Sika® Injection Systems for Concrete Structures
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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.

Structural Crack and Void Repair
Bridging and filling of cracks and voids where structural strength is required.
# The Sika® Injection Technology

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<th>Injection Material Parameters</th>
<th>Reasons</th>
<th>Injection System Requirements</th>
<th>Sika’s Injection Solution</th>
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</table>
| Viscosity                    | Better crack penetration due to low viscosity | Different viscosities of injection resins for different crack widths (see table 1) | Low Viscosity: 
Sika® injection-201 
Sika® injection-25-304 |
|                             | Reduction of high injection pressure due to low viscosity | Low particle size of moisture binder for fine cracks |
| Expansion                    | Better sealing result due to the self-injecting effect of expansion | Fast expansion, High flowability, Stable expansion with no shrinkage after curing of the system, Temporary sealing due to high flowability factor |
|                             | Complete filling of fissures and voids | High and fast Expansion: 
Sika® injection-101 |
|                             | Low actual material consumption due to increased volume of other expansion | |
| Reaction Time                | Short reaction times prevent washing out of the resin | Variable reaction times (see table 2): No reaction takes place unless the resin is in direct contact with water or moisture |
|                             | Short reaction times during the works | Short and variable Reaction Times: 
Sika® injection-101 
Sika® injection-AC100-AC200 
Sika® injection-304 |
|                             | Reaction only takes place when needed | Long Potlife | Sika® injection-101-201 
Sika® injection-29 
Sika® injection-52 Injection |
| Potlife                      | Long potlife means as pumpable as single component system | Variable potlife for different requirements (see table 3) | Sika® injection-101-201 
Sika® injection-29 
Sika® injection-304 |
| Flexibility                  | Ability to accommodate limited movement | Long-term flexibility after curing, Permanent sealing | Flexible |
|                             | | | Sika® injection-201 |
| Adhesion/Bond                | Structural bonding of cracks | Excellent adhesion, Full bond at contact surfaces, No shrinkage | High Adhesion: 
Sika® injection-52 Injection 
Sika® injection-201 |
| Durability/Permanent Sealing | High durability of the repaired structure | No shrinkage with ageing, Long-term flexibility, Permanent sealing | High Durability: 
Sika® injection-201 
Sika® injection-52 Injection |
|                             | Little ageing | Sika® injection-52 Injection 
Sika® injection-101-201 |
|                             | Permanent repair | |
| Resistance                   | High resistance to aggressive chemicals | Injection systems with high chemical resistance | High chemical Resistance: 
Sika® injection-201 
Sika® injection-52 Injection |
|                             | | | Sika® injection-25-304 
Sika® injection-101-201 |
| Environmental Hazard/Toxicity | Allows injection in ecologically sensitive environments, non-toxic and non-hazardous in application | Ecocompatible systems, Environmentally friendly raw materials, Systems tested for ground water contact | Ecocompatible systems, 
Sika® injection-101-201 
Sika® injection-52 Injection |
|                             | | | Sika® injection-25-304 
Sika® injection-101-201 |
The Sika® Injection Systems for the different Applications

Waterproofing of Construction Joints
Sealing of construction joints in concrete structures
Sika® Injection-201
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 can be accelerated with Sika® Injection-AC20.
Sika® InjectoCom-100
Two-component injection grout for sealing and structural strengthening of cracks and construction joints, based on micro cement with added admixtures and corrosion inhibitors. It is also used for the injection of the Sika® InjectoFlex Base System.

Surface Sealing of leaking Concrete Structures
Remedial surface sealing by curing injection of defects in underground building components
Sika® Injection-304
Flexible, very low viscous and very quick-setting polyurethane 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.

Waterproofing of Cracks
Curing, sealing and flexible bridging of leaking cracks in new and existing structures
Sika® Injection-101
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 can be accelerated with Sika® Injection-AC10.
Sika® Injection-201
Low viscous, flexible and solvent-free polyurethane injection resin for permanent waterproofing 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 can be accelerated with Sika® Injection-AC20.

Structural Crack and Void Repair
Bridging and filling of cracks and voids where structural strength is required
Sikadur®-52 Injection
Low viscous, solvent-free, high strength epoxy resin for structural bonding of cracks and voids in dry and damp concrete structures.
Sika® InjectoCom-100
Two-component injection grout for sealing and structural strengthening of cracks and construction joints, based on micro cement with added admixtures and corrosion inhibitors.

* other formulation available (Sika® Injection-201) that is tested and approved according to EN 14686 (RES) and registered with the Sika-List

Sika’s Ecologically Advanced Injection Systems

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 final injection gel) behave in water. 
Criteria for Selection of the Sika® Injection Systems

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

1. Structural strengthening = S
2. Durable elastic sealing = E
3. Temporary sealing = T
4. Can accommodate movement after curing
5. Non-elastic injection systems can cause subsequent cracking elsewhere.
6. Durable waterproof sealing
7. Not durable. (The injection material determines the curing penetration and reduces the injection pressure)
8. Suitable for temporary waterproofing against water under pressure.
9. Reacts only in contact with water
10. For water tight compartment injection
11. Pumpable as a single component system
12. Only suitable for low pressure injection (<10 bar)
13. Can be accelerated

<table>
<thead>
<tr>
<th></th>
<th>Polyurethane Resins</th>
<th>Polyurethane Resins</th>
<th>Epoxy Resins</th>
<th>Epoxy Resins</th>
<th>Polyurethane Resins/Cement</th>
<th>Microfine Binder</th>
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<tbody>
<tr>
<td>Sika® Injection-101</td>
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Notes:
- Sika® Injection-101 can be used as temporary sealing prior to injecting Sika® Injection-201 for permanent sealing.

The fine expansion rate of Sika® Injection-101 is up to 60 times.

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

Sikadur®-52 Injection achieves a strength of up to 60 MPa/mm.

Sika® Injection-300 reaches a flexible, waterproof, flexible #1 solid polyurethane.
Application of the Sika® Injection Systems

Crack Injection with Mechanical Packers

1. Drill packer holes at a 45° angle to the concrete surface as shown in the figure. D of drill hole ≤ 1/3 of packer + 2 mm.

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

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

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. 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.

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 crack into the crack to prevent the injection cement from being blocked by the Sika® Injection-400 adhesive and then install the surface packers as shown in the figure.

3. Polish the surface of the crack with Sika® Injection-400. Ensure that the packer and the crack on the surface are fully covered by the adhesive filler.

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 1 to 5).

Curtain Injection

1. Drill holes for the mechanical packers through the leaking building component at a distance of 20–34 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.

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 1 to 5).
Injection Pumps and Packers for Sika® Injection Materials

Injection Equipment for Sika® Injection Resins and Microfine Cement Suspension

Single-component Pumps for Polyurethane, Polyacrylate and Epoxy Resins

Two-component Pumps for Polyacrylate Gels

Mixing and Pumping Equipment for Microfine Cement Suspension

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

Injection Packets

<table>
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<tr>
<th>Application</th>
<th>Concrete Quality</th>
<th>Injection Pressure</th>
<th>Mechanical</th>
<th>Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crack and Void Injection</td>
<td>Drilling not possible (Steel reinforcement)</td>
<td>1 – 10 bar</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Injectivity Injection</td>
<td>Good and poor quality (drilling possible!)</td>
<td>X'</td>
<td>X'</td>
<td>X'</td>
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<tr>
<td>Curtain Injection</td>
<td>Good and poor quality (drilling possible!)</td>
<td>10 – 200 bar</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Crack and Void Injection (drilling possible!)</td>
<td></td>
<td></td>
<td>X'</td>
<td>X'</td>
</tr>
</tbody>
</table>

*Recommended for high pressure and high flow rate. **Specials designed for injections with microfiber fabrics. --- 1/2 inch diameter. --- 1/4 inch with button head/screw end fitting.

Sika Injection Pump/Mixer

<table>
<thead>
<tr>
<th>Sika Injection Pump/Mixer</th>
<th>Polyurethane Resin</th>
<th>Polyacrylate Resin</th>
<th>Epoxy Resin</th>
<th>Polyacrylate Resin/Gels</th>
<th>Microfine Cement Suspension</th>
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<tr>
<td>E-1/-2</td>
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<td>X</td>
<td>X</td>
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<td>Hand-E-1/-2</td>
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<tr>
<td>C-1</td>
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<td>X</td>
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<tr>
<td>MFC-1</td>
<td></td>
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</table>

Equipment Cleaning

<table>
<thead>
<tr>
<th>Equipment Cleaning</th>
<th>Sika® Thinner C</th>
<th>Water</th>
</tr>
</thead>
</table>

Sika®
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 curing injection material
- Able to form a new permanent watertight sealing surface
- Environmentally friendly

Sika Solution
Curtain injection with
- Fast reaction polyurethane gel Sika® Injection-304

Sealing of Cracks in a Basement

Problem
A basement garage which is built up of watertight concrete with watertanks, 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
- Resists 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 for temporary waterproofing
- Elastic polyurethane resin Sika® Injection-201 for permanent waterproof sealing

Sealing of Damaged Membranes in an Open-cut Tunnel

Problem
An open-cut tunnel below groundwater level was sealed with sheet waterproofing membranes and watertanks. 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 watertanks were formed into compartments.

Injection Material Requirements
- Permanently elastic
- Able to form a new permanent watertight sealing surface
- Gel time able to be adapted to the specific requirements
- Biodegradable, non-toxic, non-harming (swelling) and releasable (shrinkage) moisture

Sika Solution
Compartment injection through injection pipes with:
- Polyurethane gel Sika® Injection-304

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
Sika® Injection Systems for Concrete Structures

Sika is a globally active company in the specialty and construction chemicals business. It has subsidiary manufacturing, sales and technical support facilities in over 70 countries around the world. Sika is THE global market and technology leader in waterproofing, sealing, bonding, dampening, strengthening and the protection of buildings and civil engineering structures. Sika has approx. 12000 employees worldwide and is therefore ideally positioned to support the success of its customers.

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