

(Template for local translation, only for internal use)

Tricosal® Waterstops – Elastomer

Waterstops for joint sealing in watertight concrete structures according to DIN 7865-1-2

Product Description

Tricosal® Waterstops – Elastomer Type are permanently flexible waterstops made from Elastomers, SBR (styrene butadiene rubber) based as standard, for sealing expansion and construction joints in watertight concrete structures. They are available in a range of different types, profiles and sizes to suit different types of structures and joint sealing applications.

Designation

- Tricosal® Waterstops – Elastomer Type DIN 7865-1-2 SBR or other Elastomers

Uses

- Joint sealing in concrete structures
- Expansion and construction joint sealing in insitu concrete construction
- For connecting new to existing structures use Tricosal flanged joint sealing waterstops - Elastomer in accordance with DIN 7865-2
- Typical structures:
 - Commercial building basements, underground car parks
 - Bridges, including bridge trough structures
 - Rail and road tunnels
 - Water treatment plants
 - Locks and weirs
 - Power stations, barrages and dams (Waterstops in combination with hoses for injection / re-injection capabilities)

Characteristics / Advantages

- High tensile strength and elongation
- High permanent flexibility and high resilience
- Suitable for high water pressure and stress
- Resistant to all natural mediums aggressive to concrete
- Resistant to a broad spectrum of chemical agents (testing necessary for any additional specific situations)
- Dimensionally stable in contact with hot bitumen
- Robust dimensions for handling on site
- Vulcanizable for butt jointing the waterstops on site

Principles for Use

- Design and installation principles according to DIN V 18197
- Jointing systems in accordance with DIN V 18197 and DIN 7865

Construction



Tests

Standards/ Directives

DIN V 18197
DIN 7865-1-2
German WU Directive DAfStb.
ZTV-ING, RiZ-ING
German DS 804.6201 of DB AG
Vulcanizing instructions
Vulcanizing equipment instruction manual

Test Certificate/ Approvals

Manufacturer's test certificate
Certificate of Conformity DIN 7865
External monitoring by MPA NRW, Germany
Standard external monitoring inspection certificates
HPQ manufacturer based product qualification of DB AG, Germany
Specified for joint sealing in civil engineering structures according to ZTV-ING, RiZ-ING and DB AG RiLi 804.6201

Product Data

Form

Chemical Base

Standard Grades

SBR Elastomer based:	Styrene Butadiene Rubber For internally and externally fixed waterstops
EPDM Elastomer based:	Ethylene Propylene Diene Monomer rubber For exposed / capping joint waterstops FAE

Colours

Black for internally and externally fixed waterstops
Black with grey visible surface for exposed / capping joint waterstops FAE

Packaging

Supplied as standard rolls of 20, 25, 35 or 40 m dependent on profile, on Euro or disposable pallets
Fabricated waterstopping systems in coils, on Euro or disposable pallets dependent on size

Storage

Storage Conditions / Shelf-Life

Stored on the pallets as supplied on a flat base
For long-term storage ≥ 6 months in enclosed areas:
The recommendations of DIN 7716 apply.
The storage area should be covered, cool, dry, free from dust and moderately ventilated.
The Elastomer waterstops must be protected from heat sources and strong artificial lights with a high UV content.
Short-term storage > 6 weeks and < 6 months in enclosed areas:
The principles of DIN 7716 apply.
On construction sites, outdoors:

- In dry storage, protected by suitable covers from direct sunlight, snow and ice, or any other form of contamination
- Store separate from other potentially harmful materials, plant and equipment such as structural steel, reinforcements or fuels etc.
- Store away from traffic and site roads

Short-term storage ≤ 6 weeks on construction sites, outdoors:

- Protected from contamination or damage
- Protected by suitable covers from strong sunlight, snow or ice etc.

Vulcanizing materials should be covered and stored in a cool, dry area free from dust and contamination. It is recommended that the stock requirements be coordinated for a maximum storage period of about 6 weeks.

Mechanical / Physical Properties					DIN 7865-2, Table 1
Shore-A Hardness	62 ± 5 Shore-A			DIN 53505	
Tensile Strength	≥ 10 MPa			DIN 53504	
Elongation at Break	≥ 380%			DIN 53504	
Compression Set	168 h / 23°C	≤ 20%	ISO 815		
	24 h / 70°C	≤ 35%			
Tear Propagation Resistance	≥ 8 N/mm			ISO34-1: 2004-07	
Behaviour After Heat Ageing	Shore-A hardness change	≤ + 8	DIN 53508		
	Ultimate tensile strength	≥ 9 MPa			
	Ultimate elongation	≥ 300%			
Low Temperature Characteristic	≤ 90 Shore A			DIN 7865-2: 2008-02	
Tension Set	≤ 20%			ISO 2285/DIN 7865	
Adhesion to Metal ¹⁾	≥ 1.50 kN			DIN 7865-2	
Behaviour after Bedding in Hot Bitumen	Permanent deformation	< 20%	DIN 7865: 2008-02		
	Ultimate tensile strength	≥ 7 MPa			
	Ultimate elongation	≥ 300%			
Behaviour after Ozone Ageing	No cracks			DIN 53509-1	
Bond Strength	Tensile force of the bond ≥ 90% of the tensile force that must be exerted to break the non-jointed waterstop or a structural break in the elastomer outside the joint			DIN 7865-2	
1) For waterstops with steel straps, Form FMS/FS					

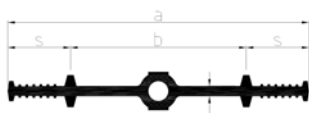
Forms

The limits of water pressure and stress given in the tables below apply to standard uses without specific additional testing.

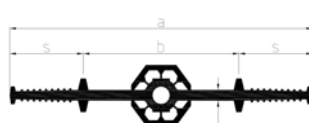
Different values may be used when precise information on all of the relevant stresses and structural requirements is available.

Expansion joint waterstops, integrally fixed

Form FM



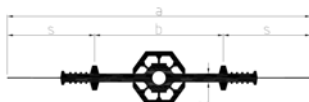
Form FM 350 HS



Form FMS Zeichnung neu



Form FMS...HS



Type	Tricosal Waterstop Elastomer	Total width	Width of expansion part	Thickness of expansion part	Width of sealing part	Roll length	Water pressure	Resulting movement
		a	b	c	s		p	v _r
		[mm]	[mm]	[mm]	[mm]	[m]	[bar]	[mm]
Internal	FM 200	200	110	9	45	25	0	25
	FM 250*	250	125	9	62,5	25	0 0.3 0.5	25 20 10
	FM 300*	300	175	10	62,5	25	0 0.5 1.2	35 30 20
	FM 350*	350	180	12	85	25	0 1.5 2.0	45 30 20
	FM 350 HS	350	180	12	85	20	0 1.5 2.0	45 30 20
	FM 400	400	230	12	85	25	0 1.5 2.0	45 30 20
	FM 500	500	300	13	100	25	0 2.0 2.5	50 30 20
						s1+s2		
Internal with lateral steel plates	FMS 350*	350	120	10	45+70	35	0 0.5 1.2	35 30 20
	FMS 400*	400	170	11	45+70	35	0 1.5 2.0	45 30 20
	FMS 500	500	230	12	65+70	25	0 2.0 2.5	50 30 20
	FMS 400 HS	400	170	11	45+70	20	0 1.5 2.0	45 30 20
	FMS 500 HS	500	230	12	65+70	20	0 2.0 2.5	50 30 20
	Forms FM / FMS ... HS with encased centre-bulb are used for compression joints with shear stress or joints with a width w _{nom} > 30 mm.							
	FMS 450 S	450	186	12	62+70	35	0 1.5 2.5	45 30 20
	Form FMS 450 S = FMS 450 RMD is a special Elastomer expansion joint waterstop with lateral steel plates and a dumbbell-shaped cross-section and is mainly for use on concrete structures for waterway infrastructure. The form of the centre bulb is dependent on the nominal joint width - 30, 40, 50 mm.							

*Standard stock product

S₁= Width of Elastomer sealing parts

s₂ = Width of lateral steel plates 70 mm

v_r Resultant movement = $(v_x^2 + v_y^2 + v_z^2)^{1/2}$

N No. of sealing ribs with AM and FAE

F Height of profile (height of sealing ribs including base plate)

Expansion joint waterstop, externally placed

Form AM



	Tricosal Waterstop Elastomer	Total width	Width of expansion part	Thickness of expansion part	Sealing ribs	Roll length	Water pressure	Resulting Movement
		a	b	c	N x f		p	v _r
		[mm]	[mm]	[mm]	[mm]	[m]	[bar]	[mm]
	AM 250*	250	100	6	4 x 31	25	0 0.3	30 20
	AM 350*	350	100	6	6 x 31	25	0 0.7	35 20
	AM 500	500	150	6	8 x 31	20	0 1.0	40 20

Waterstops for capping joints

Form FAE



	Tricosal Waterstop Elastomer	Total width	Joint width	Profile thickness	Sealing ribs	Roll length	Water pressure	Resulting movement
		a	w _{nom}	c / d	N x f			
		[mm]	[mm]					
	FAE 50*	55	20	5	2 x 30	40	0	20
	FAE 100*	105	20	5	4 x 30	40	0.1	20

Installation aid for capping joint waterstops: TFL spacers and joint formers as accessory

Construction joint waterstops

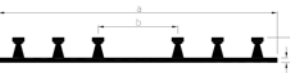
Form F



Form FS



Form A



Type	Tricosal Waterstop Elastomer	Total width	Width of expansion part	Thickness of expansion part	Width of sealing parts	Roll length	Water pressure	Resulting Movement
		a	b	c	s		p	v _r
		[mm]	[mm]	[mm]	[mm]	[m]	[bar]	[mm]
Internal	F 200*	200	75	7	62,5	25	1.2	3
	F 250*	250	80	8	85	25	2.0	
	F 300*	300	100	8	100	25	2.5	
					s ₁ + s ₂			
	FS 310*	310	80	8	45+70	50	2.0	
External					Sealing ribs			3
					N x f			
	A 250*	250	100	6	4x31	25	0.3	
	A 350*	350	100	6	6x31	25	0.7	
	A 500	500	150	6	8x31	20	1.0	

*Standard stock product

s₁ = Width of Elastomer sealing parts

s₂ = Width of lateral steel plates 70 mm

v_r Resultant movement = $(v_x^2 + v_y^2 + v_z^2)^{1/2}$

N No. of sealing ribs with AM and FAE

F Height of profile (Height of sealing ribs including base plate)

Waterstop Selection

Water Pressure / Cover Depth / Stress

The data in the tables on water pressures and the resulting movement gives the general application range in which the waterstops can be used without additional testing requirements.

Shear strains in the y direction (transverse longitudinal to the waterstop) are limited to the dimensions of the nominal joint width w_{nom} . If the shear strains are greater, then additional measures are required.

The different forms of waterstops are to be selected as detailed in DIN V 18197.

If the water pressure and/or resulting movement value is exceeded, the values applicable to the specific use should be defined on the basis of specific references, calculations or tests, with allowance for all of the actual influences and stresses anticipated.

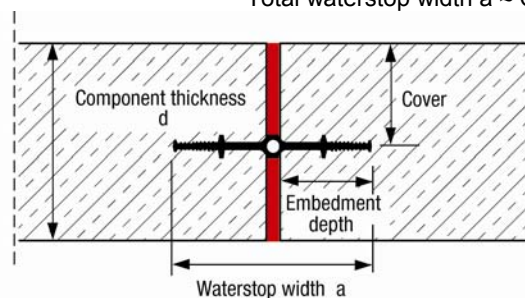
Rule of Cover Depth

As applicable to internal waterstop froms:

Concrete cover \geq embedment depth

Or

Total waterstop width $a \approx$ Component thickness



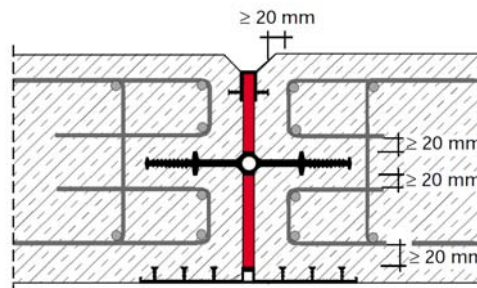
Component thickness Waterstop width a Embedment depth Cover

Externally fixed waterstops and finishing waterstops can be selected without considering the member thickness.

Anchorage Depth

The anchorage depth/concrete cover of the anchor ribs / sealing ribs must be 30 mm minimum.

Reinforcement Clearance



The clearance between waterstop and reinforcement shall be at least 20 mm.
The nominal joint width is:

Nominal joint widths

Internal expansion waterstops	$w_{nom} = 20$ or 30 mm
External expansion waterstops	$w_{nom} = 20$ mm
Waterstops for capping joints	$w_{nom} =$ in accordance with the profile clearance (10, 20, 30, 40 mm)

For a greater nominal joint width or compression joints subject to shear stresses, internal expansion waterstops with encased centre-bulb are used.

Temperature range

The service temperature range (waterstop temperature) is:

For pressurised water:	-20°C to $+40^{\circ}\text{C}$,
For non pressurised water:	-20°C to $+60^{\circ}\text{C}$.

Special stresses and exposure

Exposure to Different Temperatures and Chemical Agents

For special stresses and exposures due to different temperatures and/or chemical mediums outside the substances or situations specifically defined in DIN 4033. Separate tests are always necessary. Where required other materials are available in addition to the standard SBR (styrene butadiene rubber).

Tricosal Elastomer waterstops made from materials other than the standard SBR Grade are produced to order when required. They are not held in stock.

System Information

General

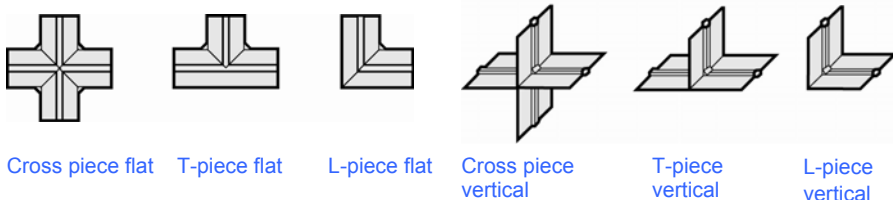
Only butt joints should be formed on site with Tricosal Elastomer waterstops; the other junctions / joints should all be factory produced.

Factory Produced Joining Pieces

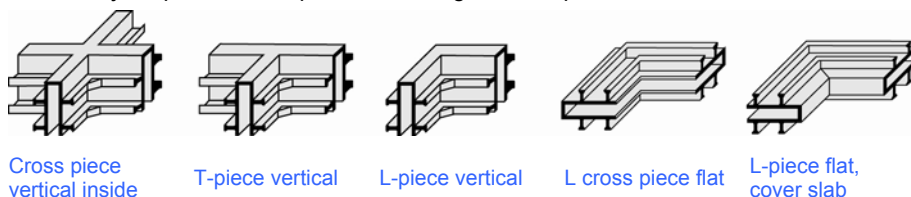
The factory production of different waterstop systems and junctions reduces the joints required to be formed on site to a minimum.

Special junctions or waterstopping systems can be factory produced for specific projects.

Standard junctions for internal and external waterstops include



Standard joint profiles of exposed /finishing waterstops include



Production of these profiles is preferably in 90°, or in standard internal or external angles 60° - 175°.

Special junctions

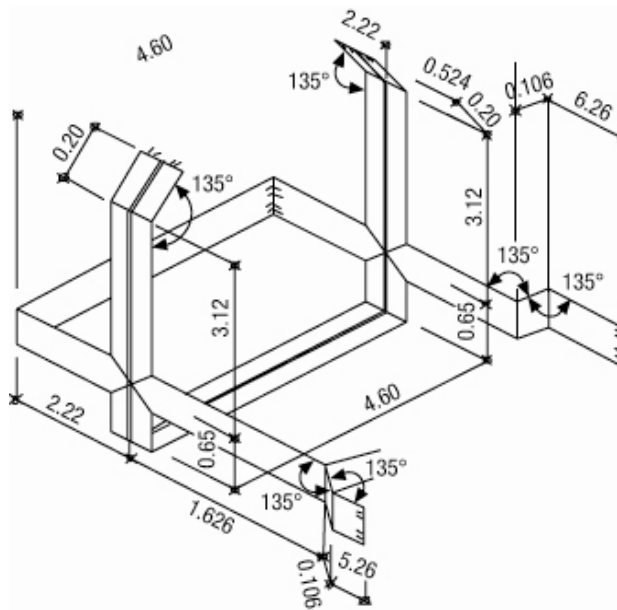
Combined junctions using different waterstop forms (as connections) e.g. form FM with AM, FM/FMS with steel sheet or AM with FAE.

In the standard approach the preformed junctions / joining pieces are built into the waterstopping systems. The sizes of the system components are dependent on the waterstop forms involved and the type and number of joints required.

The normal maximum total length of waterstopping systems: up to 25 m maximum (total for all separate lengths).

Typical Waterstop system (as example)

L-piece, vertical



Documentation

Manufacturer's test certificate, other test certificates as required
 Certificate of Conformity
 Regular external monitoring inspection certificates
 System drawings of the systems and components with detailed dimensions.

Handling

As specified in DIN V 18197.

- Careful transport and handling on site
- Installation only at waterstop material temperatures $\geq 0^{\circ}\text{C}$
- Protection is required until the waterstopping system is fully cast in
- Special care to be taken of free waterstop ends
- Waterstops are to be cleaned before casting in

Application Instructions

Application

As specified in DIN V 18197.

- Internal waterstops are installed within the concrete section and clearance from the edge of the concrete being at least half the total width a of the waterstop.
- External waterstops are installed flush with the external face of the concrete. Do not install on the top surface of horizontal or slightly sloping concrete.
- Waterstops for capping joints are installed in the joint, set back by the dimension of any joint chamfer.

If there are very high stresses or difficult concreting conditions, the waterstops can be supplied with additional injection hoses to additionally inject/grout the cast-in parts at a later date.

Jointing on Site: Site Joints

The Elastomer waterstops are butt jointed together by vulcanization, i.e. with added Tricosal rubber strips and the action of heat and pressure in a site vulcanizing equipment with moulds dependent on the profile used and longitudinal strain and specified vulcanizing parameters for the specific forms (temperature and time).

Jointing with other vulcanizing agents without heat or using adhesives or adhesive tape is not permitted.

Site joints must only be formed as stated in the vulcanizing instructions.

Requirement: Minimum ambient temperature + 5 °C and dry weather conditions.

Site joints must be formed only by trained and qualified personnel.

The key steps in the vulcanizing for all Tricosal Elastomer waterstopping forms FM/F, FMS/FS, FMS...HS, AM/A, FAE are fully described in the detailed instructions.

These key steps for site jointing complying with the vulcanizing instructions are:

- Cut the waterstop ends, straight and square
- Roughen the waterstop ends on the front, top and bottom
- Grind the steel plates until smooth, for FMS/FS
- Application of vulcanizing solvent, For FMS/FS also
- Apply 2 coats of bonding agent before application of vulcanizing solvent
- Plug the centre bulb with a foam stopper and Elastomer stopper from adhesion foil
- Apply the bonding agent on the front
- Bring together the waterstop ends and apply the tensioning harness
- Wrap in strip tape 0
- Wrap in strip tape 1
- Sprinkle the wrapped joint with talcum release agent
- Place the prepared joint in the preheated vulcanizing equipment with the moulds for the form
- Vulcanize the butt joint for about 35 minutes
- Remove from the vulcanizing equipment
- Cool (by ambient temperature - do not use coolant)

After cooling for about half an hour, the joint is finished and may be fixed / installed / stressed.

Further steps may be necessary dependent on the specific jointing requirements and the waterstop form.

The vulcanizing instructions are enclosed with the vulcanizing equipment.

All vulcanizing work is subject to the relevant local Health and Safety regulations and the Equipment and Materials Safety Information.

Formation of these site joints takes about 1 – 2 hours of working time per joint dependent on the specific waterstop form and therefore this time must be scheduled and the work completed properly before the next operations proceed.

Vulcanizing Equipment



- Vulcanizing equipment VG 450 for waterstops up to 400 mm total width
- Vulcanizing equipment VG 600 for waterstops up to 500 mm total width
- Moulds – according to the profiles being used
- Tensioning harness for longitudinal strain application

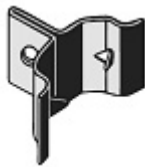
Vulcanizing equipments are electrical appliances which are subject to standard regular safety checks which must be scheduled and arranged

The vulcanizing equipments may only be used as described and according to all relevant regulations as stated in their operating instructions.

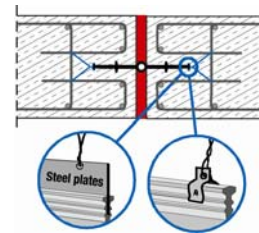
Tools, other Supplies and Protective Clothing	Cutting	Tape measure, metre ruler, set square, marker pen, rubber cutter
	Roughening	Goggles, protective gloves, hand drill, abrasive gel/carbide abrasive wheel with mounting
	<i>Removing abrasion dust</i>	
	Hand brush or paintbrush	
	Vulcanizing solution Paintbrush/round brush with long bristles	
	Adhesion foil	Scissors, roller 4 mm
	Cover strip	Scissors, roller 4 mm and roller 12 mm
	<i>Tensioning the vulcanizing equipment</i>	
	Screwdriver/ring spanner SW 32	
	Heat insulated gloves	
	Demoulding	Screwdriver
	<i>Additionally for the waterstop forms FMS/FS with lateral steel plates:</i>	
	Cutting	Jigsaw with metal blade
	Preparation of steel plates:	
	Angle grinder with steel roughing disc (small unit)	
	Priming	Paintbrush/round brush with long bristles
	Bonding agent	Paintbrush/round brush with long bristles
	Welding the steel plates:	
	Thin plate welding jig, gas or solid rod electrodes	
	Welder's protective clothing	
Vulcanizing Materials	Stopper	Profile 1 metre
	Heat solution	Can ca. 1 kg
	Adhesion foil 35 x 0.6 mm	Roll ca. 33 m
	Cover strip 035 x 2 mm	Roll ca. 26 m
	Cover strip 150 x 2.5 mm	Roll ca. 27 m
	Talcum	PE bottle ca. 200 g
	For waterstops FMS with lateral steel plates	
	Priming	Can ca. 250 g
	Bonding agent	Can ca. 250 g
	Vulcanizing materials are supplied to order and the quantity stocked should be based on a 6-week usage requirement.	
	Vulcanizing material is non-vulcanized raw rubber and must be stored in a cool, dry, dark area free from dust.	

Accessories

Waterstop fixing clamps



Size 2

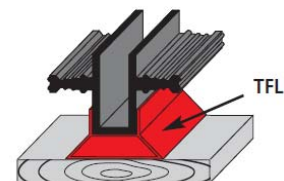
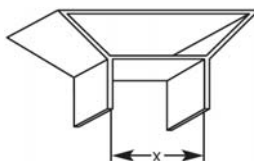


Steel plate

The waterstop fixings should be installed at maximum 25 cm centres.
Fixing should be made onto the reinforcement.

TFL insert profile

for the secure installation of capping joint waterstops



Profile	Joint width $w_{nom} = x$	Units
	[mm]	[m]
TFL 20	10	1 m / 2.50 m in coils of 10
TFL 30	20	1 m / 2.50 m in coils of 10
TFL 40	30	1 m
TFL 50	40	1 m

Future injection capability

- Injection hose SikaFuko®-VT 1 and 2 or SikaFuko®-Eco 1
- Fast setting binder (for waterstop form FMS/FS)
- Round clamp 16/18 (for SikaFuko®-VT 1 and waterstop form FM/F)
- Round clamp 22 (for SikaFuko®-VT 2 waterstop form FM/F)

Fixings to be placed every 12.5 cm.

Installation and injection of the SikaFuko injection hoses is detailed in their respective Product Data Sheets, Sika Method Statement / Installation guidelines for and relevant local regulations for the specific injection hoses used.

Stoppers

to plug the centre bulb at free waterstop ends (DIN V 18197).

Use profiled cords in metre lengths,

On site put in cuts approx. 10 cm, to a depth of approx. 5 cm.

On permanent free ends the projecting part is cut off.

On temporary free ends the stoppers should be removed before forming the connecting butt joint.

Metal Sheet connections

for the connection of metal sheets to the internal Tricosal® Elastomer waterstops are factory vulcanized on strap sheets for the waterstop forms FM and F and welded on for the waterstop forms FMS and FS.

Standard strap sheet size: 300 x 200 x 2 mm

Local Restrictions

Please note that as a result of specific local regulations the performance of this product may vary from country to country. Please consult the local Product Data Sheet for the exact description of the application fields.

Health and Safety Information

For information and advice on the safe handling, storage and disposal of chemical products, users shall refer to the most recent Material Safety Data Sheet containing physical, ecological, toxicological and other safety-related data.

Legal Notes

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

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