FRANK | Spacer Technology

Technologies for the construction industry

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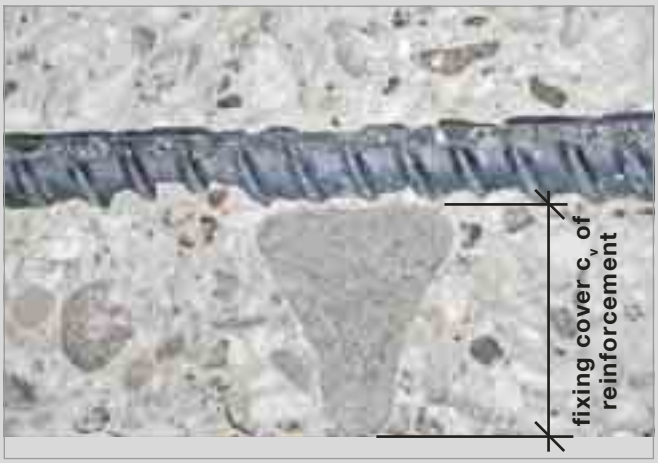
Spacer Technology | Table of contents

Spacers made of fibre concrete

The correct quality and depth of concrete cover to the reinforcement is of great importance, both for the durability of reinforced and prestressed concrete structures and for their fire resistance. According to EN1992-1-1:2004 Design of concrete structures. General rules for building "the reinforcement is to be placed with a fixing cover c_v, so that there is a high degree of probability that the minimum reinforcement cover c_{min} is achieved". For this spacers are required to maintain cover before and during concreting and they must not affect the serviceability and durability of the structural member after concreting. FRANK fibre concrete spacers match all of the above requirements and more.



Durability
Protection of reinforcement against carbonation, chloride ingress and other aggressive substances

Stability
Safe transmission of static forces into the concrete

Fire resistance
Protection of reinforcement against high temperatures during fire events

45 years experience in the manufacture and site use of fibre concrete spacers and distance tubes.

Quality fibre concrete spacers with different properties

We manufacture spacers to meet your requirements.

Material quality "Standard"

Spacer properties match the standard requirements of most international specifications.

Certified to most international standards (DIN, BS, etc.).

Material quality "Premium"

Spacer properties match the highest durability requirements of most international specifications.

Certified to most international standards (DIN, BS, etc.).

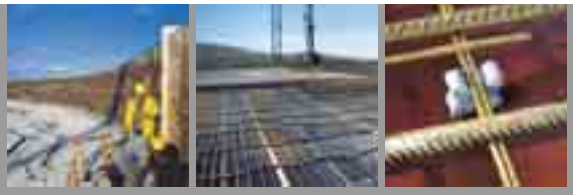
In addition to the **"Standard"** and **"Premium"** grades, we can, upon request also manufacture as part of our spacer production programme **"Basic"** grade. **"Basic"** grade can be used for applications where the strength and durability benefits of standard or premium grade products are not required.

Applications for Standard and Premium grade fibre-reinforced concrete spacers

This chart allows you to select the appropriate grade of spacers.

Application	Material quality	
	Standard	Premium
Structural elements with normal durability requirements	yes	no
Structural elements with higher durability requirements	no	yes
Resistance to high levels of sulphate	no	yes*
Acid resistance (down to pH = 2)	no	yes*
Approved for potable water use	yes**	no
Resistance to fire	yes	yes
White cement or colour mixtures	no	yes*
Specific customer requirements	no	yes*

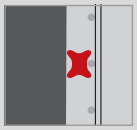
* *Premium grade is adapted for specialist applications*
** *Standard grade is adapted for this application*



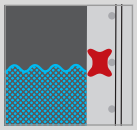
Fibre concrete – the optimum material in combination with in-situ concrete

- Consistent high compressive strength with resistance to tilting

- Excellent bond with in-situ concrete – no hairline cracks between the spacer and the concrete



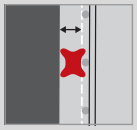
- Extremely suitable for impermeable concrete



- Excellent physical and chemical resistance

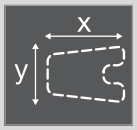
- Fire resistant to the highest requirements specified in **EN 13501-1:2002 – class A1**

- Consistent and accurate dimensional tolerances and do not deform under temperature fluctuations



- Quick and easy installation with a number of fixing options

- Spacers with special dimensions and shapes can be manufactured at short notice



- Manufactured in accordance with **EN ISO 9001: 2000**

Construction Sites

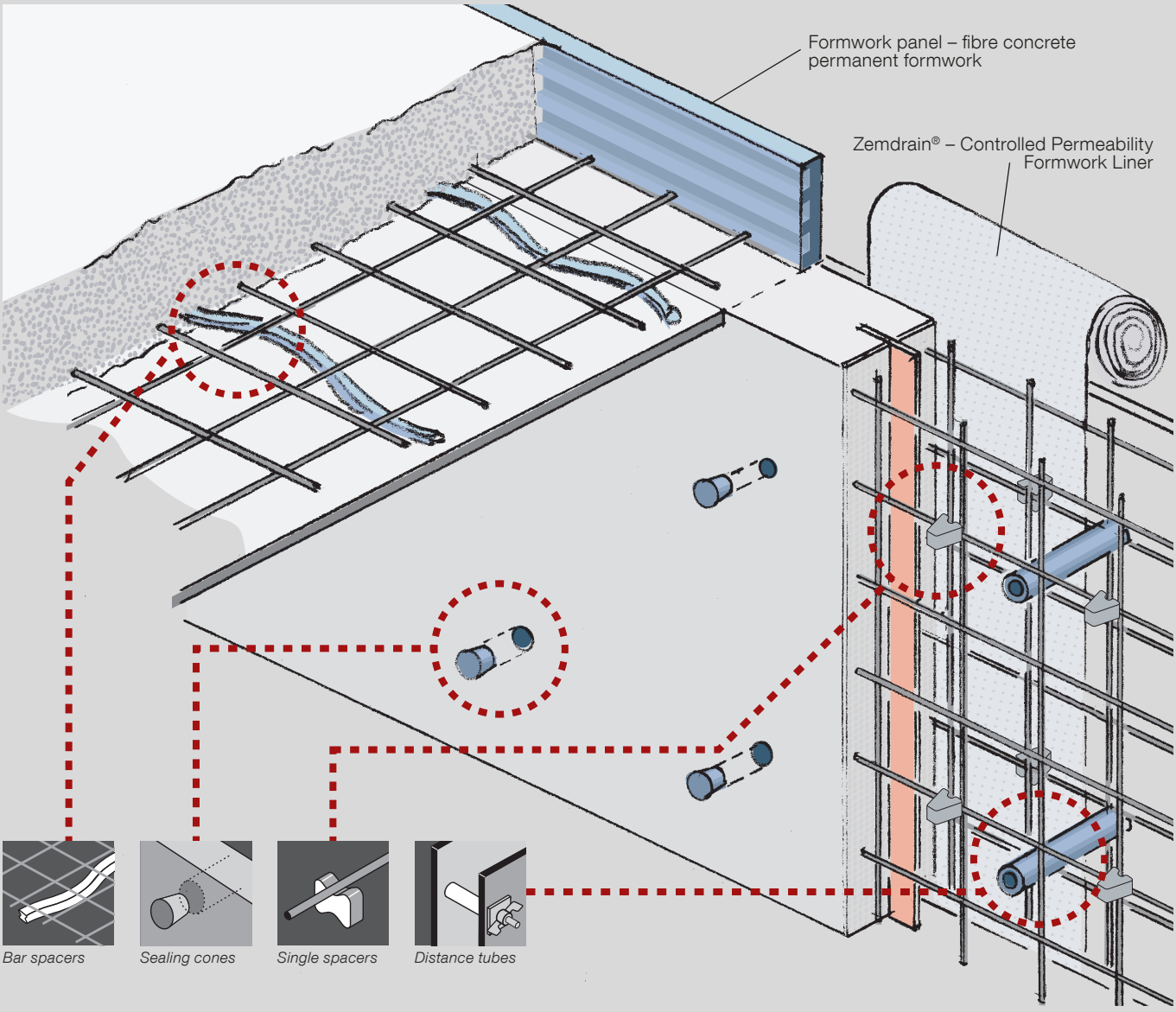
Spacers for all construction applications

Precast Plants

Spacers for lightly loaded applications

Wastewater Works

Spacers for acidic environments



Tunnel construction

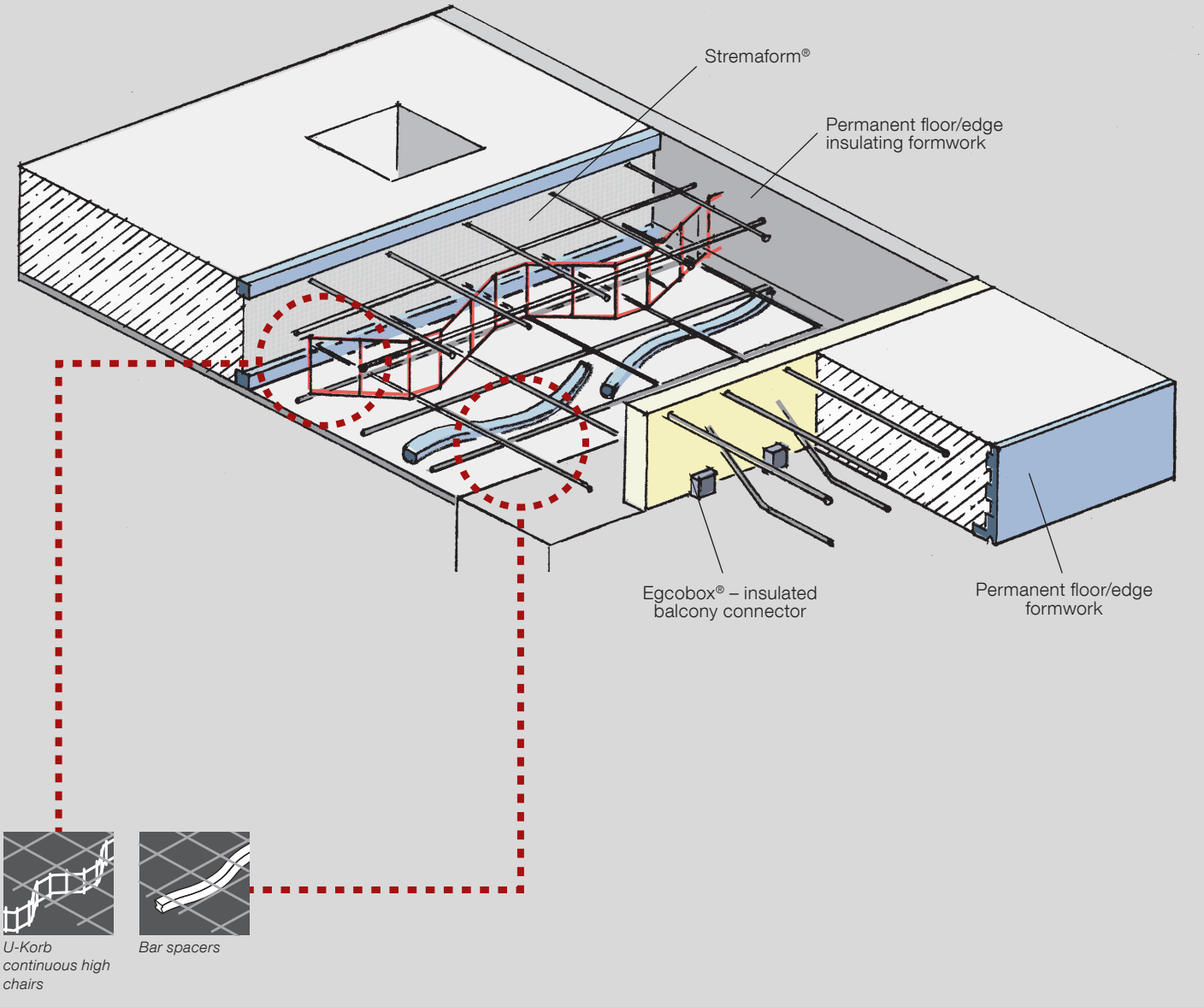
Secure fixing in any position even with overhanging reinforcement

Exposed concrete

Products meeting highest architectural requirements (colour and exposure)

Drinking water applications

Certified products for use in drinking water applications



Spacers are used to ensure that the concrete cover specified for structures and structural elements made of reinforced concrete is adhered to, both before and during concreting.

Marking of spacers according to German Society for concrete and construction technology (DBV) data sheet
Spacers certified to DBV data sheet must be marked as follows:
DBV – c – L/F/T/A/D

These abbreviations mean:
For normal requirements:
DBV - This spacer fulfils the requirements of the present data sheet
c - fixing cover for reinforcement c_v (mm)
L - performance classes
L1 = no increased requirements with regard to load-bearing capacity and tilting stability, e.g. reinforcement not subject to foot traffic
L2 = increased requirements with regard to load-bearing capacity and tilting stability – used as standard spacers in in-situ concrete

For special requirements:
F - increased freeze-thaw resistance
T - suitable for structural elements subject to extreme temperature variations
A - watertight and resistant to chemical attack
D - permissible reinforcement bar diameter range for the spacer (if necessary)

- Spacers with simple cover concrete cover 15 + 20 fulfil performance class L1: DBV – c – L1
- Spacers with simple cover concrete cover as of 25 mm fulfil performance class L2: DBV – c – L2
- Spacers with multiple cover are certified to DBV data sheet, however, application of DBV marking is not possible for them, as they have two or three different concrete covers.
- The same applies for bar spacers with lengths > 35 cm.

Products certified to DBV-c-L/F/T/A/D are marked in our documentation. Please ask for the corresponding test reports if required.

Mermber of the European Concrete Society Network (ECSN).

You should observe the following when selecting spacers:

- Instructions for selection of the appropriate spacer with reference to the exposure class according to EN206-1:1997 and other international standards
- Instructions for selection of the appropriate spacer depending on the type of structural element and on the type of spacer according to appropriate international standards
- Required concrete cover according to EN1992-1-1:2004 nominal dimension of installation of concrete cover c_{nom}
- Spacer loading due to reinforcement weight and additional loads, e.g. during concreting, installation of steel mesh and preassembled structures
- Diameter and location of the reinforcement – wall/slab
- Type of reinforcement – single bar or mats
- Simple, rapid and economical fixing
- Type of fixing – without tying wire, with tying wire, with steel or synthetic clips
- External influences affecting the concrete, such as pressure, temperature, chemical attack, alternating moisture penetration, fire and corrosion
- Treatment of concrete surface (stucco work)
- Exposed concrete – possible imprint left by spacers on the concrete surface

FRANK has stood for quality and customer-oriented solutions for more than 45 years.

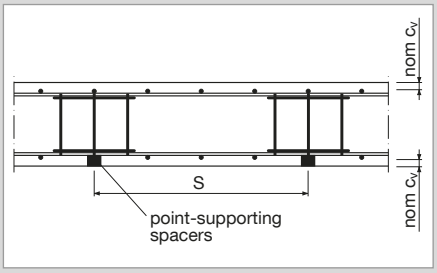
Consider deflection of thin supporting bars during concreting. Check resistance of spacers to extra loading for heavy reinforcement.

The fixing interval is based primarily on the accepted deflection at maximum loading, e.g. when the reinforcement is walked on especially during concreting. When placing bar spacers in the tension zone, we also recommend the use of short lengths staggered across the formwork.

Structural element: slabs

Spacer fixing distances S

Supporting bar diameter d_s	max. S	Required quantity m²			
		Single spacer	Bar spacer		
			L = 0.18 m	L = 0.33 m	L = 1.00 m
≤ 6.5 mm	0.50 m	4	3.0	2.5	1.33
> 6.5 mm	0.70 m	2	1.6	1.4	0.84



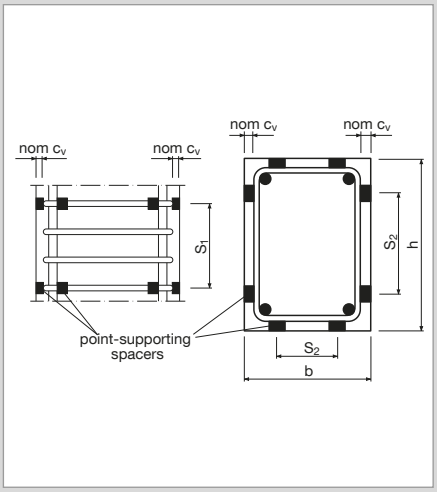
Structural element: beams and columns

Spacer fixing distances max. S_1 in longitudinal direction

Bar diameter d_s	Columns	Beams
≤ 10 mm	0.50 m	0.25 m
12 to 20 mm	1.00 m	0.50 m
> 20 mm	1.25 m	0.75 m

Spacer fixing distances max. S_2 in transverse direction

	Quantity, distances	
b or h	Columns	Beams
≤ 1.00 m	2 pieces	2 pieces
> 1.00 m	≥ 3 pieces	≥ 3 pieces
max. S_2	0.75 m	0.50 m

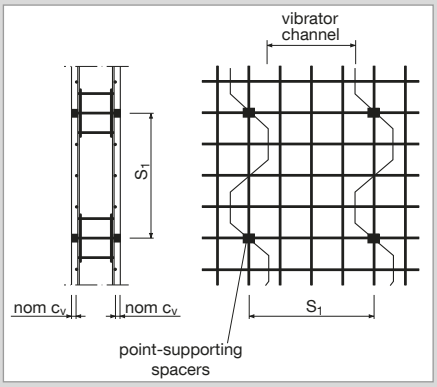


Structural element: walls

Spacer fixing distances S_1 and number per m² of wall

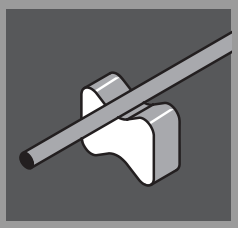
Supporting bars d_s	max. S_1	Required quantity m² wall[1)]		
		Single spacers	Bar spacers	
			L = 0.18 m	L = 0.33 m
≤ 8 mm	0.70 m	4	1.6	1.4
> 10 mm	1.00 m	2	1.0	0.8

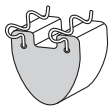
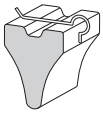
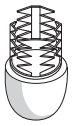
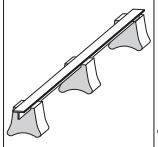
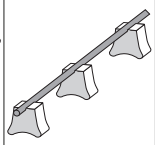
[1)] and per wall side



Single spacers

The use of spacers manufactured from fibre concrete ensures that the concrete cover specified for structures and structural elements made of reinforced concrete is adhered to, both before and during concreting.
We offer you the optimum spacer for every application.



	Without tying wire	With tying wire	With steel clips	With transverse clip	With plastic clip	Combined spacers	
						With plastic rail	With structural steel rail
Type of products	**AO**	**AD**	**AK**	**AK-Q**	**AC**	**KOMBI**	**KOMBST**
Drawing							
Horizontal reinforcement	⊖	⊕ [1]	⊖	⊖	⊖	⊕	⊕
Vertical reinforcement	⊖	⊕ [1]	⊕ [1]	⊕ [1]	⊕ [1]	⊖	⊖
Exposed concrete	⊖	○	⊕	⊕	○	⊕	⊕
Group type [2]	B1	B2	B2	B2	B2	C1	C1

Material quality		**Standard**	**Premium**
Concrete cover	mm	15 – 100 (other dimensions are possible)	20 – 100
Load-bearing capacity	N	> 3000	> 3000
Performance class		P2	P2
Compressive strength	N/mm^2	50	60 (> 100 N/mm^2 can be produced)
Permitted deformations	mm	< 1	< 1
Permitted tolerances	mm	± 1	± 1
Water absorption	% after 30 min	< 3	< 2
Exposure class [4]		X0/XC/XD/XS/XF/XA	X0/XC/XD/XS/XF/XA
Construction materials class		A1 – not flammable	A1 – not flammable
Fire resistance class		F30 – F180	F30 – F180
Requirement CS [3]		F / T / A	F / T / A
I.S.A.T (after 10 sec.)	$ml/m^2/sec$	< 0.5	< 0.25
Chloride diffusion	$m^2/sec \times 10^{-12}$	< 5.0	< 1.0
Rapid chloride permeability (RCP)	coulomb	n/a	< 1000 (very low)
Adhesion to concrete	N/mm^2	0.4	0.4

⊕ suitable

○ conditionally suitable

⊖ not suitable

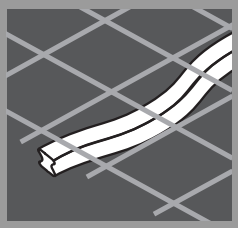
[1] provided that tilting or displacement is not possible

[2] group type according to DBV data sheet “spacers”
B1 = point-supporting, not fixed
B2 = point-supporting, fixed
C1 = linear-supporting, not fixed
C2 = linear-supporting, fixed

[3] Certified to the requirements of the DBV data sheet “spacers”:
F = increased freeze-thaw resistance
T = Suitability for structural elements subject to extreme temperature variations
A = watertight and resistant to chemical attack

Bar spacers

The excellent material properties of fibre concrete ensure high compressive strength, impermeability to water, fire resistance, application stability and thus guarantee the durability of the concrete surface. The shape and design of our bar spacers provides for safe and cost-effective use on site.



Triangular	Triangular concave	Triangular concave with hook	Triangular concave with tying wire	Square	Round	Snake + Snake N	Banana + Banana N	Rail
FAHD	FAHK	FAHDH	FAHKZD	FAHV	FAHR	FAHKS	FAHKB	FAHSS
⊕ [5]	⊕ [5]	⊖	○	⊕ [5]	⊕ [5]	⊕ [5]	⊕	⊕ [5]
⊖	⊖	⊕	⊕ [5]	⊖	⊖	⊖	⊖	⊖
⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖
C1	C1	C2	C2	C1	C1	C1	C1	C1

Material quality		Standard	Premium
Concrete cover	mm	15 – 100 (other dimensions are possible)	20 – 100
Load-bearing capacity	N	> 3000	> 3000
Performance class		P2	P2
Compressive strength	N/mm^2	50	60 (> 100 N/mm^2 can be produced)
Permitted deformations	mm	< 2	< 2
Permitted tolerances	mm	± 1	± 1
Water absorption	% after 30 min	< 3	< 2
Exposure class[4]		X0/XC/XD/XS/XF/XA	X0/XC/XD/XS/XF/XA
Construction materials class		A1 – not flammable	A1 – not flammable
Fire resistance class		F30 – F180	F30 – F180
Requirement DBV[3]		F / T / A	F / T / A
I.S.A.T (after 10 sec.)	$ml/m^2/sec$	< 0.5	< 0.25
Chloride diffusion	$m^2/sec \times 10^{-12}$	< 5.0	< 1.0
Rapid chloride permeability (RCP)	coulomb	n/a	< 1000 (very low)
Adhesion to concrete	N/mm^2	0.4	0.4

[4] Exposure class to EN 206-1:2001
XC = Carbonation
XD = Chlorides (except for sea water)
XS = Chlorides from sea water
XF = Frost with / without thawing agent
XA = Chemical attack

[5] with longitudinal dead limit (350 mm or ≤ 2 x h or ≤ 0,25 x b, whereby h = structural element thickness and b = structural element width).

Our complete programme of single spacers and bar spacers is manufactured in **"Standard"** material quality.

Material qualities **"Basic"** and **"Premium"** are manufactured on request.

Single spacers

Single spacers are used to ensure that the specified concrete cover for structures and structural elements made of reinforced concrete is adhered to, both before and during concrete placement.

Fibre concrete, the optimum material in combination with in-situ concrete

- High compressive strength, no deformation in heat or cold, the required concrete cover will be accurately retained
- The spacers remain in position during formwork erection and concrete placement
- Eminently suitable for impermeable concrete as hairline cracks do not develop between the spacer and the concrete

Spacers without tying wire

For horizontal reinforcement

Spacer type 4013 without tying wire – can be used for horizontal single bar reinforcement or mesh reinforcement.

Spacers with tying wire

For horizontal and vertical reinforcement

Spacer type 3572 D – this type of multi-cover spacer gives the option of reduced stock levels

Spacers with steel clips

For vertical reinforcement

Spacer type ZS with 2 steel clips guarantees the fastest possible fixing time and thanks to the preformed groove an exact and secure seating of the reinforcement.

Spacers with cross-clips

For vertical reinforcement

Spacers with cross-clips – secure fixing at the crossing point for vertical reinforcement by means of a 2 mm thick steel clip and the preformed groove.

Spacers with plastic clips

No tying wire within the concrete cover

Spacers with plastic clips guarantee a secure and exact concrete cover - no metal parts within the concrete cover.

Spacers with shuttlecock clips

No tying wire within the concrete cover

Spacers with shuttlecock clips secure the exact concrete cover for reinforcing steel mesh or reinforcement not subject to foot traffic, e.g. in a precast plant.

Spacers for concrete pipe production

For centring of reinforcement cages

Spacers for concrete pipe production – fixed to both internal and external concrete pipe reinforcement.

Reinforcement end supports

Used as stands for vertical single rebars

Just press onto rebar end – self-clipping; very high loading capacity – cannot tip over.

RONDO round spacer with metal clip

For use with prefabricated reinforcement cages

Round spacers help to minimise damage to the formwork face during installation of the reinforcement.

Spacers for fire protection reinforcement

In tunnel constructions

The fire protection spacer made of fibre concrete is used in tunnel constructions to provide simultaneously for an appropriate concrete cover of the fire protection reinforcement and of the supporting reinforcement.
Fire protection reinforcement prevents spalling of the concrete surface during fire events.

Combined spacers with plastic rail

For reinforcement not subject to foot traffic in a precast plant

Ideal for exposed concrete applications due to reduced contact with formwork.

Combined spacer with structural steel rail

For reinforcement not subject to foot traffic in a precast plant and on the construction site

Ideal for exposed concrete applications due to reduced contact with formwork.

Bar spacers made of fibre concrete

Bar spacers are used to ensure that the concrete cover specified for structures and structural elements made of reinforced concrete is adhered to, both before and during concreting.

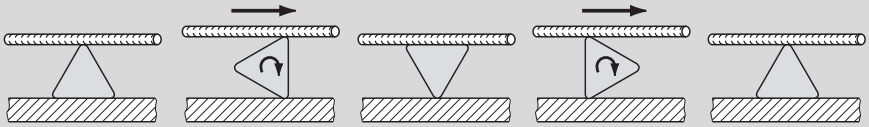
Fibre concrete – the optimum material in combination with in-situ concrete

- High compressive strength, no deformation in heat or cold, the required concrete cover will be absolutely retained
- Eminently suitable for impermeable concrete as hairline cracks do not develop between the spacer and the concrete
- Large support area – reduces penetration into support layer
- Substantial labour cost savings due to the rapid and simple laying
- Fire resistant to the highest requirements specified in EN 13501-1:2002 – Class 1A (not flammable)

Triangular bar spacers

For horizontal mesh and rod reinforcement – made with continuous reinforcing fibres

Application stability – triangular bar spacers always provide the same concrete cover in any position.



Triangular concave bar spacers

For horizontal mesh and rod reinforcement – lightweight version made with continuous reinforcing fibres

Triangular concave bar spacers do not provide the same concrete cover in every position they are placed. If there is a danger that they will tip over, you should use triangular bar spacers instead.

Triangular concave bar spacers with hook clip

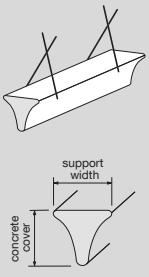
For vertical mesh and rod reinforcement

Simply clip to reinforcement.

Triangular concave bar spacers with two tying wires

For secure fixing in any position

Secure fixing in any position, even with overhanging reinforcement (tunnel construction).
Bar spacers can be held in position using either one or two wires.
Non-tipping due to the large support width.



Square bar spacers

For heavy horizontal reinforcement – made with continuous reinforcing fibres

- For particularly heavy reinforcement
- Large supporting surface for use on deformable layers (insulation)
- Non-tipping due to large support width

Round bar spacers

For horizontal reinforcement and exposed concrete – made with continuous reinforcing fibres

- Eminently suitable for exposed concrete
- For precast plants and construction sites
- Almost invisible due to linear contact area

“Snake” type bar spacers

For horizontal mesh and rod reinforcement

- Suitable for rapid and inexpensive fixing of mesh and rod reinforcement
- Stable and non-tipping, simple laying

“Snake N” type bar spacers with notches

For horizontal mesh and rod reinforcement

- Contact with the formwork is reduced to a few points due to the notched contact surface.
- Suitable for fixing of single bar reinforcement when placed with overlaps.

“Banana” type bar spacers

For horizontal mesh reinforcement

- Suitable for rapid and inexpensive fixing of mesh reinforcement
- Standard length 0.33 m specially made for R-mats and standard length 0.25 m specially made for Q-mats provide an optimum application stability and are non-tipping

“Banana N” type bar spacers with notches

For horizontal mesh reinforcement

- Contact with the formwork is reduced to a few points due to the notched surface.
- Standard length 0.33 m specially made for R-mats and standard length 0.25 m specially made for Q-mats provide an optimum application stability and are non-tipping

“Rail” type bar spacers

For horizontal mesh and rod reinforcement

- Suitable for rapid and inexpensive fixing of mesh reinforcement
- Large supporting surface for insulation

“Rail B” type bar spacers

For horizontal mesh reinforcement

- High load bearing capacity
- Excellent bond to concrete
- Protects formwork
- Rapid and efficient laying
- Secure application

Special spacers

Special spacers are manufactured quickly and efficiently to meet your demands. We offer you numerous technically accurate and inexpensive possibilities from supporting profiles for internal formwork in bridge-building up to filigreed spacers.

Spacers manufactured to special shape, size and properties

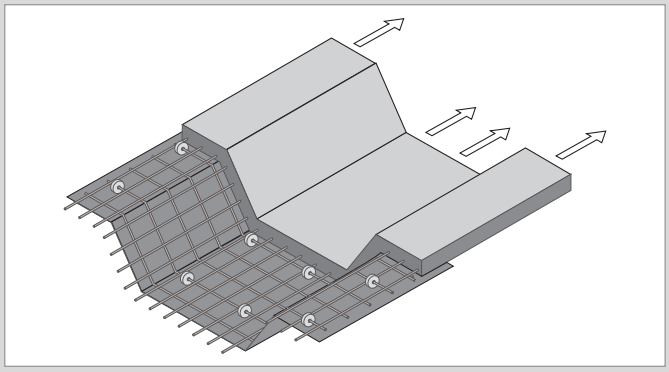
- Special shapes and dimensions can be produced quickly and efficiently to match your requirements.
- Production in fibre concrete is also possible in small quantities and with low tooling costs
- Special mixtures made of extremely sulphate resisting cement are available
- Various colours can be produced using white cement or pigments
- Compressive strengths of up to 100 N/mm² or greater are possible
- Spacers with specific properties appropriate for individual site conditions:
  - Highly acid-proof
  - High resistance to freeze-thaw
  - Reduced water absorption

Appropriate spacer solutions to specific problems

Our experience over 45 years enables us to arrive at the most appropriate solutions for your specific problems.

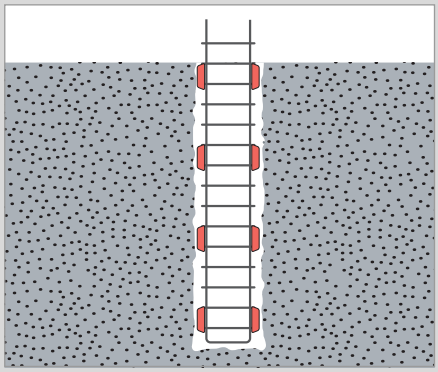
Circular spacer

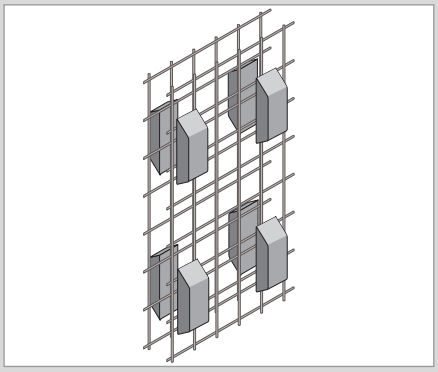
For rolling of large reinforcement cages into the correct position during short time periods.



Diaphragm wall spacers

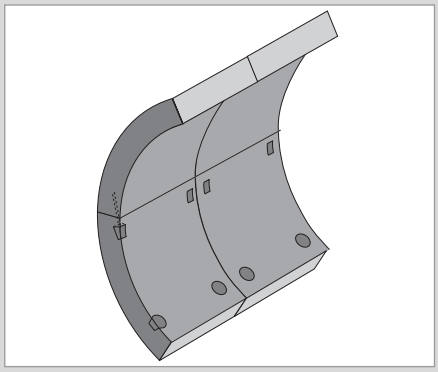
The skid-shaped form allows the lowering of larger reinforcement elements without the risk of jamming.





Wedges and sealing cones for tunnel segments

Closing of wedge sockets and cone holes in tunnel lining segments



Spacers with higher compressive strength

Spacers with higher compressive strength are required for structures in which they are subject to high loads during installation and concreting. With our fibre concrete quality “Premium” we are able to produce spacers with compressive strengths > 100 N/mm².

Spacers with enhanced resistance to Freeze/Thaw action

For structures such as bridges exposed to extreme freeze/thaw cycles we can supply “Premium” grade spacers that are highly durable in this type of environment.
Use of these spacers has been approved after testing in 400 alternating freeze-thaw cycles, in accordance with the test on behaviour under exposure to frost/de-icing agents for spacers, BE II FT visually, according to the D-R method, issued by LPM AG, Beinwill am See, Switzerland.

Appropriate spacer solutions for specific problems

Spacers with enhanced acid resistance

The special material composition of the “Premium SB” type spacers makes them particularly acid-proof. “Premium SB” spacers are more stable than conventional spacers and protect the reinforcement against acid attacks over a longer time period and thus considerably extend the working life of structures. This type of spacer is used for erection of cooling towers of power plants.

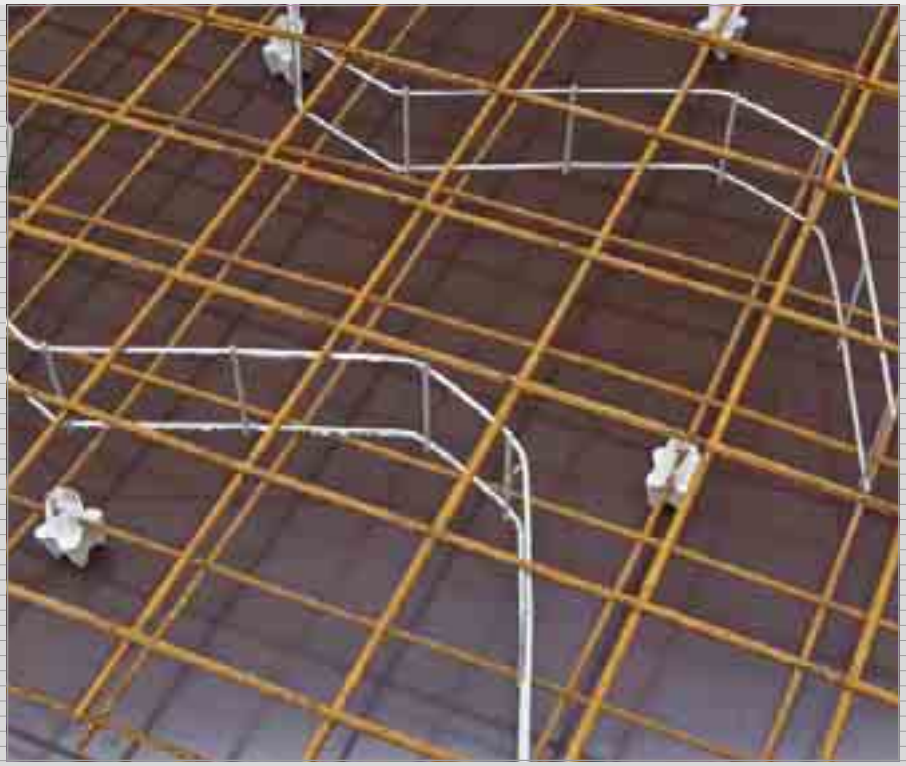
Spacers with enhanced sulphate resistance

Structures exposed to chemical attack by sulphates require special highly sulphate-resisting spacers. In accordance with EN206-1 these spacers may be used for exposure classes XA2 and XA3.
Use of this type of “Premium” spacer made from sulphate-resisting cement (SRPC) or a cement combination considerably extends and improves the useful life of these structural elements.

We produce the appropriate spacer solution for your specific application purpose.

U-Korb continuous high chairs

Continuous high chairs are used as spacers between the lower and upper reinforcement layers in bases, slabs and walls. They fix the distance between both reinforcement layers and hold them in the correct structural position.



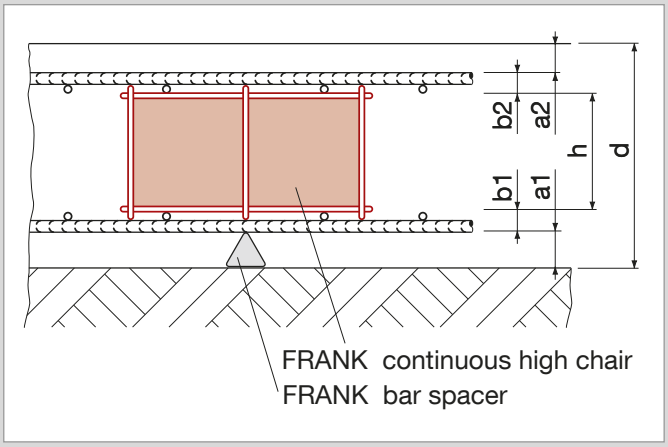
U-Korb use ensures the correct cover whilst protecting the formwork

- Conforms to the requirements of European Concrete Societies Best Practice Guide 2 – “Chairs for reinforcement”
- Saves labour time and material due to rapid laying and a support width of 20 cm
- Non-tipping due to a stable contact surface on the lower reinforcement
- No contact with the formwork, therefore no damage to the formwork skin and no rust stain formation on the concrete surface
- Stable, when subject to foot traffic due to the vertical uprights at the buckle points of the continuous high chair
- Suitable for use with both fixing mats and single reinforcing bars

Designation according to German Society for Concrete and Construction Technology (DBV) Guide to good Practice

DBV/EC2 = Continuous high chairs have been tested and fulfil the requirements of the DBV data sheet

h = Continuous high chair height (in mm)
S = Stands on the reinforcement
L = Linear supporting chair
E.g. for orders CS-10-R-L



System construction “slab” + “base”
Support width 200 mm

Determination of the necessary chair height:

Determination of the necessary chair height taking the required concrete cover and design slab thickness into account

		Example:
1. Lower reinforcement concrete cover	a1	30 mm
2. Upper reinforcement concrete cover	a2	20 mm
3. Lower reinforcement thickness*	b1	15 mm
4. Upper reinforcement thickness*	b2	15 mm
	Total x	80 mm

Required slab thickness “d” minus total “x” gives necessary chair height “h”. In our example with a required slab thickness of 200 mm: 200 – 80 = 120 m chair height. The chair height corresponds with UKS12.

* please take mesh overlap into account

Determining the required quantity:

The following number of continuous high chairs are required for normal construction loadings:

This table is only a guideline for determining the number required. The exact spacing interval must always match the requirements of the reinforcement and concrete cover and must be checked on site. The decisive factor is the deflections that can be accepted when the reinforcement is subject to foot traffic (when concreting).

If the reinforcement is not subject to foot traffic, such as in precasting plants or when using continuous high chairs for wall constructions, the required quantity determined as above can be reduced by 10 – 20 % without problems.

Bar diameter to be supported	Spacing interval	Requirement approx. pieces/m²
$d_s \leq 6{,}5$ mm	500 mm	1,0
$d_s > 6{,}5$ mm	700 mm	0,7

Distance tubes made of fibre concrete

Distance tubes are used to secure the concrete wall thickness using reusable tie bars.

The technically perfect solution for shutter ties

- High compressive strength
- Large contact area, therefore no pressing into the formwork
- Conforms to EN1992-1-1:2004 (concrete and reinforced concrete) and to DIN 18216 (formwork ties for concrete formwork)
- Can be manufactured as impermeable shutter ties
- Fire resistance class F30 – F180, suitable for fire walls F90 to EN 13501-1:2002
- Sound-proof due to glued stoppers

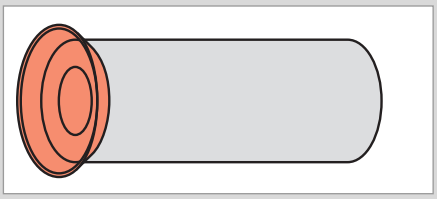
Contact zone between the distance tube and the formwork face

There are four different methods of forming the transition between the distance tube and the formwork surface:

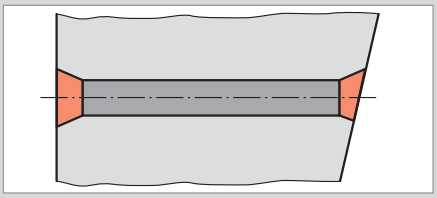
Distance tube directly butting the formwork
The bearing area for the most common distance tube (ø 22 standard wall thickness) is 7 cm². According to DIN 18216 at least 5 cm² are required for a compressive force of 1.5 kN. Although the bearing area is sufficient according to DIN 18216, we recommend the general use of sealing caps or cones.

Distance tube with sealing cap
(Normal design according to manufacturer's recommendations).
Irregularities in the formwork face are evened out by the sealing cap and this helps to prevent any cement slurry from running into the distance tube.

Distance tube with cone
Use of the cone allows the distance tube to be cast 10 mm deeper into the wall which results in a permanent cone-shaped impression. This has the effect of visually relieving the smooth concrete wall.



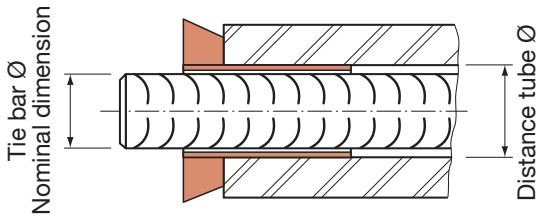
Distance tube with deep cone
The 30 mm to 50 mm long cone is often used as an aid for non right-angled transitions, as it prevents twisting. Sometimes this does not require further finishing, i.e. just one diagonal cut.



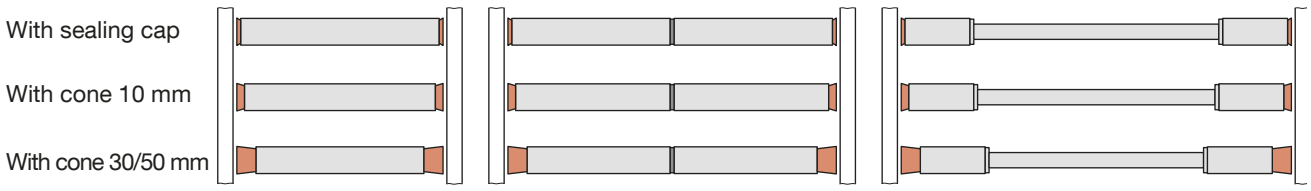
To ensure optimum performance always use Frank accessories with Frank distance tubes!

Selection table tie bar

Distance tube Ø	Tie bar Ø Nominal dimension
22	12.5
22	15.0
27	20.0
32	22.0
40	26.5



The appropriate distance tube system for every wall thickness

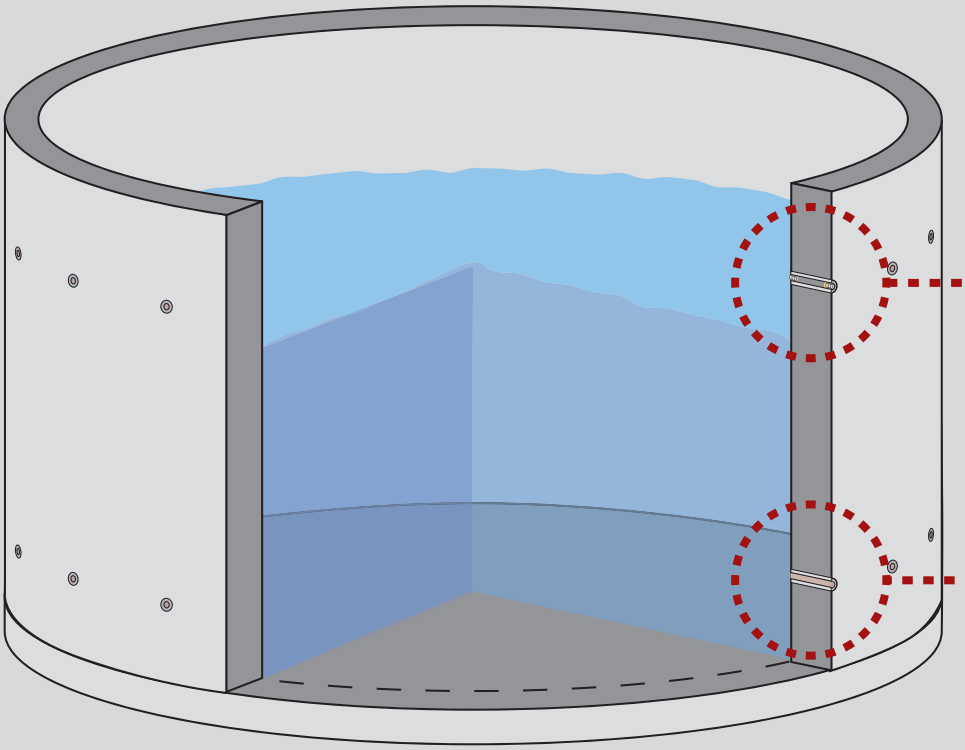


Up to 0.40 m wall thickness

0.40 – 0.60 m wall thickness with centre coupling

over 0.60 m wall thickness for high loads

FRANK distance tubes can also be used in the construction of watertight concrete structures.



Alternative methods of sealing distance tubes:

Distance tube sealed with an FB stopper + Repoxal glue

Distance tube sealed with a speciality mortar

Sealing of distance tubes with Frank mortar 3/25

Method 1

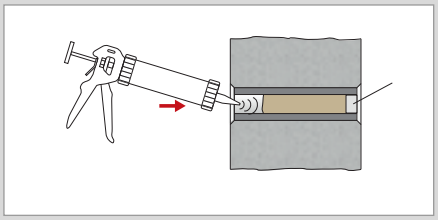
Insert the sealing cone on one face and afterwards grout the distance tube from the other side. After sealing float the surface.

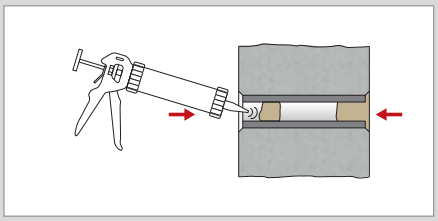
Method 2

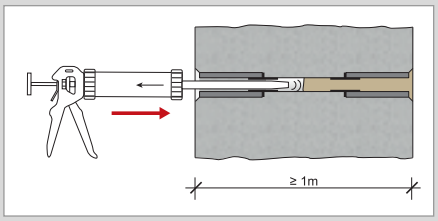
Grout the distance tube from both sides and then float the exposed face.

Method 3

Continuous grouting of distance tubes/ shutter ties. FRANK combined shutter ties or distance tubes for larger walls (thicker than around 1 m) should be grouted using the extension nozzle from the inside towards the outer surface.







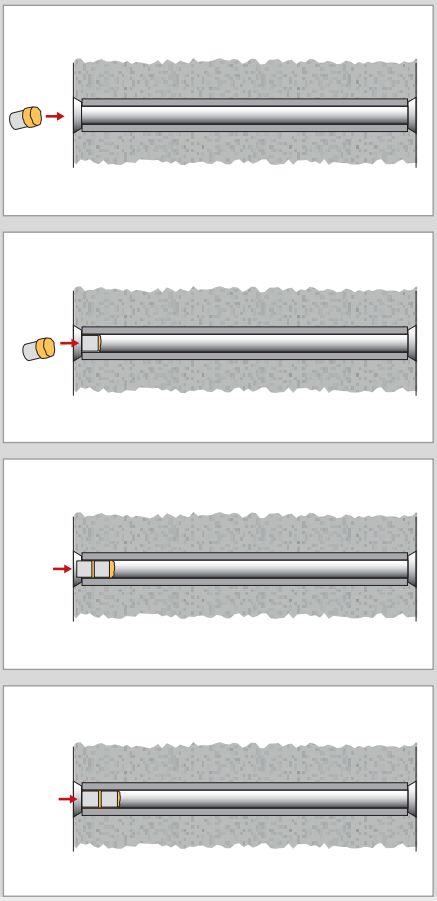
Installation of FRANK stoppers in distance tube using Repoxal two-component glue

1) When inserting stoppers always start from the side that is subject to water pressure

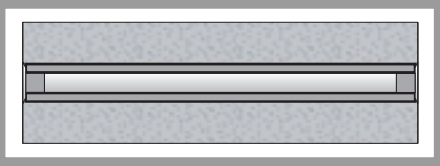
2) Dip the first stopper into the glue and rotate it briefly so that it is completely immersed around its circumference. Then insert it and ensure that this first stopper is approx. 10 mm below the wall surface.

3) After that insert the second stopper (also immersed in glue) and drive it in until flush with the wall surface, then distribute/remove excess glue.

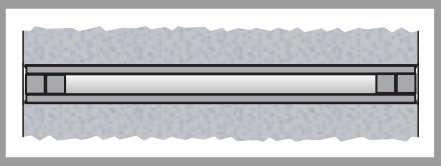
4) These stoppers should then be left to harden for a few hours. After this period you can start from the other side in a similar manner using two stoppers.



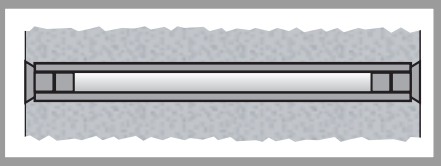
Sealing options



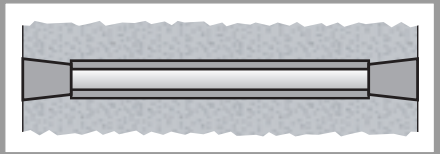
Normal seal
Only requires one stopper on each side.



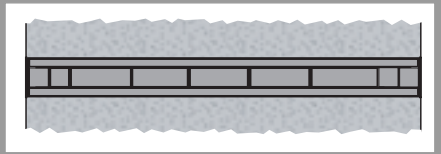
Watertight/sound-proof seal
requires two stoppers on each side.



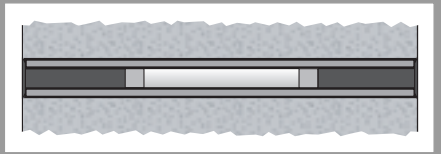
Watertight/sound-proof seal
requires one fibre concrete sealing cone and one stopper on each side.



Watertight/sound-proof seal
if one fibre concrete sealing cone of minimum length 50mm is used on each side, no stoppers are required



Continuous seal/Fire Wall seal
using several stoppers completely fill the tube and seal ends with sealing cones



Watertight/sound-proof seal
using Frank speciality mortar 3/25 – injected from each side.

Sealing cones made of fibre concrete

Due to the numerous design possibilities available to them, architects and designers are increasingly focusing on exposed concrete for their construction projects. Coloured or smooth exposed concrete surfaces have nowadays become decisive features of modern architecture.

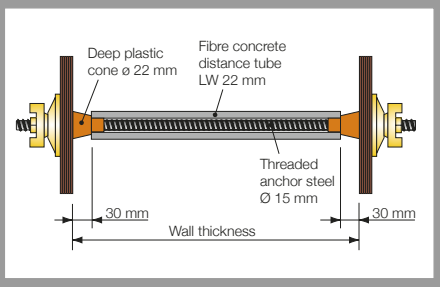
Individual design of concrete surfaces

- Unique design possibilities
- High dimensional accuracy
- Quick and proper sealing of form tie holes
- Smooth surface of low porosity
- Exposed concrete quality to the highest standards
- Can be produced in many different colours
- Watertight seal of structures

The holes used for shutter ties can be decisively important. They can have a damaging impact on the overall concept of an aesthetical striking high-quality structure, unless they are of excellent design and perfectly sealed. There are presently no binding rules worldwide to define basic “exposed concrete” features. However, the characteristics of exposed concrete surfaces should always be in accordance with accepted best practice.

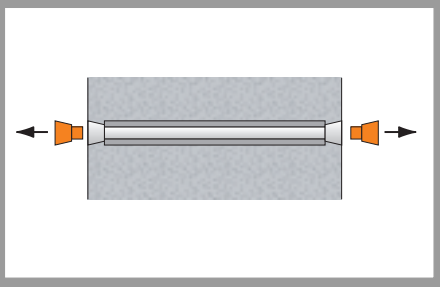
The use of FRANK plastic caps and cones in conjunction with our fibre concrete distance tubes helps to prevent bleeding of concrete into the shutter ties. The dimensions of Frank fibre concrete cones exactly match those of the FRANK plastic cones. This ensures a tight and accurate fit to give the best surface appearance. Special dimensions and shapes of cones for exposed concrete can be manufactured upon request.

Distance tube with deep cone Ø 22 mm



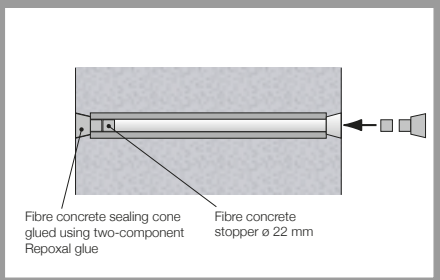
Distance tube installation

Deep plastic cones ø 22 mm are assembled with the distance tube and installed in the formwork.



Distance tube after formwork removal

After stripping-off the formwork, the deep plastic cones Ø 22 mm are extracted from the distance tube using the special cone pull-out device.

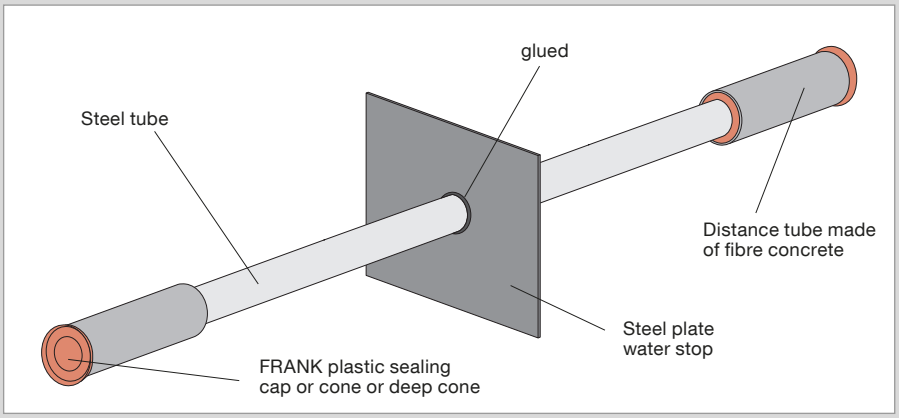


Cone hole sealing

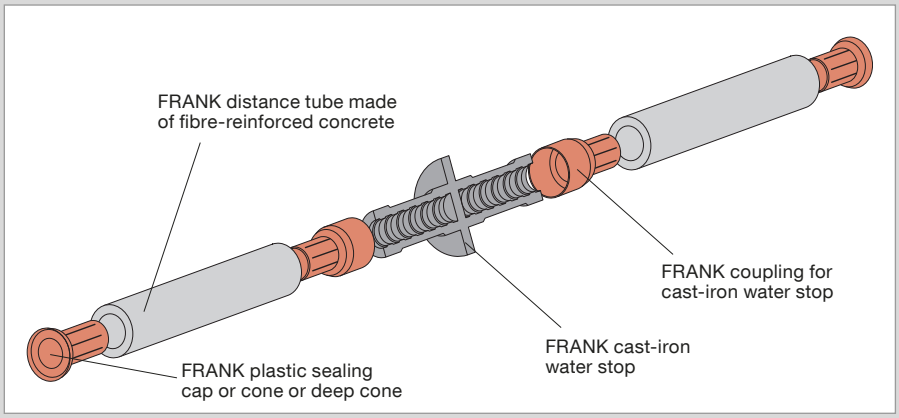
Fibre concrete sealing cones are glued in position flush with the wall on both sides using Repoxal two-component glue. A potable water approved version of this glue is also available.

Combined shutter tie with steel plate water stop

For component thickness from approximately 0.60 m upwards you should use steel tubes coupled with distance tubes of at least 100 mm length on each side to ensure that the required reinforced concrete wall thickness is maintained.



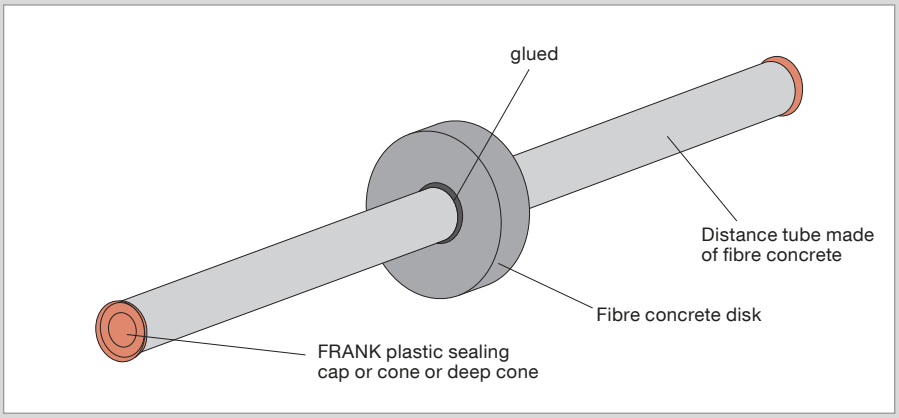
Combined shutter tie with cast-iron water stop



The use of FRANK combined shutter ties with cast-iron water stop is particularly recommended when the specifications prevent the use of formwork ties, which leave behind a continuous bore, such as ZTV-W.

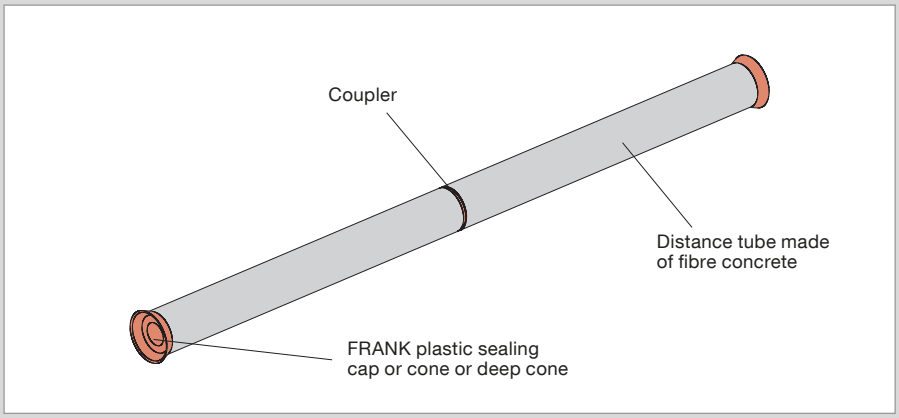
Distance tube with glued –on fibre concrete disk

Distance tubes with glued-on fibre-concrete disks can be used for shutter ties up to 0.60 m.

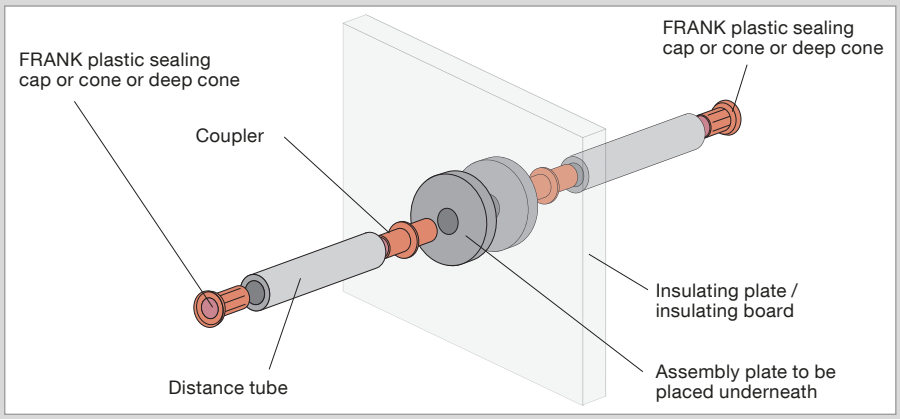


Distance tubes in two parts with coupler

Distance tubes in two parts are used with wall thicknesses from approx. 0.40 m up to 0.60 m to avoid damage to the distance tube caused by bending due to high tensioning forces.



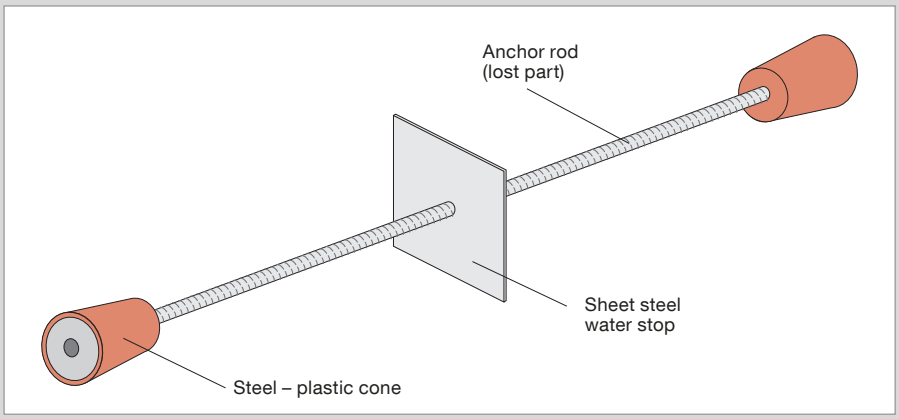
“2-layer system” distance tubes



Construction of walls with internal insulating plate / insulating board, for acoustic separation of two wall disks.

“Lost anchor” distance tubes

Sheet-steel water stop welded onto anchor rod, combined with reusable steel – plastic cones.



In Germany and many other countries drinking water reservoir constructions are mainly made of concrete. The governing standard EN1508 and the DVGW (The German Technical and Scientific Association for Gas and Water) standard W300 consider that a high quality low porosity surface is essential for hygienic reasons and detail the principles to be taken into account during the planning and construction phases.

The DVGW data sheet W300 "planning and construction of water reservoirs for drinking water supply" recommends a concrete impermeable to water and of low porosity which does not require any additional measures in terms of surface treatment or lining. In order to avoid any drinking water pollution, the materials used in such applications have to be approved to:

- UBA guideline with regard to Epoxy resin coatings, for hygienic assessment of epoxy resin coatings in contact with drinking water.
- DVGW data sheet W347: "Hygienic requirements on cement based materials in drinking water applications" – for cement based materials such as fibre concrete – corresponds with KTW testing (migration test).
- Testing according to DVGW data sheet W270: "Test on microbiological growth for materials used in drinking water applications". Materials in contact with drinking water must not deteriorate the microbiological condition of the water, i.e. release agent residues which could lead to micro organism growth. In order to determine those materials suitable for drinking water applications this test is indispensable.

Single spacers made of fibre concrete TW

	Article number	Concrete cover mm
	AO3572TW	35/40/50
	AO4573TW	45/55/60
	AD3572TW	35/40/50
	AD4572TW	45/55/50
	AK40ZSTW	40
	AK45ZSTW	45
	AK50ZSTW	50

Distance tubes made of fibre concrete TW

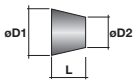
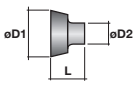
Article number	Inside diameter mm	Length m
MR221250TW	22	1,25

Stoppers made of fibre concrete TW

Article number	Diameter mm	Length m
ST220020TW	22	20
ST220050TW	22	50

Sealing cones made of fibre concrete TW

For the sealing of conical shutter tie holes

	Article number	Dimensions mm
	FBVK22TTW	Ø 42,6 x Ø 32,0 x 28
	FBVKSKKTW	Ø 59,0 x Ø 50,0 x 40
	FBVKZ22TW	Ø 41,0 x Ø 21,6 x 22
	FBVKZ22TTW	Ø 42,6 x Ø 21,6 x 40

Fibre concrete TW – tested to DVGW – W270 and DVGW-W347

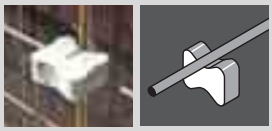
Repoxal TW – two-component glue

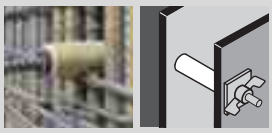
Article number	Description
MREPOXTW	Repoxal two-component glue (approved for impermeable joints in the drinking water sector, 0.75 kg per tin, 6 pieces/carton

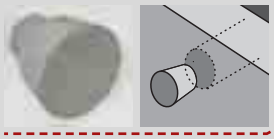
Tested to DVGW-W270 and UBA guideline for epoxy resin coatings

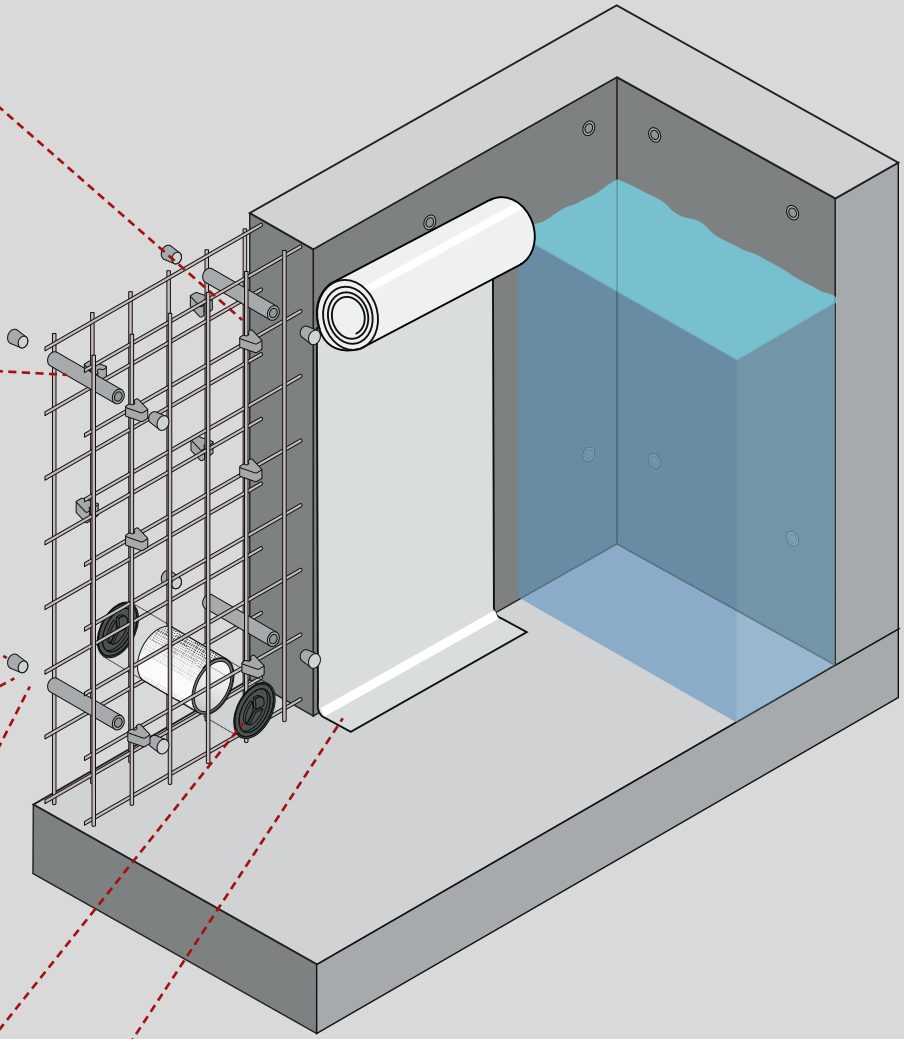
As well as manufacturing spacers and sealing cones that comply with the DVGW regulations in Germany, Frank spacers are also manufactured and certified to comply with the governing standards for products in contact with potable water in other countries. These standards include BS6920, SS375 and AS/NZS4020:2002.

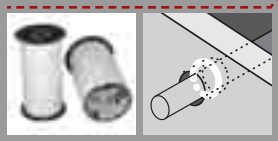
FRANK products are approved for drinking water applications and fulfil these strict requirements. Their use in the drinking water sector is permitted without any restrictions. It is therefore possible to build impermeable drinking water structures.

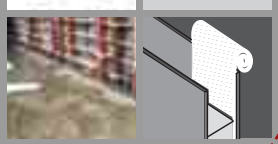












Permur Monolith – a special mould for monolithic circular chases cast in a concrete wall
Zemdrain® formwork liner – for uncontaminated, virtually blowhole free, low porosity concrete surfaces.

For more detailed information on our products Permur Monolith and Zemdrain® formwork liner please consult our brochures, which we will gladly send you on request; or simply visit our Website **www.maxfrank.com** and download these documents.

Plastic distance tubes

Plastic distance tube with roughened surface and plugged-in end caps

- Inner diameter of 22 mm for threaded steel ø 15 mm
- Roughened outside for improved concrete bond
- Supplied in variable lengths

Plastic distance tube with sealing stopper

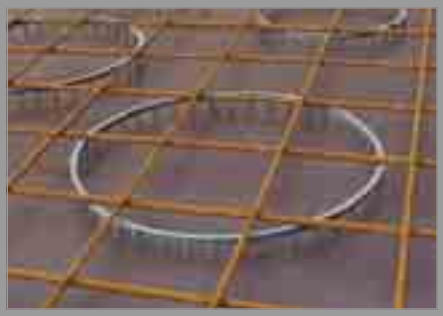
Single-piece plastic distance tube – in stable design – with large formwork support

- Inner diameter of 22 mm for threaded steel ø 15 mm
- Supplied in standard lengths for wall thicknesses from 0.20 – 0.40 m

Plastic ring spacers

For reinforcement ø 10 mm

- Concrete cover from 15 - 50 mm



Millihax – plastic disk spacer

For horizontal reinforcement

- Supplied in diameter range approx. 150 – 400 mm
- Concrete cover from 15 to 30 mm
- Easy installation

U-Profile “with”
Supporting profiles with lateral notches

Linear plastic spacer for horizontal reinforcement

- Concrete cover from 15 – 50 mm
- Supplied in 2 metre lengths

U-Profile “without”
Supporting profiles for insulation without lateral notches

Linear plastic spacer for horizontal reinforcement on insulation

- Concrete cover from 15 – 50 mm
- Supplied in 2 metre lengths
- The large supporting surface prevents the material from being pressed into the insulation.

Wana – weather drip profile

Made of plastic

- Available in standard sizes
- Supplied in 2.50 metre lengths
- The weather drip remains inside the concrete and thus forms a clear weather drip edge without any cracks

Chamfer – triangular profile

Plastic profile for chamfered corners

- Available in standard sizes
- Supplied in 2.50 metre lengths
- Due to the profile’s smooth surface it is easily removed with the formwork

Chamfer – triangular profile with flange

Plastic profile with flange for secure chamfered corners

- Available in standard sizes
- Supplied in 2.50 metre lengths
- Due to the profile’s smooth surface it is easily removed with the formwork

Trapezoidal profile 10/20

Made of plastic

- Dimension 20/10 mm
- Supplied in 2.50 metre lengths
- Due to the profile’s smooth surface it is easily removed with the formwork

Article Number	Test Certificates
Fibre concrete	
Spacers and bar spacers made of fibre-reinforced concrete	
YPROS01019	**Test on load at rupture - spacers** Issued by Prof. Rehm, certificate no. 489/90
YPROS01054	**Test on frost resistance according to DBV (German Concrete Association) data sheet "spacers" – requirement "F"** Issued by the Institute for Material Testing in Leipzig, Germany
YPROS01066	**Testing on alternating temperature resistance of concreted spacers according to DBV data sheet "spacers" – requirement "T"** Issued by the Institute for Material Testing in Leipzig, Germany
YPROS01039	**Test on water penetration depth on concreted spacers according to DBV data sheet "Spacers" – requirement "A"** Issued by the Bavarian Trade Association, certificate no. BP0030004
YPROS01071	**Test on water penetration depth on concreted spacers according to DBV data sheet "Spacers – requirement "A" bar spacers type FAHKS40** Issued by the Institute for Material Testing in Leipzig, Germany
YPROS01072	**Test on water penetration depth on concreted spacers according to DBV data sheet "Spacers" – requirement "A" spacers type AD 4013** Issued by the Institute for Material Testing in Leipzig, Germany
YPROS01059	**Test on behaviour under exposure to frost/de-icing agents for spacers,** BE II FT visually, according to the D-R method **Spacers AD 30R6Z10 and FBSP5353506** LPM AG, Beinwill am See, Switzerland / Report no. A-28'129-2
YPROS01087	**Cementitious spacer block extrusions compressive strength testing** – Report 37284/F/1 – Sandberg LLP, London
YPROS01088	**Cementitious spacer block extrusions durability testing for mix ST** – Report 37284/F/2 – Sandberg LLP, London
YPROS01089	**Cementitious spacer block extrusions durability testing for mix SS** – Report 37284/F/3 – Sandberg LLP, London
YPROS01090	**Cementitious spacer block extrusions durability testing for mix NOR** – Report 37284/F/4 – Sandberg LLP, London
YPROS01102	**NOR spacer mix chloride ion penetration test results** – Report 39210/F – Sandberg LLP, London
Distance tubes made of fibre-reinforced concrete	
YPROS01030	**Test on water impermeability** **Sealing with fibre-concrete stoppers, tested to 5 bar, ø 22 mm** Prof. Dr.-Ing. Harald Sipple
YPROS01031	**Sealing with fibre-concrete stoppers, tested to 5 bar, ø 32 mm** Prof. Dr.-Ing. Harald Sipple
YPROS01027	**Sealing with fibre-concrete stoppers, tested to 30 bar, ø 22 mm** Prof. Teubert
YPROS01016	**Sealing with FRANK special mortar 3/25** Issued by the Material Testing Institute of North Rhine Westphalia
YPROS01017	**Test on load at rupture – distance tubes –** Issued by Prof. Rehm, certificate no. 490/90
YPROS01050	**Expert's report on behaviour under fire of reinforced concrete walls with distance tubes** Issued by the Material Testing Institute of Civil Engineering at the Technical University of Braunschweig, Germany
YPROS01075	**Expert's report on influence of stoppers in distance tubes on the airborne sound insulation of a concrete wall** Issued by the Institute for Material Testing in Leipzig, Germany
YPROS01014	**Test on suitability for shelters** Issued by the Federal Minister for Regional Planning, Civil Engineering and Urban Development
YPROS01022	**Behaviour of Repoxal TW glue in contact with drinking water** Issued by the Hygienic Institute of Gelsenkirchen, Germany, test certificate according to the UBA guideline "Hygienic evaluation of epoxy resin coatings in contact with drinking water"
YPROS01057	**Repoxal glue for drinking water applications – Test on microbiological growth for materials in drinking water applications** Issued by the Hygienic Institute of Gelsenkirchen, Germany, test certificate according to DVGW – W270
Fibre concrete TW	
YPROS01053	**Hygienic requirements on cement-based materials in drinking water applications** Issued by the Hygienic Institute of Gelsenkirchen, Germany, test certificate according to DVGW data sheet W347
YPROS01055	**Test certificate on microbiological growth on materials for drinking water applications** Issued by Hygienic Institute of Gelsenkichen, Germany, test certificate according to DVGW data sheet W270
YPROS01085	**Testing of non-metallic materials for use with drinking water (BS 6920) –** Test report M104175 – WR_C, UK

Photos: Max FRANK

Advanced Technical College Frankfurt a. M.
FRANK coloured sealing cones for exposed concrete surfaces

House of German Emigrants, Bremerhaven
FRANK spacers for exposed concrete surfaces

Museum, Island of Hombroich, Neuss
FRANK distance tubes and fibre concrete sealing cones for exposed concrete surfaces

Allianz-Arena stadium, Munich
FRANK bar spacers

Metro system, Dubai
FRANK single spacers in special design

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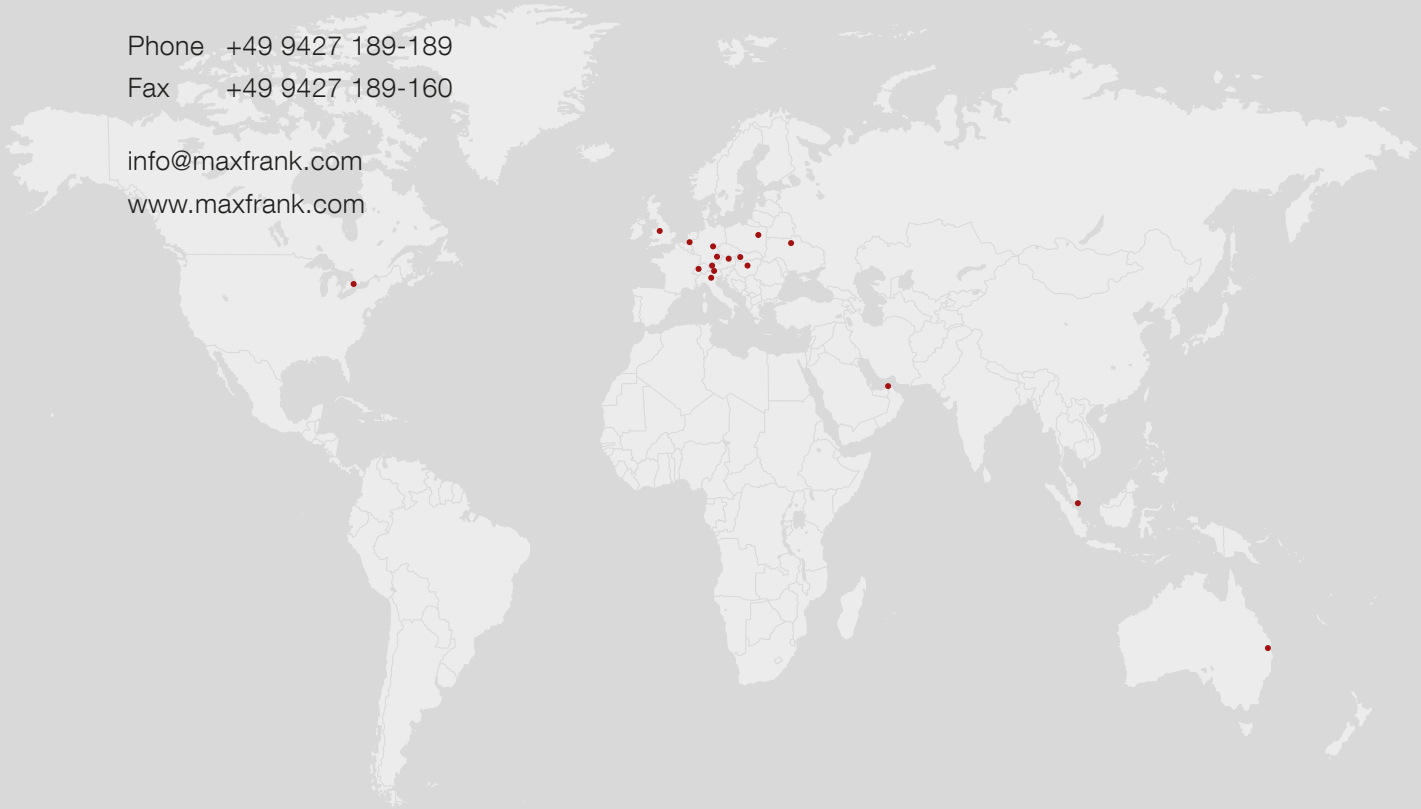

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