Crack Injection

with polymeric filling material & mineral material

Referent: Bernd Kress / DESOI GmbH

Structure

- Technical rules
- Causes of cracks, types of cracks
- Fillers for crack injection
- Procedure for crack repair
- Injection devices, injection packers
- Control and documentation

Technical rules

1. Series of standards DIN EN 1504
   Products and systems for the protection and repair of concrete structures

2. National regulations are gradually being replaced:

- RiLi-SIB Protection and repair of concrete components of the German Committee for Reinforced Concrete (DAfStb)
- ZTV-ING (Part 3, solid construction) Additional technical contract conditions and guidelines for civil engineering

3. DIN V 18026, surface protection systems for concrete made from products according to DIN EN 1504-2; Edition 06.2006

4. DIN V 18028, crack fillers according to DIN EN 1504-5; Edition 06.2006

Technical rules

Series of standards DIN EN 1504

The aim is…
... to remove damage from cracks, cavities and defects in concrete components by:

- Establishing the tightness, in particular the water tightness
- Corrosion protection of the reinforcement by preventing the penetration of aggressive substances
- Increasing the load-bearing capacity of the concrete through force-fit reinforcement

Technical rules - ReaCH

Substances that can be used according to the European Chemicals Regulation

REACH compliant filler

- Environmentally friendly in production
- Health-friendly during installation
- Environmentally friendly in use
- Sustainable and environmentally friendly - reusable (construction waste)

Application adhesive packer

You can find the video on our website at **www.desoi.de/catalog/de/service/mediathek/videos/**

Object examples

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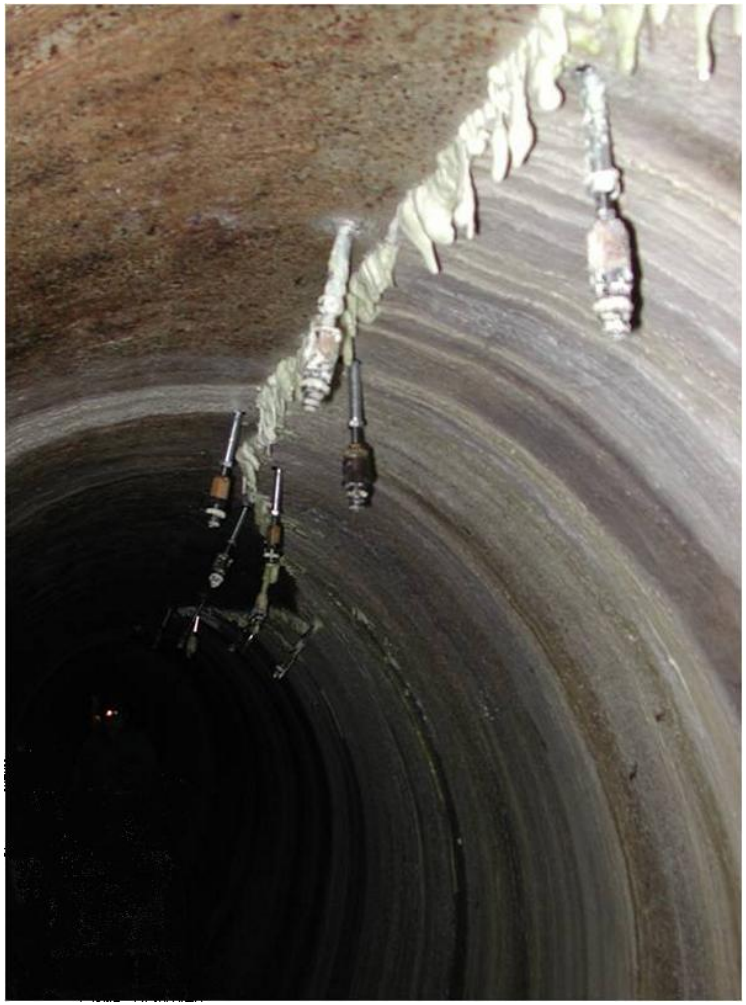
Object examples



Dock in Meyer Werft densified

In the foundation of the building dock, the cracks through which moisture penetrates are clearly visible

Dock in Meyer Werft densified

Injection of polyurethane through the previously set packers

Causes of cracks

Experience shows that cracks usually have several causes:

- incomplete or incorrect load assumptions,
- Improper reinforcement position and guidance
- Insufficient concrete cover, reinforcement corrosion
- Cracks as a result of shrinkage processes
- Insufficient reduction in heat of hydration

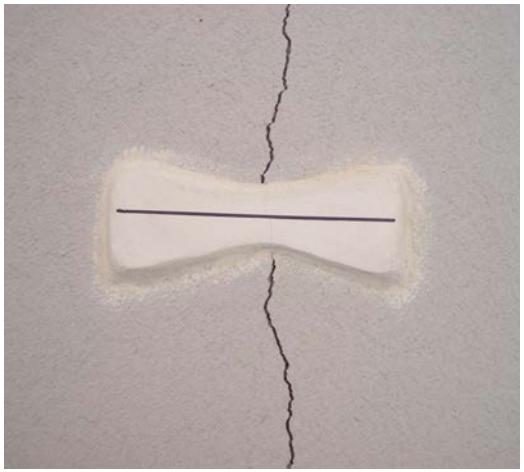
Examine cracks

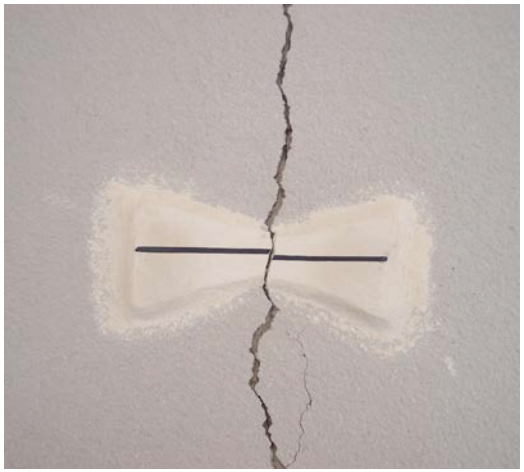
General information about the investigation

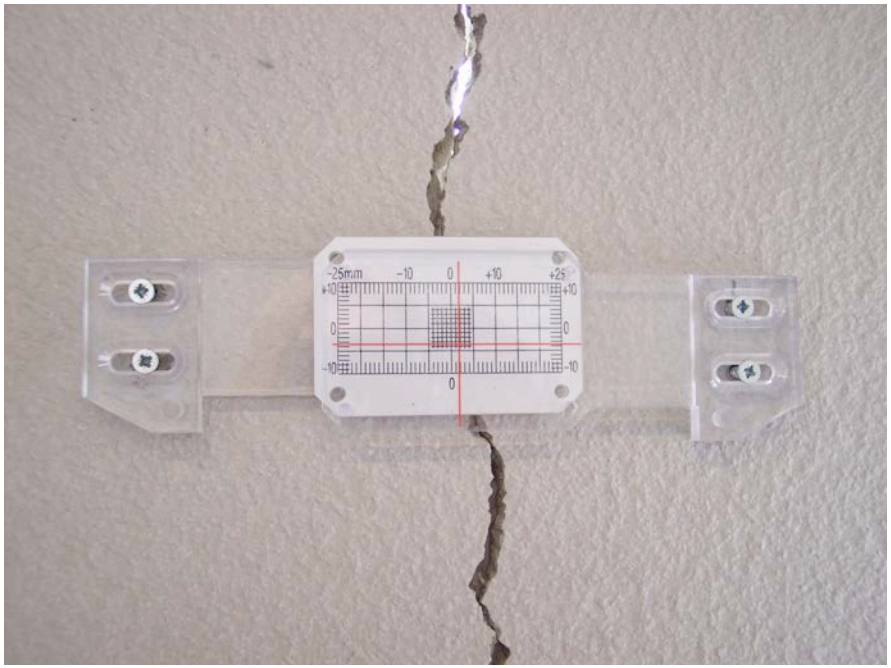
- Is the cause of the crack still present?
- Examination of the construction plans and statics
- Establish property inspection and any special features when creating the structure (quality assurance documents)
- Analysis of crack patterns and photographic documentation

Examine cracks

Gypsum or glass „tell tales“indicate whether crack is static or dynamic

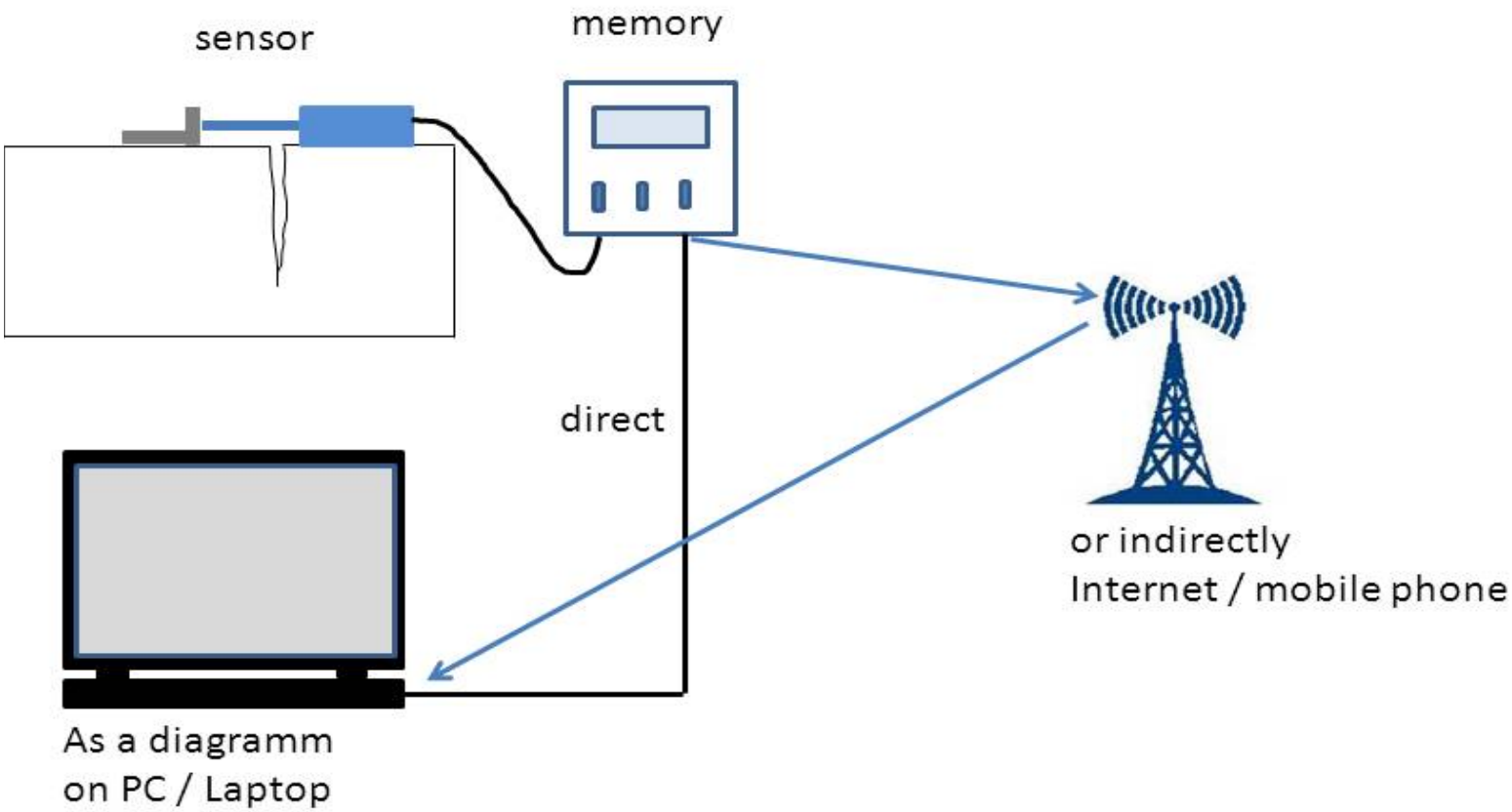






Examine cracks

Crack measuring methods



Objecties of Filling of cracks and voids by Injection

- **Closing**

  Cracks & voids to prevent the penetration of sustances promoting or initiating corrosion

- **Sealing**

  Of leaks from cracks & voids

- **Flexible sealing**

  Across crack flanks as in expansion joints

- **Structural**

  Creating a connection between sides of cracks and voids to reinstate structural integrity

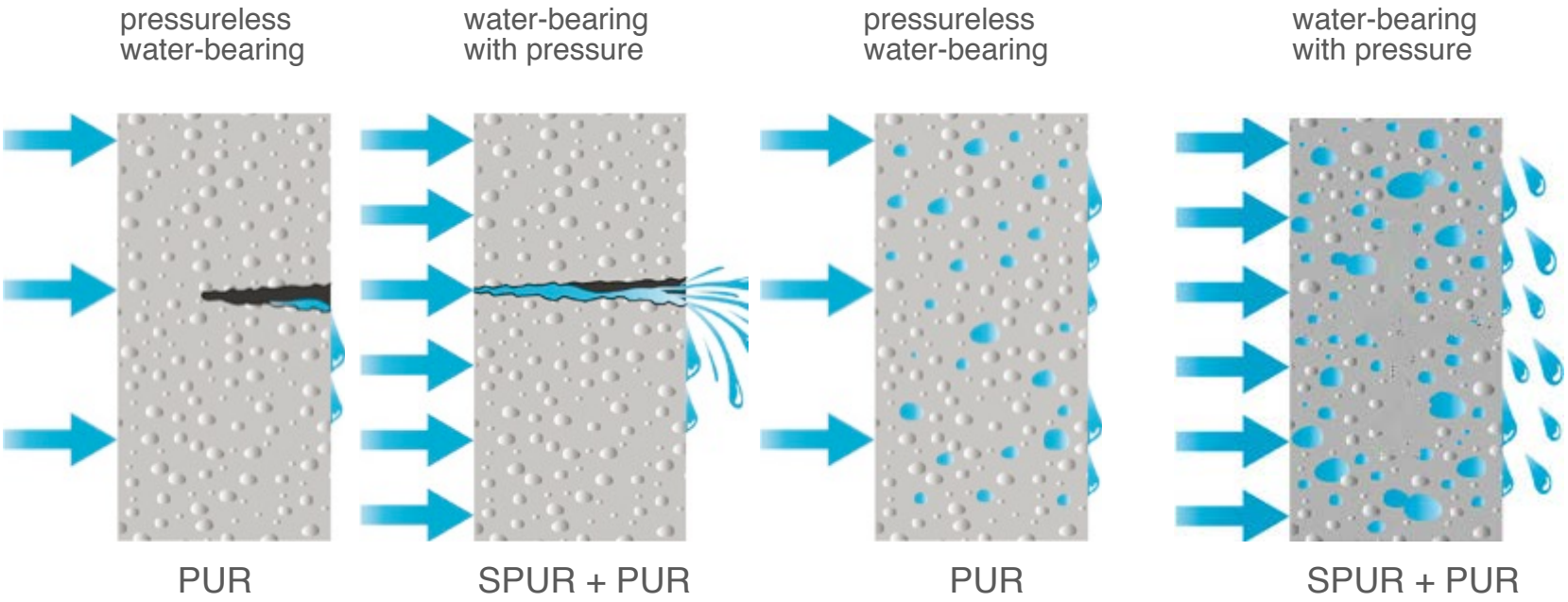
Conditions for success

- Accurate preliminary assessments
- Detailed planning
- Injection project
- Core drilling
- USPV?
- Qualified technicians
- etc…

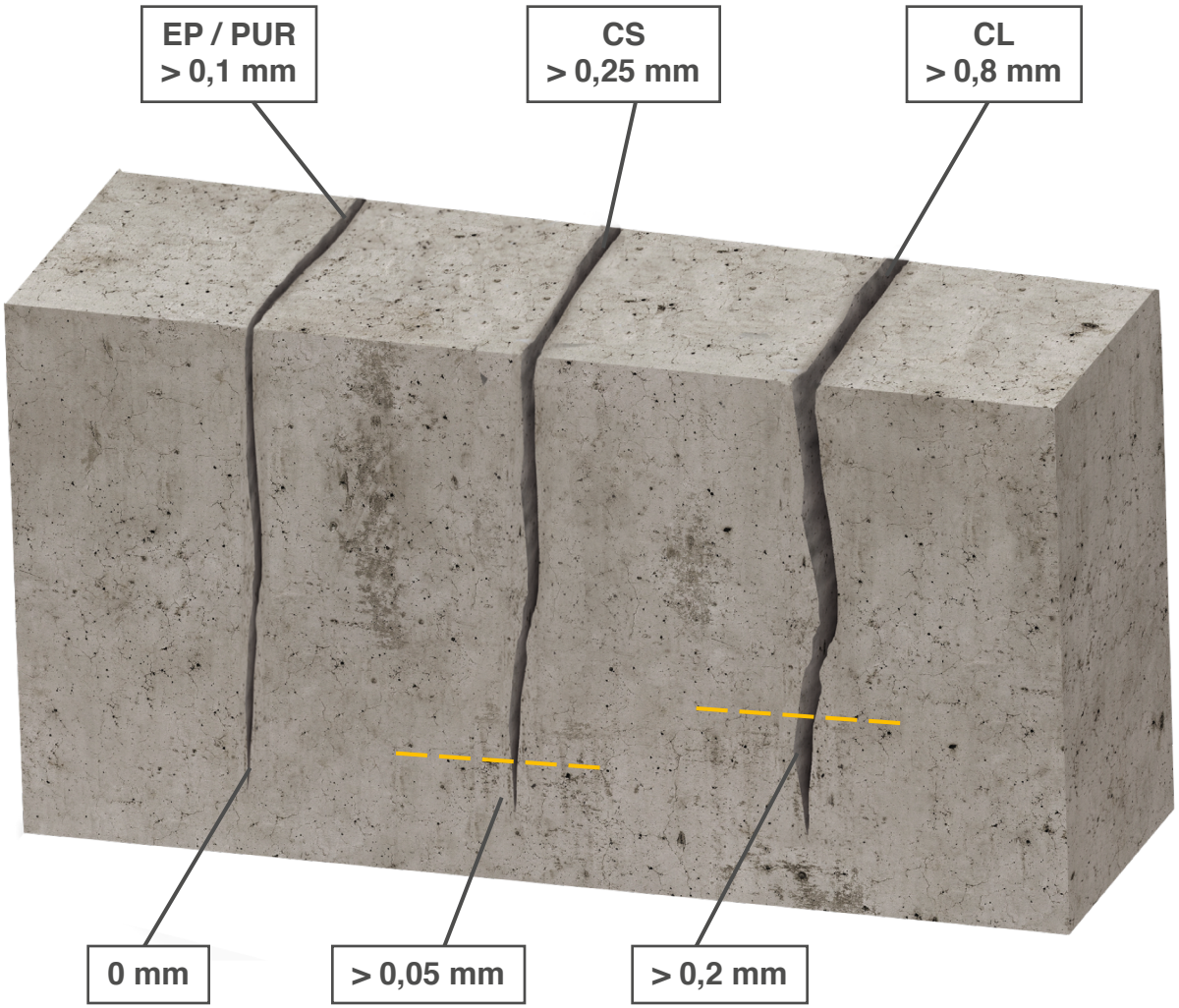
- or

Injection decision

depending on the structural disorders



Injection materials



Materials for Crack Injection

Polyurethane resin (PUR/SPUR)

- Two component, solvent free, low viscosity
- Very fast reacting pu to seal high volume water leaks
- Polyurethane builds a foam in contact with water, SPUR is not stable (may have to be reinjected with PUR)
- Modern polyurethanes can be used to seal cracks and make structural repairs, as well as fill hollows and voids

Materials for Crack Injection

Cement paste / Cement suspension (CP/CS)

- Cement suspensions are classified by particle size
- Injection cement must not shrink after application and during curing
- Injection cement provides an alkaline environment thus inhibiting steel corrossion

Materials for Crack Injection

Epoxy resin (EP)

- Two component, solvent free and low viscosity
- Complete curing in the crack and creates a structural seal
- Normaly used in dry cracks
- Very good penetration

Materials for Crack Injection

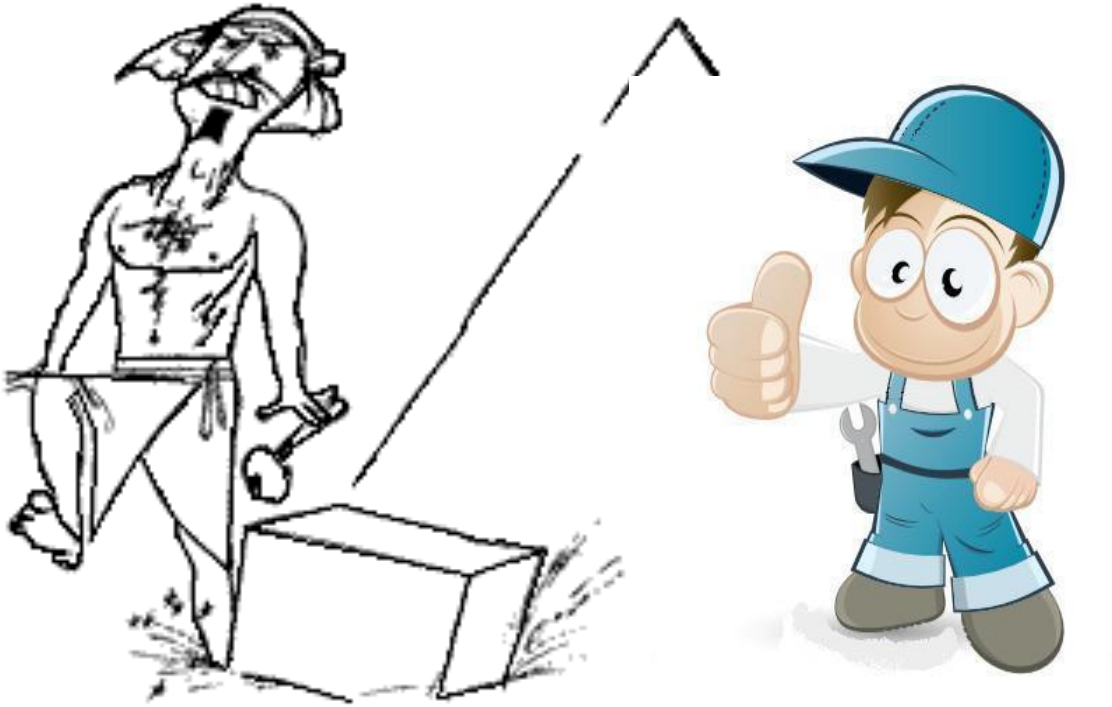
Acrylic gel (AY)

- Multi-component hydrostructure resins
- The material is swelling by absorbing water
- Good sealing due to the swelling pressure
- The swelling process is reversible
- Very low viscosity

Protection before start

Personal protective clothing

- Safety goggles
- Safety gloves
- Protective clothing
- Protection and care cream
- Eye wash liquid on Site !



Injection Devices

DESOI M-Power 20L

DESOI M-Power 60Z

Injection Devices

DESOI AirPower S25

DESOI PowerInject 303

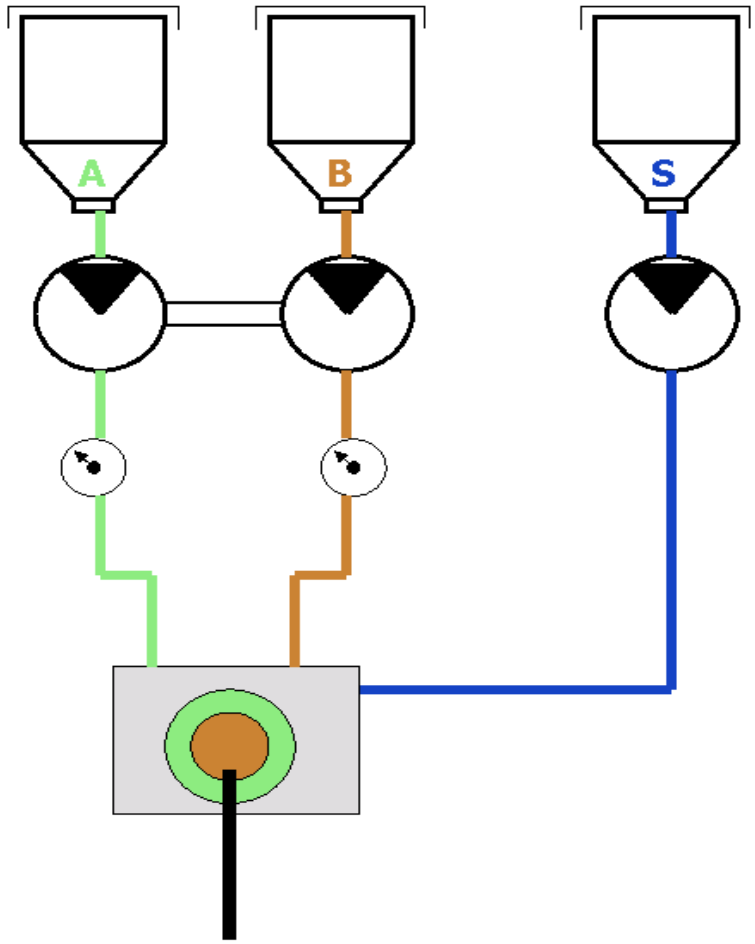
Injection Devices – Multi component pump

Material Containers

Pump

Manometer

Mixing head



Injection Devices 2Component

DESOI AirPower L36-2C

2C-Mixing head - stainless steel

Injection Devices properties

- Easy operation, easy testing of functionality
- Low susceptibility to failure - reliable
- Controllable or limited pressure,
- Easy cleaning and maintenance
- High dosing accuracy
- Low susceptibility to malfunction
- Control with alarm signal or switching off when mixing errors

Injection Packer

- General requirements
- Compatible with the intended injection material
- Reliable securing / tightening in packer hole
- Corrosion resistance of the parts remaining in the host material
- Designed for the flow rate and properties of the injection material

Universal Adhesive Packer

with cross sliding valve, moulded pan head nipple Ø 16 mm, base Ø 50 mm, high 48 mm

To use with

- Injection resins
- Injection cements

benefits

- Opening and closing the cross sliding valve at any time
- No opening pressure is required
- High tightness is reached
- Packer does not drip
- Through the eight holes, a rivet effect obtained
- Free passage Ø 3 mm
- No restricted section
- With protection for the injection opening

Adhesive Packer

EP / PUR resin

Adhesive packer - polymer

Adhesive packer - steel

Cement (ZL) & Cement suspension (ZS)

Adhesive packer

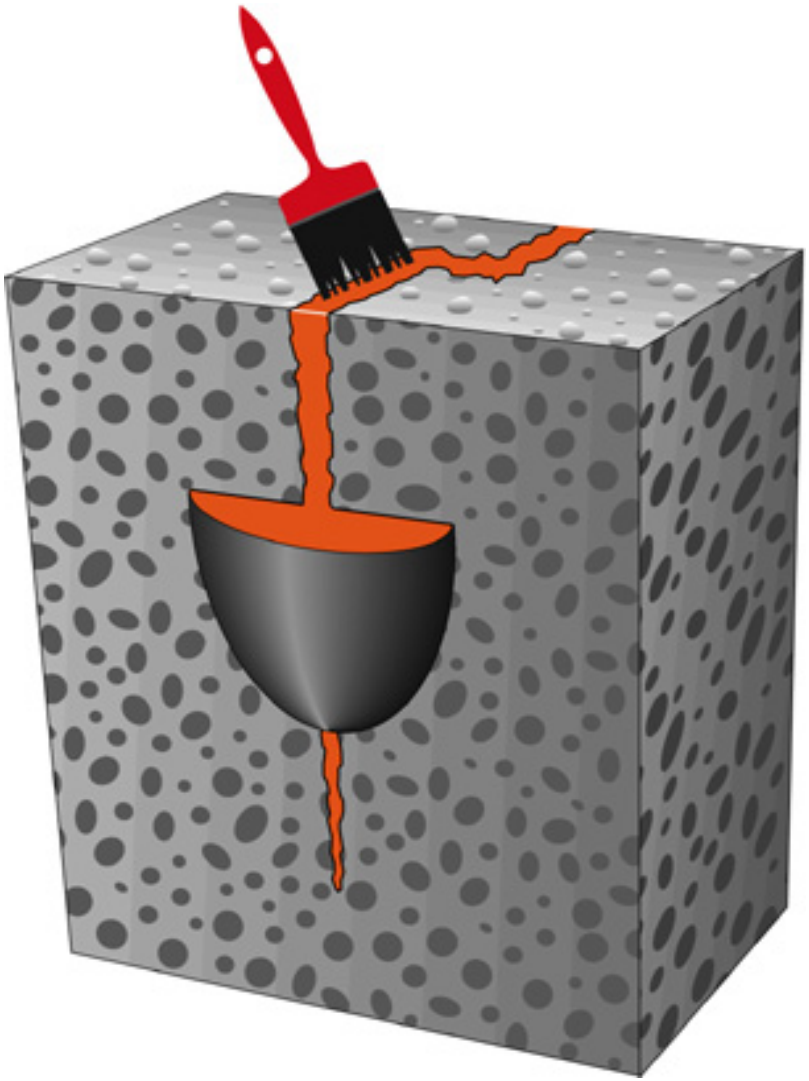
Angle adhesive packer

Crack repair methods

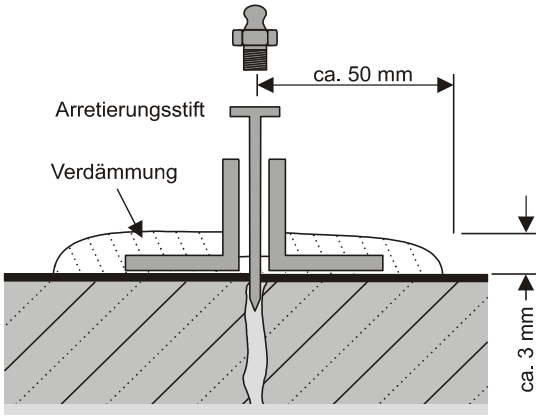
Impregnation of cracks

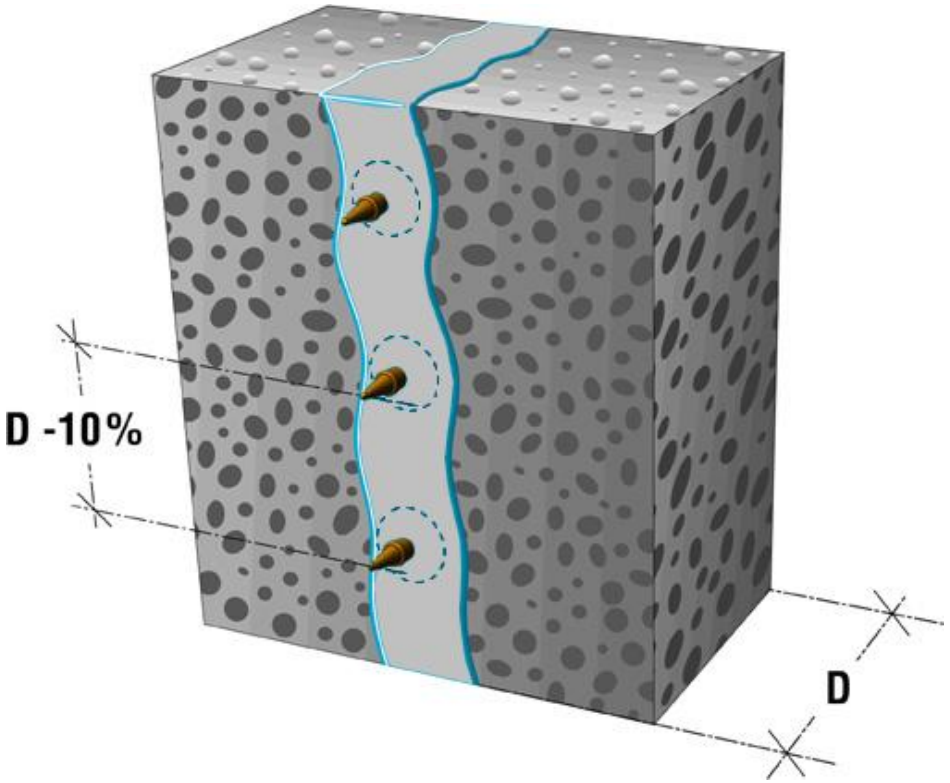
- Epoxi resin EP
- Cement paste ZL
- Cement suspension ZS

- Limited penetration into crack
- Pressure < 0,1 bar



Crack injection with adhesive packer





Crack injection with packer and drive in packer

Duistance between packer

Injection from one side

- thikness of building component : 2

Injection from 2 sides

- For elements of 30 cm or more thick

Video

You can find the video on our website at **www.desoi.de/catalog/de/service/mediathek/videos/**

Surface sealing material

- The surface sealing material prevents the injection material from running out during injection
- For moving cracks an elastic sealing material is applied.
- Wet cracks and saturated surfaces will require a pu or pe based surface sealing material
- Bleed points must be incorporated on vertical cracks at the highest point to allow air to escape

- Consumption of sealing material:
  about 0.5 kg per running meter

- thickness of the layer = 3 mm
- width = 100 mm

Typical packers

EP/PU resin

Steel packer

Cone shaped drive in packer

Progressive lamella drive in packer

Cement suspension

Combi packer

Drive in packer

Video


DESOI-Injektionstechnik:
DESOI Injection Technique:
DESOI

Assessment of injection

Determination of:

- Complete filling
- Leaks
- Frictional connection
- Filling

Note:

A successful injection is when the cracks in the drilled cores are filled to at least 80% (ZTV-ING part 3 S. 7)

Final Report (Documentation)

According to form ZTV-ING part 3: B 3.5.1

Overview of content, injection material, material consumption

- The results of self-monitoring and control test
- Details of procedures used
- Photos (before & after) and samples

At the end