
- Sika® Injection-29/-306
- Sikadur®-52 Injection
- Sika® InjectoCEM-190

Flexible

- Sika® Injection-105 RC/-201 CE/-201 RC/-203
- Sika® Injection-29/-306

High Flexibility

- Sika® Injection-304/-306

High Adhesion

- Sikadur®-52 Injection
- Sika® Injection-451
- Sika® Injection-201 CE/-201 RC/-203

High Durability

- Sika® Injection-201 CE/-201 RC/-203
- Sikadur®-52 Injection and Sika® Injection-451
- Sika® Injection-29/-304/-305/-306
- Sika® InjectoCEM-190

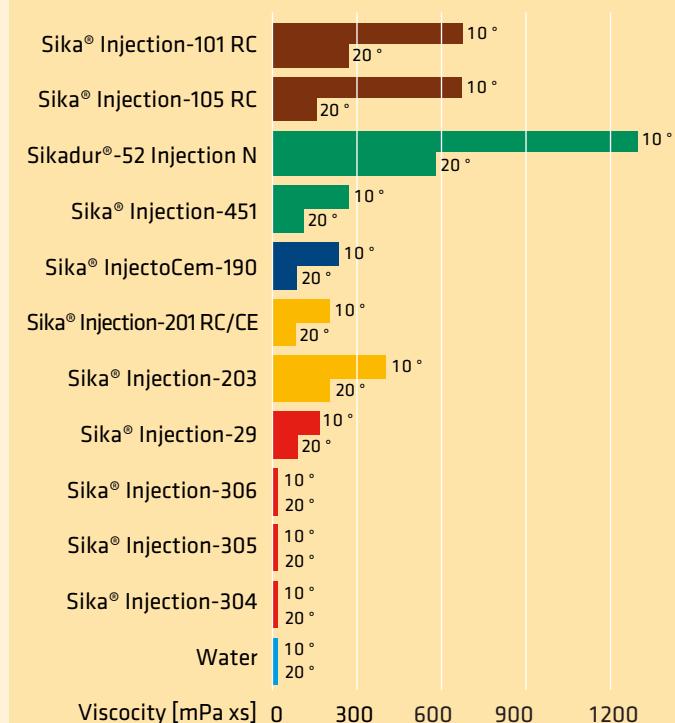
High Chemical Resistance

- Sika® Injection-201 CE/-201 RC/-203
- Sikadur®-52 Injection and Sika® Injection-451
- Sika® Injection-29/-304/-305/-306
- Sika® InjectoCEM-190

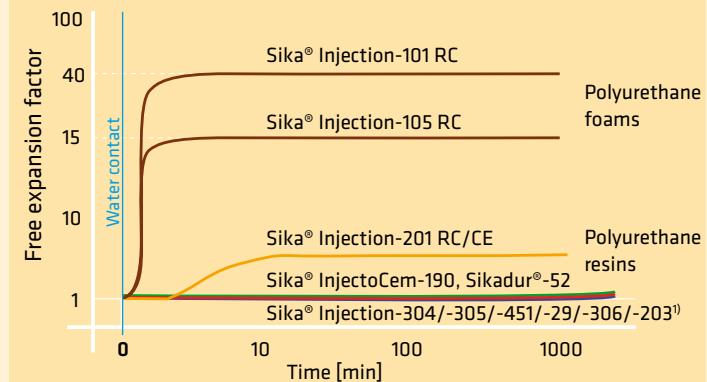
Environmentally friendly

- Sika® Injection-101 RC/-105 RC/-201 CE/-201 RC/-203
- Sikadur®-52 Injection and Sika® Injection-451
- Sika® Injection-29/-304/-306
- Sika® InjectoCEM-190

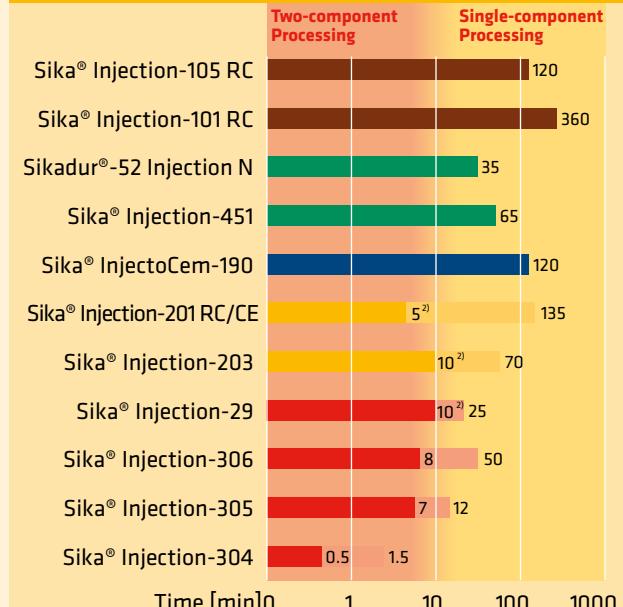
1. Viscosity of different Injection Materials at 10 °C and 20 °C



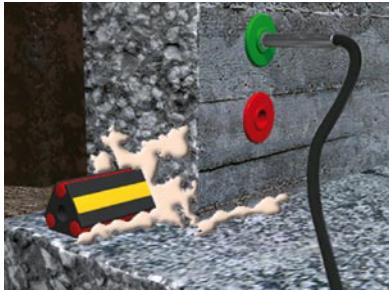
2. Free Expansion Factor of different Injection Materials



3. Potlife in Minutes of different Injection Materials at 20 °C



The Sika® Injection Systems for the



Waterproofing of Construction Joints

Sealing of construction joints in concrete structures

Sika® Injection-29 /-306

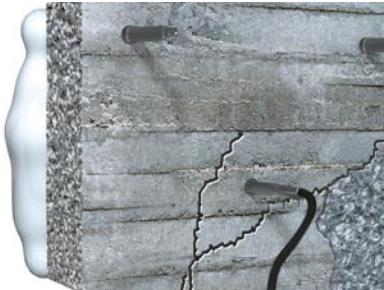
Low viscous, flexible and solvent-free polyacrylic injection resins with high solids content. They are used for the injection of the SikaFuko® Injection Hose Systems.

Sika® Injection-201 CE / RC1

Low viscous, flexible and solvent-free polyurethane injection resin for permanent waterproof sealing of cracks and construction joints. It forms, in contact with water, a uniform, closed and therefore watertight pore structure. The reaction time of Sika® Injection-201 RC/CE can be accelerated with Sika® Injection-AC20.

Sika® InjectoCem-190

Two-component injection grout for sealing and structural strengthening of cracks and construction joints, based on microcement with added admixtures and corrosion inhibitors. It is also used for the injection of the SikaFuko® Injection Hose System (Sika® Injectoflex).



Surface Sealing of leaking Concrete Structures

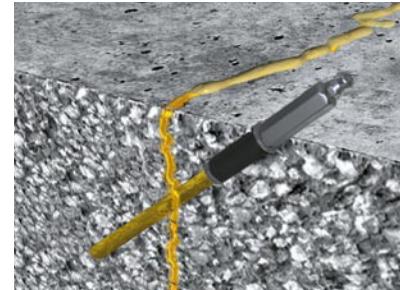
Remedial surface sealing by curtain injection of defects in underground building components

Sika® Injection-304

Flexible, very low viscous and very quickgelling polyacrylic injection gel for permanent watertight sealing of leaking surfaces. The material reacts to form a waterproof, flexible but solid gel with good adhesion to both dry and wet substrates.

Sika® Injection-306

Flexible, very low viscous polyacrylic injection resin for a permanent watertight sealing. A wide range of adjustable curing time allows an easy adaptation to current conditions.



Waterproofing of Cracks

Closing, sealing and flexible bridging of leaking cracks in new and existing structures

Sika® Injection-101 RC

Fast foaming, low viscous and solvent-free water-reactive polyurethane injection foam resin for temporary waterstopping. The material cures to a very dense hard-elastic foam with a very fine cellular structure. The reaction time of Sika® Injection-101 RC can be accelerated with Sika® Injection-AC10.

Sika® Injection-201 CE/RC¹

Low viscous, flexible and solvent-free polyurethane injection resin for permanent waterproof sealing of cracks and construction joints. It forms, in contact with water, a uniform, closed and therefore watertight pore structure. The reaction time of Sika® Injection-201 RC/CE can be accelerated with Sika® Injection-AC20.

Sika's Ecologically Advanced Inje

Sika® Injection systems have been tested by independent institutes with respect to the potential risks concerning water quality, working safety and toxicology. These tests give information on how the liquid materials i.e. immediately after injection, or the hardened /cured material affects the quality of water.

Sika® provides full environmental reports on Sika® Injection-101 RC / -105 RC / -201 CE / -201 RC / -203 / -304 / -29.

different Applications



Structural Crack and Void Repair

Bridging and filling of cracks and voids where structural strength is required

Sikadur®-52 Injection²⁾

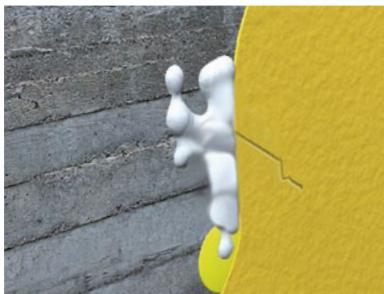
Low viscous, solvent-free, high strength epoxy resin for structural bonding of cracks and voids in dry and damp concrete structures.

Sika® Injection-451

Ultra low viscous, solvent-free, high strength epoxy resin for structural bonding of cracks and voids in dry and damp concrete structures.

Sika® InjectoCem-190

Two-component injection grout for sealing and structural strengthening of cracks and construction joints, based on microcement with added admixtures and corrosion inhibitors.



Waterproofing of damaged Membranes

Repair by injection of damaged waterproofing membranes (single and double layer systems)

Sika® Injection-305

Flexible, very low viscous and quickgelling polyacrylic injection gel for permanent watertight sealing of damaged membranes (single and double layer systems). The material reacts to form a waterproof, flexible but solid gel with good adhesion to both dry and wet substrates.

Sika® Injection-306

Flexible, very low viscous polyacrylic injection resin with a wide range of adjustable curing time is compatible to nearly all membrane materials.



Waterproofing of Foundation Pits

Sealing of water-bearing cracks and joints in retaining walls of foundation pits

Sika® Injection-105 RC

Fast foaming, low viscous and solvent-free water-reactive polyurethane injection foam resin for flexible waterproof sealing of leaking foundation pits. The material cures to a very dense flexible foam with a very fine cellular structure.

ction Systems

¹⁾ other formulation available (Sika® Injection-203) that is tested and approved according to ZTV-ING (RISS) and registered with the BASt-List

²⁾ other formulation available for underwater injection (Sikadur®-53)

Criteria for Selection of the Sika®

Selection Criteria for Injection Systems to be used in the Repair and Waterproofing of Concrete Structures:

1	Structural strengthening = S Durable elastic sealing = E Temporary sealing = T The rheological properties of the injection system and damaged concrete structures determine the most suitable application system.
2	Can accommodate movement after curing Non-elastic injection systems can cause subsequent cracking elsewhere.
3	Durable waterproof sealing Long-term effectiveness and reliable protection against ground water pressure.
4	Improvement in matrix quality The injection system strength is appropriate for repairs to weaker concrete and mortar.
5	Penetrates into fine cracks (e.g.>0.2 mm) The low viscosity of the injection material determines the crack penetration and reduces the injection pressure.
6	Not durable Suitable for temporary waterproofing against water under pressure.
7	Reacts only in contact with water The reaction only takes place when needed.
8	For watertight compartment injection Repair by injection of waterproofing membranes (single and double layer systems).
9	Pumpable as a single component system Injection systems with long potlives (>20 min) can be pumped with a single-component pump.
10	Only suitable for low pressure injection (<10 bar) Low injection pressure prevents separation of microfine cement suspensions.
11	Drinking water approval Allows injection in ecologically sensitive environments.
12	Can be accelerated Acceleration of the reaction time reduces waiting times during works (especially at cold temperatures) and prevents washing out of the resin.



The free expansion rate of **Sika® Injection-101 RC** is up to 40 times.



Due to the low viscosity of **Sika® Injection-201 RC/CE** it can penetrate into cracks >0.2 mm in width.



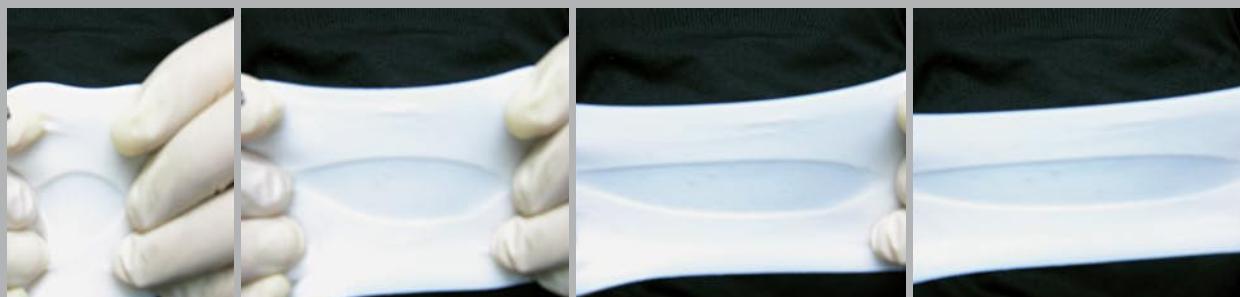
Sikadur®-52 Injection achieves a strength of up to 50 N/mm².



Injection System

Polyurethane Foams		Polyurethane Resins	Epoxy Resins		Polyacrylate Resins/Gels				Microfine Binders
Sika[®] Injection-101 RC*	Sika[®] Injection-105 RC	Sika[®] Injection-201 CE/-201 RC/-203 *	Sikadur[®]-52 Injection	Sika[®] Injection-451*	Sika[®] Injection-29	Sika[®] Injection-304	Sika[®] Injection-305	Sika[®] Injection-306	Sika[®] InjectoCam-190
T	T	E	S	S	E	E	E	E	S
	X	X			X	X	X	X	
		X	X	X	X	X	X	X	X
		X	X	X					X
X	X	X	X	X	X	X	X	X	X
X	X								
X	X					X	X	X	
X	X	X	X	X	X			X	X
		X							X
X	X	X			X	X			

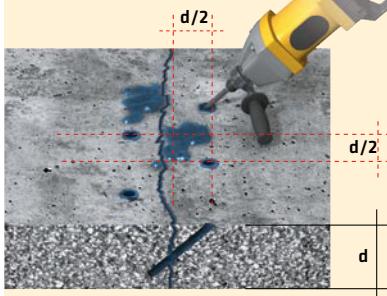
* *tested and approved by ZTV-Ing.



Sika[®] Injection-304 reacts to form a waterproof, flexible but solid polyacrylic gel.

Application of the Sika® Injection

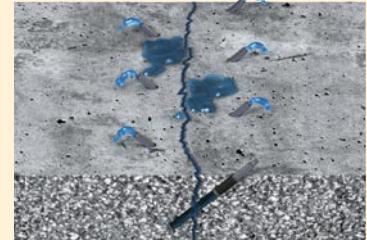
Crack Injection with Mechanical Packers



1. Drill packer holes at a 45° angle to the concrete surface as shown in the figure. of drill hole = of packer + 2 mm.



2. Install the mechanical packers. Tighten the mechanical packers so that they can withstand the maximum injection pressure.

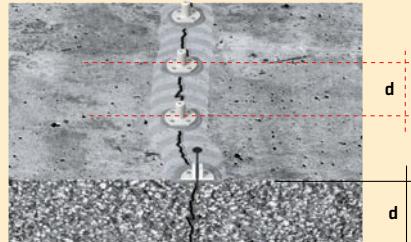


3. Fix the non-return valve on the first packer and start the injection process.

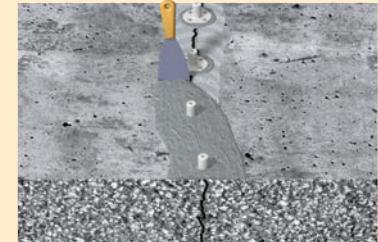
Crack Injection with Surface Packers



1. Prepare the substrate by blast cleaning or mechanically by grinding etc., then clean by brush and vacuum.

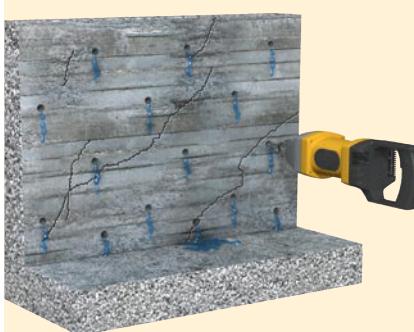


2. Place a steel nail through the packer into the crack to prevent the injection canal from being blocked by the Sika® Injection-490 adhesive and then install the surface packers as shown in the figure.

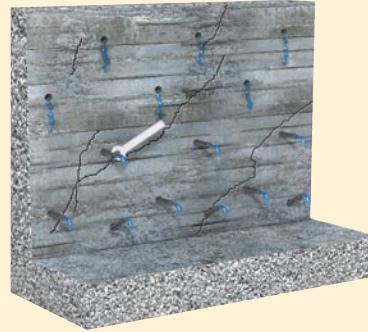


3. Patch the surface of the crack with Sika® Injection-490. Ensure that the packer and the crack on the surface are fully covered by the adhesive filler.

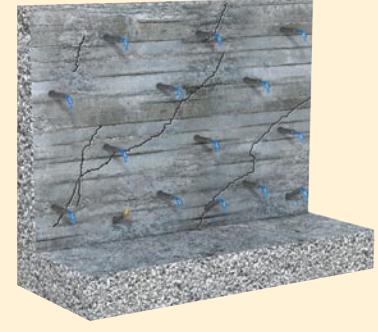
Curtain Injection



1. Drill holes for the mechanical packers through the leaking building component at a distance of 30 - 50 cm apart as shown in the figure.



2. Install the mechanical packers. Tighten the mechanical packers so that they can withstand the maximum injection pressures.



3. Fix the button head (non-return) fittings on the first packer and start the injection process at the lowest row of drill holes.

Systems



4. When the injection material flows out of the second packer during the injection process, fix the non-return valve on it as quick as possible. Stop injection at the first packer and continue at the second packer.

5. Repeat this procedure from packer to packer.

6. If necessary, a secondary injection procedure is carried out to ensure the crack is completely filled and sealed.



4. As soon as the adhesive has cured, remove the nail and fix the button head fittings (non-return) on the first packer and start the injection process.

5. Continue the injection procedure as for crack injection with mechanical packers (points 4, 5 and 6).



4. When the injection material flows out of the second packer during the injection process, fix the non-return valve on it as quickly as possible. Stop injection at the first packer and continue at the second packer.

5. Continue the injection procedure as for crack injection (points 5 and 6).

Important Notes for the Application of Sika Injection Systems:

- Make sure that there is no drainage pipe in or behind the surface
- Always start injection with low pressure

- The surfaces of voids and cracks need to be clean
- Always work by injecting from the bottom to the top

Injection Pumps and Packers for

Injection Equipment for Sika® Injection Resins and Microfine Cement Suspension

Single-component Pumps for Polyurethane, Polyacrylate and Epoxy Resins

Sika® single-component injection pumps are universal injection devices suitable for a wide range of applications. They are designed for professional use in crack and SikaFuko® Injecton Hose System (Sika® Injectoflex). Sika® Injection Pump EL-1, EL-2, Hand-1 and Hand-2 are suitable for Sika polyurethane, epoxy and polyacrylate resins.



Two-component Pumps for Polyacrylate Gels

Sika® Injection Pump PN-2C is specially designed for curtain injection. A two-component pump is required for these fast reacting polyacrylate gels. The individual components are introduced to the mixing head separately. The actual mixing process takes place in a static mixer located in the mixing head.



Mixing and Pumping Equipment for Microfine Cement Suspension

The colloidal mixer Sika® Injection Mixer C-1 is needed for the complete and thorough mixing of Sika® microfine cement suspensions. Sika® Injection Pump MFC-1 is used for the pumping of Sika® microfine cement suspensions. It provides continuous pumping without separation of the suspension.



Vacuum Pump

The Vacuum Pump is an important tool for the SikaFuko® Injection Hose Systems and is needed for cleaning the injection hose after the injection with an acrylat gel or a microfine cement to enable the system for further injection.



Sika Injection Pump/Mixer	Polyurethane Foams	Polyurethane Resins	Epoxy Resins	Polyacrylate Resins/Gels	Microfine Binders
	Sika® Injection-101 RC/-105 RC	Sika® Injection-201 RC/201 CE/-203	Sikadur® 52 Injection-Sika® Injection-451	Sika® Injection-29	Sika® InjectoCem-304/-305
EL-1/-2	X	X	X	X	X
Hand-1/-2	X	X	X	X	
PN-2C				X	X
C-1					X
MFC-1					X
Vacuum Pump				X	X
Equipment Cleaning	Sika® Colma® Cleaner			Water	

Sika® Injection Materials

Sika® Injection Packers for different Applications

Sika® Injection Packers are filler necks used as connection pieces between the injection pump and the structure. Sika provides a full range of injection packers. There are two different types of packers:

Mechanical Packers

for high and low pressure injection where hole drilling is possible



Surface Packers

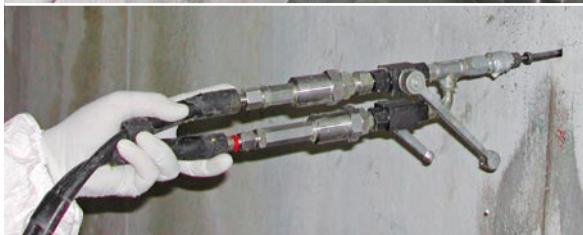
for low pressure injection, where drilling is not possible



		Sika® Injection Packer			
		Mechanical			Surface
Application	Concrete Quality	Injection Pressure	MPS	MPR ¹	MPC ²
Crack and Void Injection	Drilling not possible (steel reinforcement)	1 - 10 bar			
	Good and poor quality (drilling possible!)		X	X	X
SikaFuko® Swell			X ³	X ³	X ³
Curtain Injection				X ⁴	
Crack and Void Injection	Good and poor quality (drilling possible!)	10 - 200 bar	X	X	
SikaFuko® Swell			X ³	X ³	

¹ Recommended for high pressures and high flow rates ² Specially designed for injection with microfine binders ³ Just 13 mm diameter ⁴ Only with button head (non-return) fitting

Case Studies



Surface Sealing of a Leaking Shaft

Problem

An inadequate waterproofing system had been selected for a concrete shaft standing in groundwater. Water was infiltrating the shaft from several construction joints and damaging the electrical installations.

Injection Material Requirements

- Very fast reacting injection material
- Able to form a new permanent watertight sealing surface
- Environmentally friendly

Sika Solution

Curtain injection with

- Fast reaction polyacrylate gel Sika® Injection-304

Injection Equipment

- Sika® Injection Pump PN-2C and
- Sika® Injection Packer MPR with button head fittings

Sealing of Cracks in a Basement

Problem

A basement garage which is built up of watertight concrete with waterbars, suffered settlement cracks in the structure after construction. Water was infiltrating because the garage was exposed to groundwater pressure.

Injection Material Requirements

First phase:

- Fast foaming injection foam
- Reacts only in contact with water

Second phase:

- Low viscosity
- No shrinkage in subsequent dry conditions
- Good adhesion to concrete
- Environmentally friendly and chemically resistant

Sika Solution

Crack injection with

- Fast reacting polyurethane foam
- Sika® Injection-101 RC for temporary waterstopping
- Elastic polyurethane resin Sika® Injection-201 RC for permanent waterproof sealing

Injection Equipment

- Sika® Injection Pump EL-2 and
- Sika® Injection Packer MPS



Sealing of Damaged Membranes in an Open-cut Tunnel

Problem

An open-cut tunnel below groundwater level was sealed with sheet waterproofing membranes and waterbars. Damage occurred during the construction period and went unnoticed until the tunnel began leaking. Fortunately the damage location was easily identified as the membrane and waterbars were formed into compartments.

Injection Material Requirements

First phase:

- Permanently elastic
- Able to form a new permanent watertight sealing surface
- Gel time able to be adapted to the specific requirements
- Capable of reversibly absorbing (swelling) and releasing (shrinking) moisture

Sika Solution

Compartment injection through injection pipes with

- polyacrylate gel Sika® Injection-305

Injection Equipment

- Sika® Injection Pump PN-2C and
- Sika® Injection Packer MPR with button head fittings



Structural Crack Repair of a Bridge

Problem

Cracks with the potential to become a problem for the structural integrity occurred in the support piers of a motorway bridge due to the dynamic loads.

Injection Material Requirements

- Different low viscosities for different crack widths
- High mechanical and adhesive strengths
- Suitable for both dry and damp substrate conditions

Sika Solution

Crack injection with

- Low viscous epoxy resin Sikadur®-52 Injection for cracks > 0.3 mm
- Ultra low viscous epoxy resin Sika® Injection-451 for cracks 0.1 – 0.3 mm
- Epoxy patching material Sika® Injection-490

Injection Equipment

- Sika® Injection Pump EL-2 and
- Sika® Injection Packer SP

SIKA WORLDWIDE



- - 5 Continents
- - Subsidiaries in over 101 countries
- - Manufacture in over 300 factories
- - More than 24,000 employees

KwaZulu-Natal
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Gauteng
Tel: +27 11 573 4940

Bloemfontein
Tel: +27 51 430 0333

Western Cape
Tel: +27 21 555 0755

Eastern Cape
Tel: +27 41 453 2813

Zululand
Tel: +27 35 797 3814

Namibia
Tel: +264 6125 9092

Botswana
Tel: +267 311 2773



Consult most current
local Product Data Sheet prior to any use.
www.sika.co.za