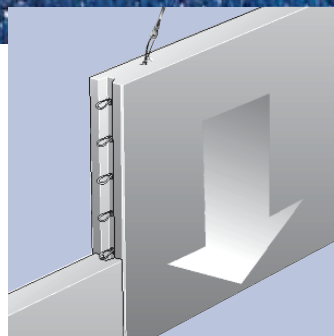


**New: Geometrie
of joint**



02/2017



Product overview PFEIFER VS[®] System

**PFEIFER
SEIL- UND HEBETECHNIK
GMBH**

DR.-KARL-LENZ-STRASSE 66
D-87700 MEMMINGEN

PHONE Technical
 support 083 31-937-345
 Sales 083 31-937-290
FAX 083 31-937-342
E-MAIL bautechnik@pfeifer.de
INTERNET www.pfeifer.de

PFEIFER – Safely in the right direction

“Made in Germany” for over 430 years.

PFEIFER Seil- und Hebeteknik GmbH in Memmingen is the headquarters of the PFEIFER Group and can look back on a family tradition of more than 430 in the manufacture of ropes and cables. Today, Gerhard Pfeifer, the 12th generation of the family, heads the internationally active group of companies providing top-class performance in the areas of wire rope technology, lifting technology and connecting and lifting systems.



Quality is our business.

All our products have always been safety-related. The precast concrete industry has now been lifting its precast elements, often weighing tons, for half a century using PFEIFER anchors. In every case, human lives depend on our products working safely. We ensure this with our quality and expertise. We want to gain – and retain – the trust of our customers through reliable and innovative products and a reliable service.

And that is exactly why both today and in the future we are backing „Made in Germany“ where it matters.

We will be pleased to give you advice. Good advice.

With constant ongoing development, regular testing and inspection of our products, our engineers and technicians are a team of advisors with a comprehensive body of knowledge and innovative strength. As developer, our technology experts can develop reliable, economical and safe suggestions and solutions for installations – even for the most difficult applications, e.g. anchors even in limit situations that differ from the general installation manuals.

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General information on the PFEIFER-VS® System	4-5
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VS® FDS Joint Pressure Formwork	21

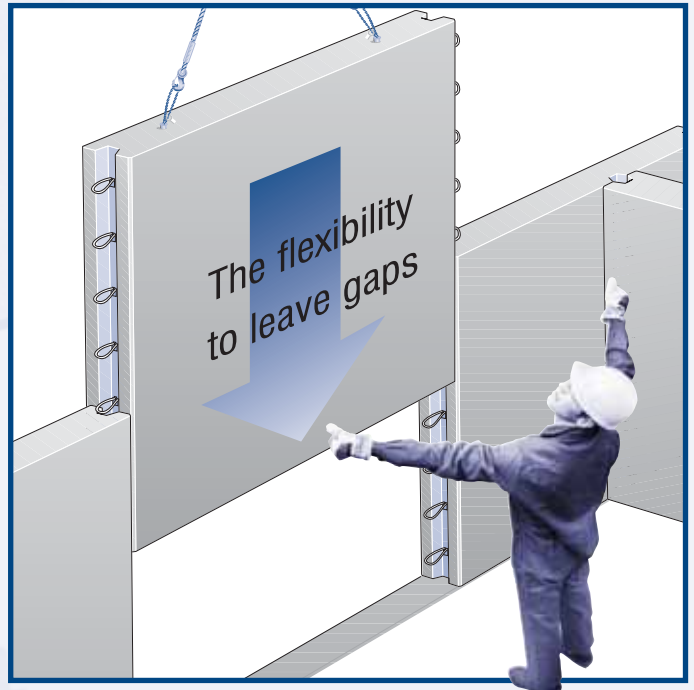
Important note

This document gives a basic overview of the PFEIFER-VS® System. General information about installation and use is given here.

This document contains no information about dimensioning or load-bearing capacity! It is essential that the applicable national regulations (approvals/standards) are observed in respect of joints that support static loads and are therefore subject to building regulations.



PFEIFER-VS[®] System: Your solution for lightning- fast, problem-free assembly of precast concrete wall elements



Consistent manufacturing quality thanks to semi-automated processes within the scope of a quality management system certified by BS EN ISO 9001:2000.

Experienced long-term employees control and organise production at the head office in Memmingen, producing high quality products – Made in Germany.

With PFEIFER you have many advantages



Advantages in planning

- Safety from one source: the intelligently co-ordinated spectrum of products in the PFEIFER-VS® System offers the planner a comprehensive range for any application
- Safety through steel ferrules that transmit the full cable breaking force into the concrete element without additional retention reinforcement
- Spring-back wire rope loops allow the planner to arrange precast concrete sections flexibly



Advantages in precast element production

- Easy fixing to the formwork by nailing or gluing to steel formwork with hot-melt adhesive
- Careful processing and accurate fabrication ensures that the highest demands for sealing against concrete slurry penetration are satisfied



Advantages in precast element assembly

- The wire rope loops are easily folded out using a roofing hammer – no difficult bending of reinforcing steel, no time-consuming screwing
- No rusting, since the recess rail and wire ropes are galvanized
- Flexible, spring-back wire rope loops allow precast concrete elements to be placed leaving gaps



Advantages for the purchasing department

- PFEIFER offers a comprehensive, well-rounded range with VS® Boxes, VS® Rails and VS® Long Boxes
- Specially economic solution through modern production plants
- Easily handling saves assembly time and wage costs





Ideal positioning of the wire rope loops ensured through engagement mechanism.



PFEIFER-VS[®] Box universal application and simple assembly



Efficiency

- Axis distances can be adjusted economically
- Inexpensive solution
- Low mortar consumption through economical casting channel



Innovation

- Convenient steel sheet box for any desired configuration
- Usable anywhere
- Ideal loop fixing



Quality

- The box, which is only 2 cm high, can easily be fitted between or underneath the reinforcement
- Colour identification of the plastic slides according to loop length



PFEIFER-VS[®]-Box

Item no. 05.025



PFEIFER

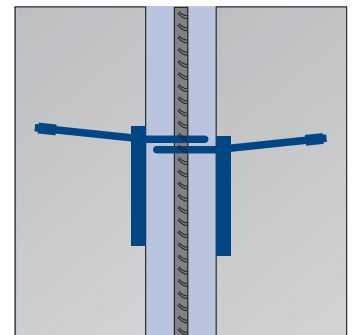
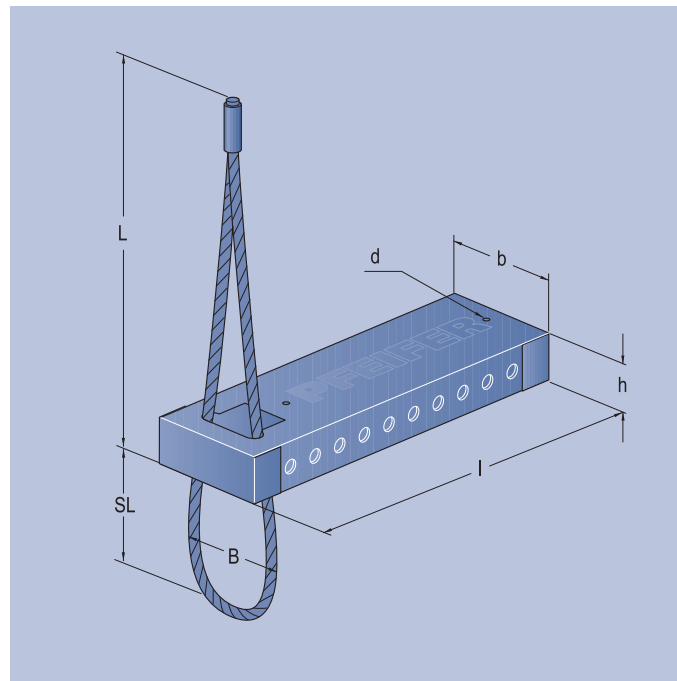
Connecting elements
VS[®]-Box

The PFEIFER-VS[®] Box is primarily used for non-load-bearing connections between concrete elements. It consists of a construction-orientated and stable steel sheet box in which the folding, flexible wire rope bonding loop is located. Wall joints can be achieved economically, easily and securely.

Casting is particularly fast and effective with the help of the FDS VS[®] Joint Pressure Formwork.

Materials:

Box: steel sheet, galvanized
Steel rope: high-strength, galvanized
Steel ferrule
Cover: tape



Ref.-No.	Type	Dimensions [mm]							Colour clip	Packing unit/pieces	Weight approx. kg/piece
		b	l	h	d	L	SL	B			
05.025.016.01.060	VS [®] 60	50	160	20	3	200	60	55	yellow ■	1000	0,20
05.025.016.01.080	VS [®] 80	50	160	20	3	180	80	60	black ■	1000	0,21
05.025.016.01.100	VS [®] 100	50	160	20	3	160	100	65	white □	1000	0,22
05.025.016.01.120	VS [®] 120	50	160	20	3	170	120	70	grey ■	1000	0,23
05.030.48 Replacement tape, 50 m roll, silver grey, 50 mm wide											

General installation instructions for the PFEIFER-VS[®] Box

Use

Fig. 1



The PFEIFER-VS[®] Boxes are provided for the connection of reinforced concrete precast wall elements (Figures 2 to 5) made of concrete of grade C30/37 or better.

The systems always consist of the VS[®] Boxes and of a suitable casting mortar.

Fig. 2:
Butt joint

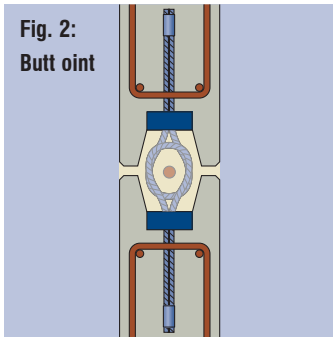


Fig. 3:
Corner joint

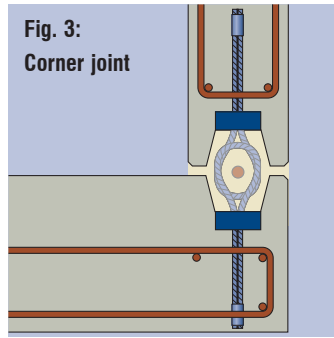


Fig. 4:
T-joint

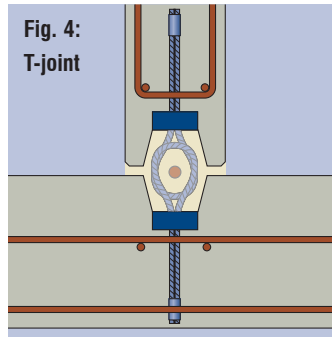
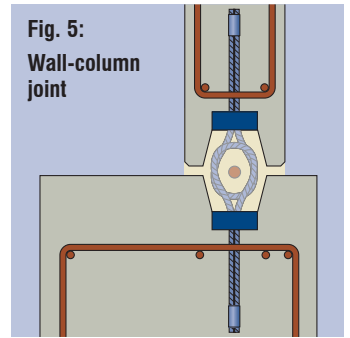


Fig. 5:
Wall-column joint



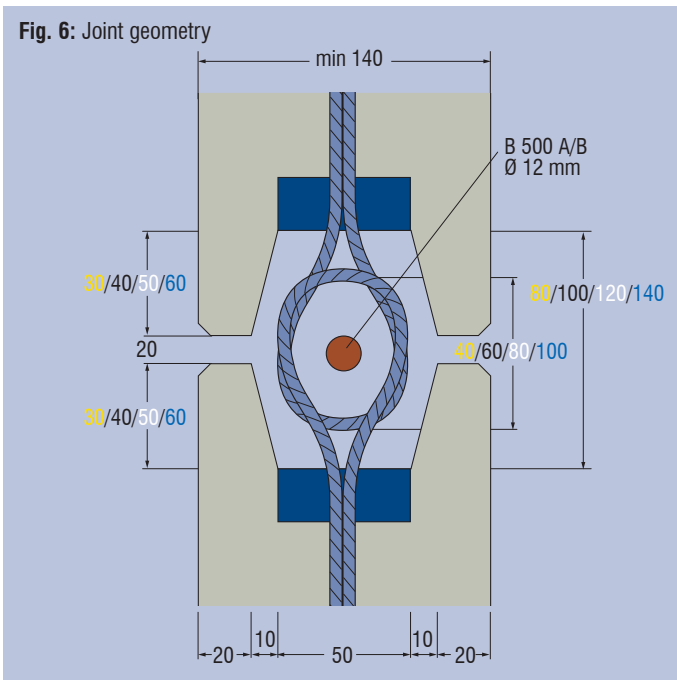
Dimensioning

! **Notice:** When used at statically relevant locations, the applicable national regulations must be applied. These only exist for the VS[®] Box in a few countries! It is strongly recommended that the VS[®] Slim Box/VS[®] Plus Box is used in accordance with national regulations instead of the VS[®] Box for static load-bearing connections.

Installation and usage

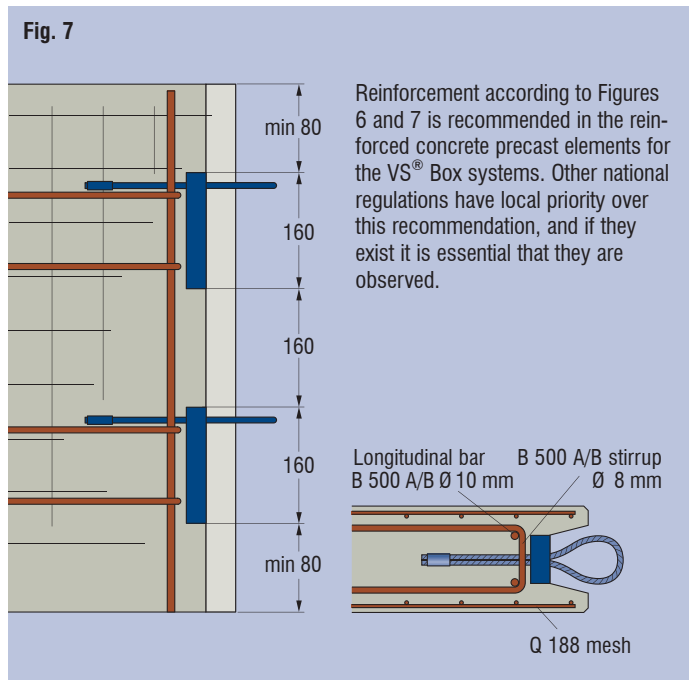
Installation

Fig. 6: Joint geometry



Reinforcement

Fig. 7



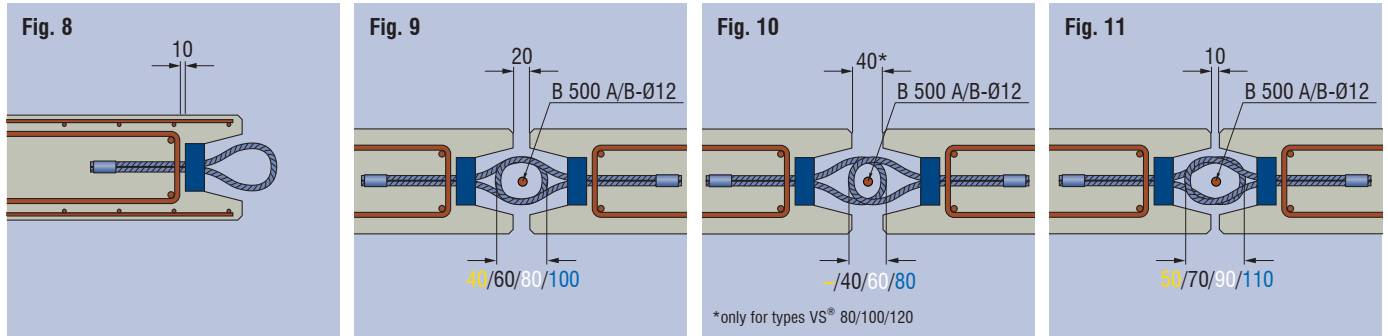
Reinforcement according to Figures 6 and 7 is recommended in the reinforced concrete precast elements for the VS[®] Box systems. Other national regulations have local priority over this recommendation, and if they exist it is essential that they are observed.

! **Notice:** As an alternative to the stirrups, a suitable mesh cap can also be installed.

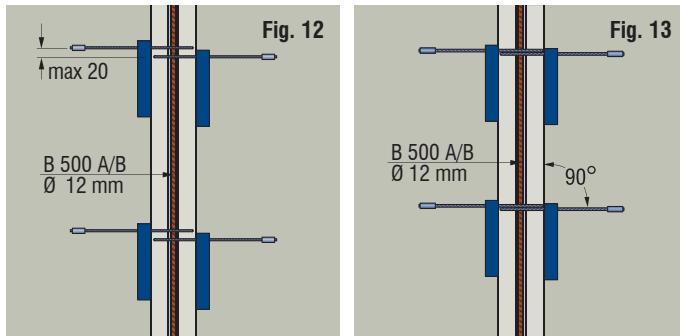
Installation and usage

Element joint

Standard joint = 20 mm (Figure 9), maximum joint = 40 mm (Figure 10), minimum joint = 10 mm (Figure 11)



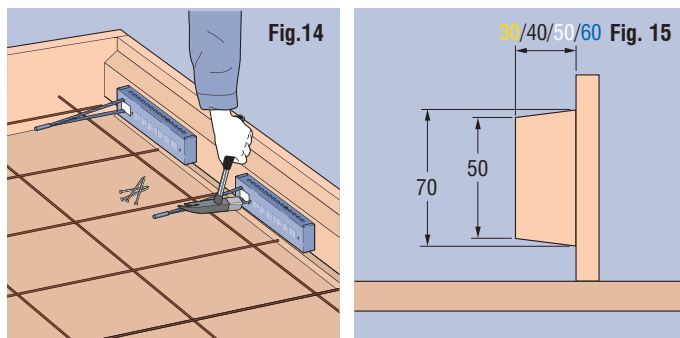
Installation tolerances



The VS® Box joint functions as an overlapping joint. For that reason, the loops must each lie above one another within certain vertical and horizontal tolerances.

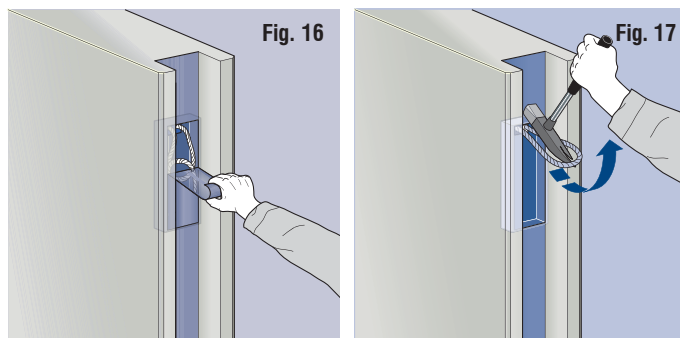
Vertically, the loops are usually to be fitted without any offset, so that they touch one another and lie directly on top of one another (Figure 13). This happens when the boxes are arranged in the same way from the base of the elements to be joined. A maximum vertical position error of 20 mm is permitted (Figure 12).

Manufacture of the steel reinforced concrete precast elements



The wall elements are usually concreted on formwork tables. A trapezoidal strip is fastened to the frontal vertical end of the wall elements, according to Figure 14. The dimensions of the trapezoidal wood can be obtained from Figure 15. Care should be taken to see that the position is central within the load-bearing concrete layer. When inserting the VS® Box into the formwork, it is necessary to ensure that the wire rope end is threaded as straight as possible between the reinforcement. The anchorages for the wire rope ends are to be arranged at 90° to the joint (Figures 14/18). Fixing the loops to the reinforcing mat with wire prevents the loops from slipping out of place.

Starting from the lowest point of the element, the boxes are then nailed into place, or attached with hot-melt adhesive in the case of steel formwork. It is always important to see that the arrangement is the same on both sides of the joint!

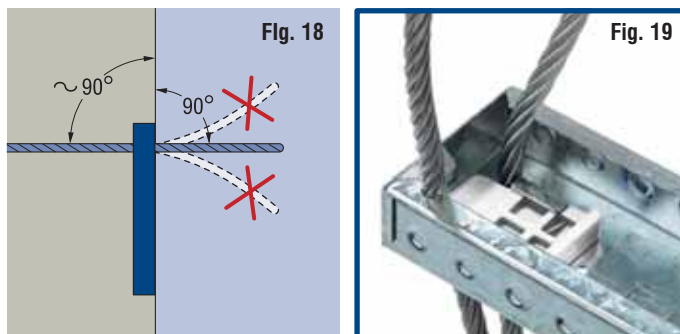


After demoulding

The flexible covering foil is simply pulled off after demoulding (Figure 16) The inside of the VS® Box is then exposed, and the wire rope loops are visible. The wire rope loops can then easily be folded out, using a tool to avoid injury (Figure 17).

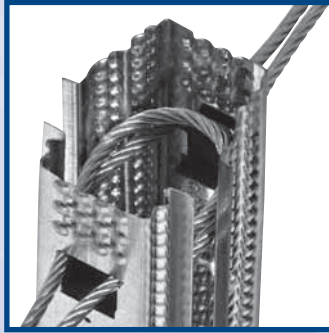
The wire rope loop should protrude perpendicularly from the structural element (Figure 18), and should spring back to this position again even after having been pushed aside when assembling the elements. To do this, the loop is hooked into the fastening that is integrated into the sheet metal box (Figure 19).

This is important in order to ensure that the loops will overlap properly later on. The wall elements are now ready for final installation on site.



Caution: The most sensitive element of the connection of the joint between wall elements is always the casting mortar. The joints can only function when the joints have been properly and completely cast, and the joint concrete has been suitably compacted.

Assembling the precast elements: The joints, the VS® Boxes and the loops must be clean, free from dirt or from separative fluids. The wall elements are either placed on a bed of mortar or on underlaid plates of different heights using the permitted connection method. The elements must be levelled so that their position and heights are in accordance. The width of the opening at the element joint is usually 20 mm, and must not be outside the tolerance range of between 10 and 40 mm. Vertically, the loops should lie in contact one the other, or may have a distance of no more than 20 mm between them (see page 15, Fig. 8/9/10 Page 9).



The VS[®] Rail T50 and the Long Box T20 offer an optimum casting channel for your column-wall connection



Efficiency

- Butt and T wall joints, as well as wall-column connections – economical, simple and secure to implement
- Rail profile acts simultaneously as formwork – no additional wooden formwork needed
- No additional tools necessary



Innovation

- Optimum loop overlapping through fixed geometry
- Lateral profiling ensures firm hold in the ground



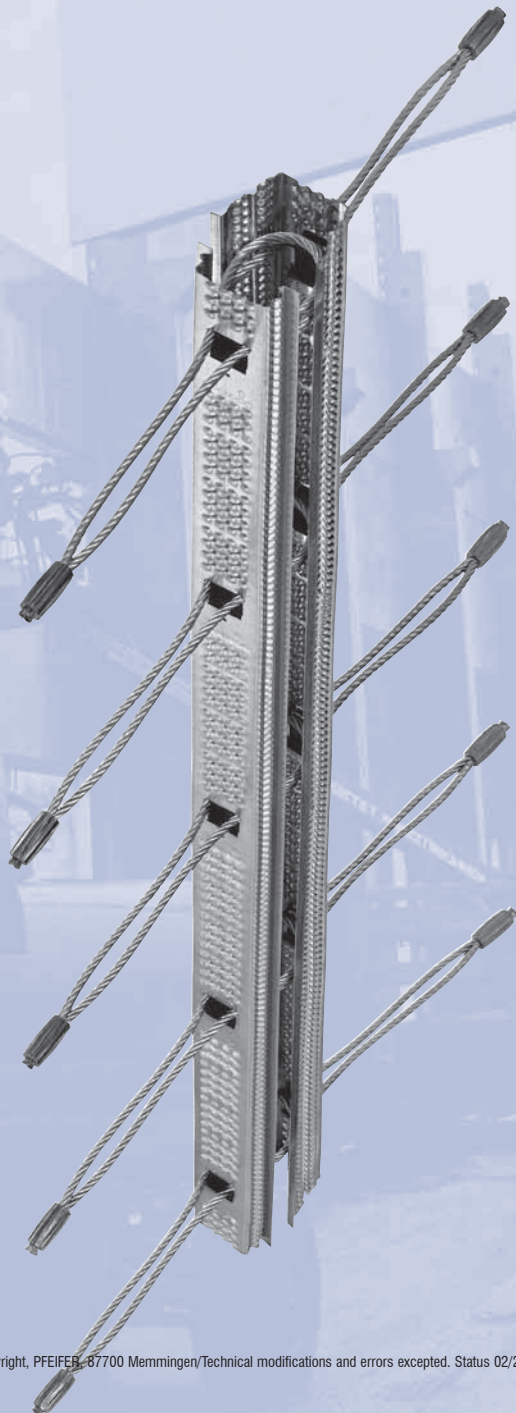
Symmetry

- Non-directional installation
- Practical and reliable



Quality

- Every application found in practice is covered
- Robust, galvanized sheet steel strip
- Loops protected in the rail when folded out



PFEIFER VS[®] Rail T20

PFEIFER VS[®] Long Box T50

Item no. 05.031
Item no. 05.030

For constructive wall and column connections in prefabricated construction



PFEIFER

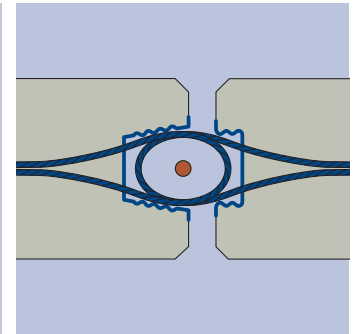
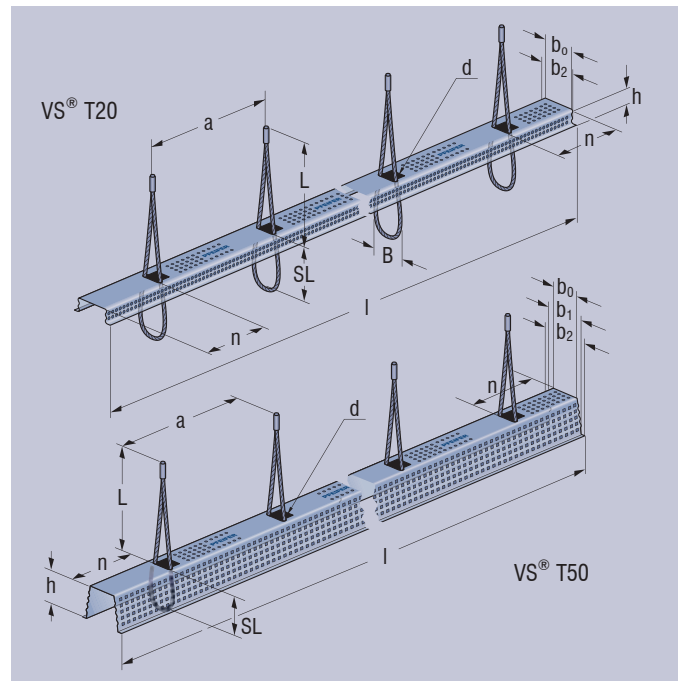
Connection Systems
VS[®] Systems

The PFEIFER rails and strips T20 and T50 are used for the construction of prefabricated partition walls and supports as well as wall-wall connections.
Filling materials as well as grout mortars having plastic / thixotropic properties can be used as joint filling material.

VS[®] PAGEL[®] GROUT and the VS[®] P PAGEL[®] JOINT FILLING MORTAR are, for example, available to users as joint filling materials.
Casting is particularly fast and effective with the help of the FDS VS[®] Joint Pressure Formwork.

Material:

Rail: steel sheet, galvanized
Steel rope: high-strength, galvanized
steel spit clamp
Cover: tape



Ref.-No.	Type/size	Dimensions [mm]										Loops Quantity	Colour clip	Packing unit/pieces	Weight approx. kg/piece	
		b ₀	b ₁	b ₂	h	l	SL	L	a	n	B					d
05.030.002.075	VS [®] -T20/2	50	-	70	20	1180	75	205	590	295	60	3	2	black	100	0,88
05.030.004.075	VS [®] -T20/4	50	-	70	20	1180	75	205	295	148	60	3	4	black	100	1,08
05.030.006.075	VS [®] -T20/6	50	-	70	20	1180	75	205	186	125	60	3	6	black	100	1,40
05.030.007.075	VS [®] -T20/7	50	-	70	20	1180	75	205	155	125	60	3	7	black	100	1,70
05.027.002.075	VS [®] -T50/2	50	65	80	50	1180	75	205	590	295	60	3	2	black	60	1,15
05.027.004.075	VS [®] -T50/4	50	65	80	50	1180	75	205	295	148	60	3	4	black	60	1,35
05.027.006.075	VS [®] -T50/6	50	65	80	50	1180	75	205	186	125	60	3	6	black	60	1,75
05.027.007.075	VS [®] -T50/7	50	65	80	50	1180	75	205	155	125	60	3	7	black	60	1,90
05.030.000	VS [®] -T20/0	50	-	70	20	1180	-	-	-	-	-	3	-	-	150	0,68
05.027.000	VS [®] -T50/0	50	65	80	50	1180	-	-	-	-	-	3	-	-	150	1,00



Lateral rail profiling
ensures firm hold!



The PFEIFER VS[®] Rail W50 – implement wall joints economically, simply and securely



Efficiency

- Comprehensive range for all applications
- Fast, efficient assembly using materials by the meter
- Simple fabrication of storey-height casting channel



Innovation

- Lateral rail profiling ensures firm hold in the concrete – even during demoulding



Symmetry

- Non-directional installation
- Practical and reliable



Quality

- Strong, convenient steel sheet box for any desired configuration
- The rails can be separated or shortened easily
- Optimum joint casting due to simple rail geometry



PFEIFER VS® Rail T50

Item no. 05.027



PFEIFER

Connection Systems

VS® Rail T50

The PFEIFER VS® Rail T50 is used for non-load-bearing connections between concrete elements. Wall joints can be achieved economically, easily and securely. The length of the wire rope loops is matched to the rail profile so that optimum connection conditions are achieved in the casting channel.

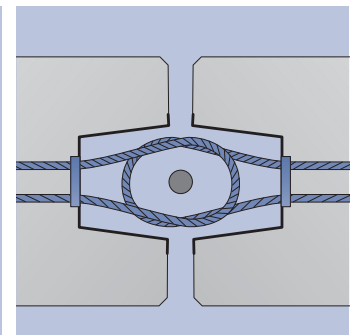
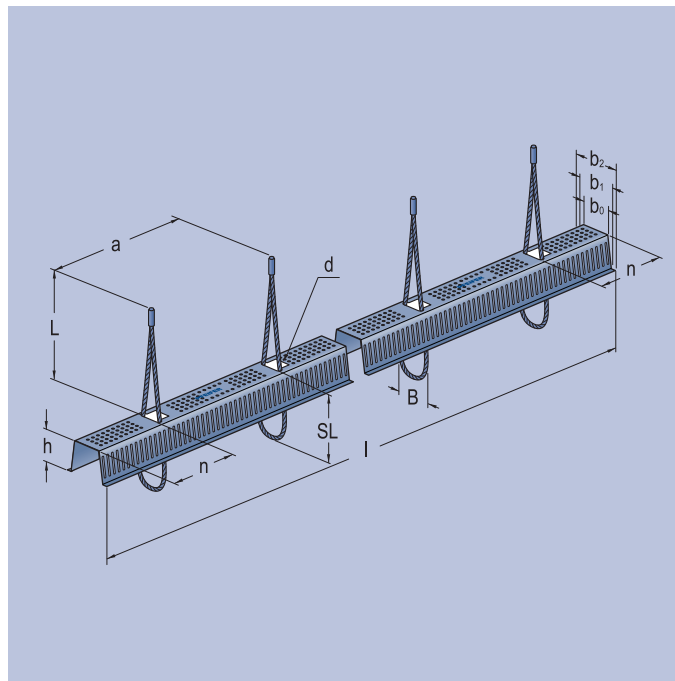
The trapezoidal rail guarantees secure, easy casting of the joint over the entire height of the storey.

VS® PAGEL® GROUT and the VS® P PAGEL® JOINT FILLING MORTAR are, for example, available to users as joint filling materials.

Casting is particularly fast and effective with the help of the FDS VS® Joint Pressure Formwork.

Materials:

Box: steel sheet, galvanized
steel rope: high-strength, galvanized
steel ferrule
cover: tape

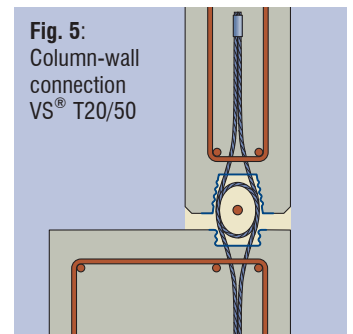
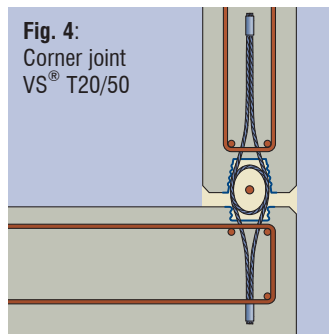
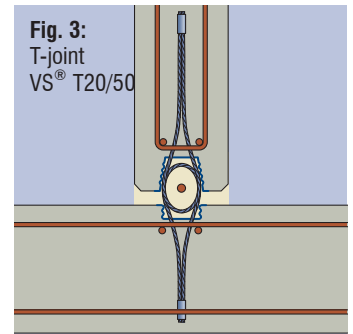
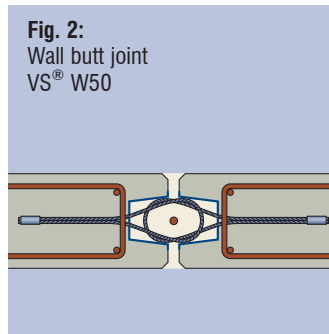
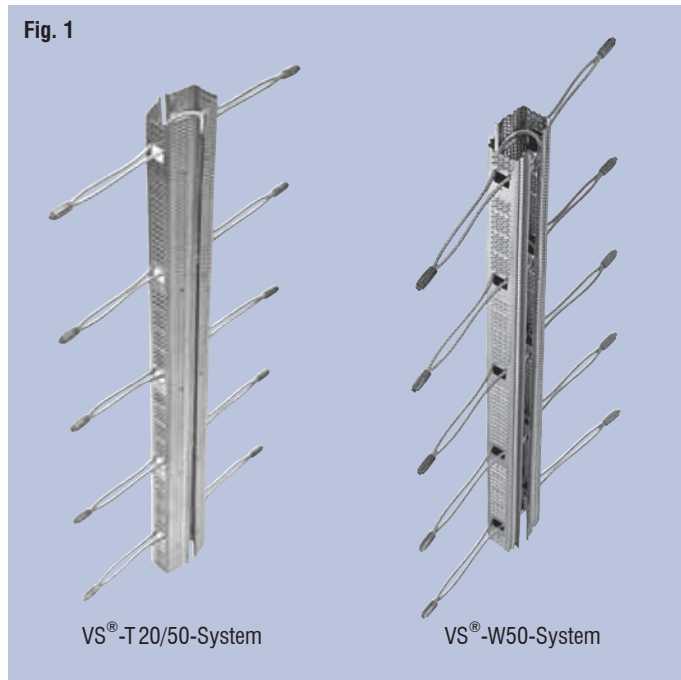


Ref.-No.	Type/size	Dimensions [mm]											Loops Quantity	Colour clip	Packing unit/pieces	Weight approx. kg/piece
		b ₀	b ₁	b ₂	h	l	SL	L	a	n	B	d				
05.027.590.100	VS®-W50/2	50	65	80	50	1180	100	180	590	295	60	3	2	white	60	1,15
05.027.295.100	VS®-W50/4	50	65	80	50	1180	100	180	295	148	60	3	4	white	60	1,35
05.027.186.100	VS®-W50/6	50	65	80	50	1180	100	180	186	125	60	3	6	white	60	1,75
05.027.155.100	VS®-W50/7	50	65	80	50	1180	100	180	155	125	60	3	7	white	60	1,90
05.027.000.000	VS®-W50/0	50	65	80	50	1180	-	-	-	-	-	3	-	-	150	1,00

General installation instructions for VS[®] rail systems

Use

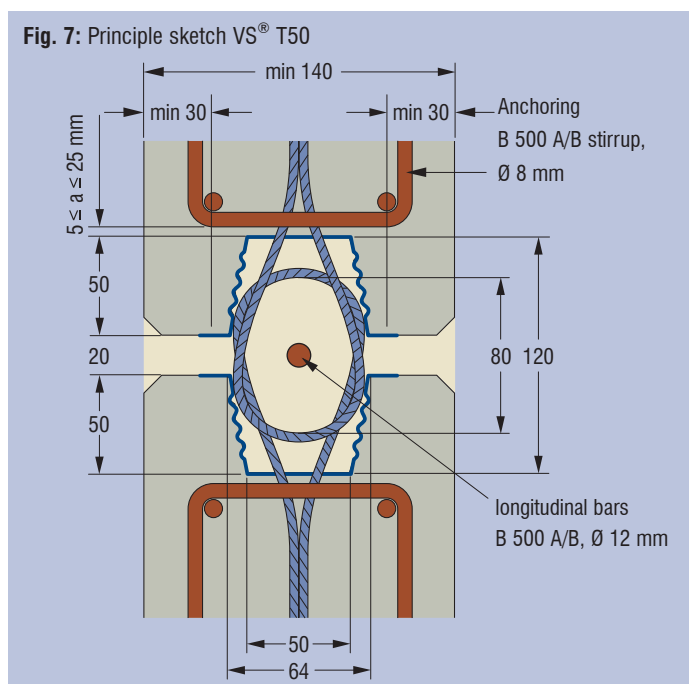
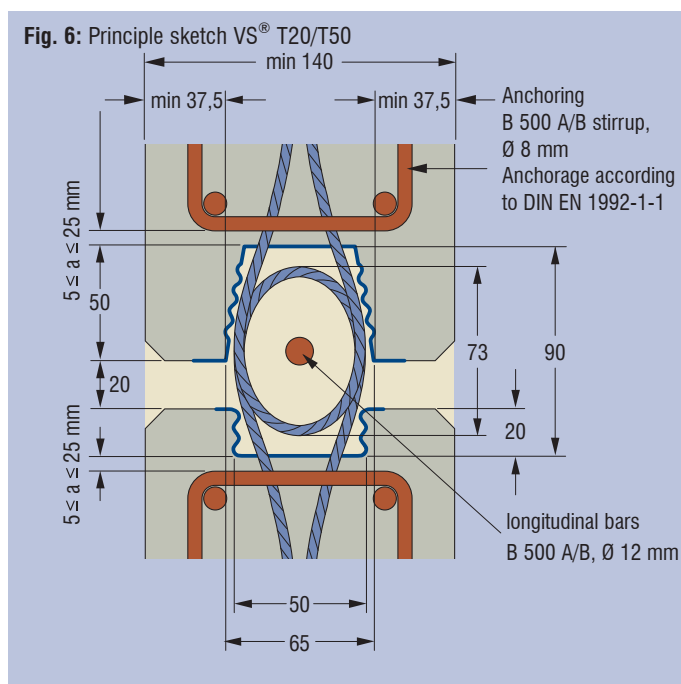
The PFEIFER VS[®] rail systems are provided for the connection of reinforced concrete precast wall elements (Figures 2 to 5), or walls and columns made of concrete of grade C30/37 or better. The systems always consist of the VS[®] profiled rails and of a suitable casting mortar.



Dimensioning

! **Notice:** It is strongly recommended that the VS[®] ISI / VS[®] BZ 50 rails are used in accordance with national regulations for static load-bearing connections.

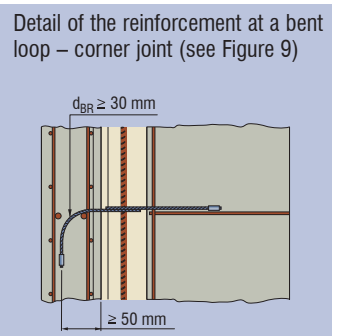
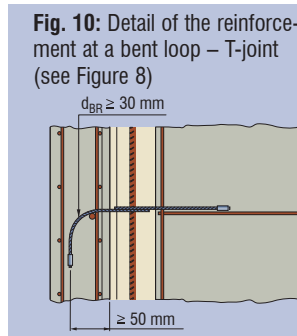
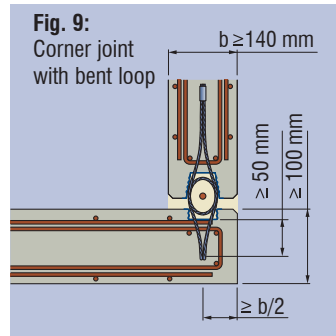
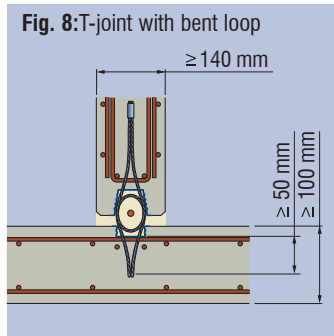
Installation and usage



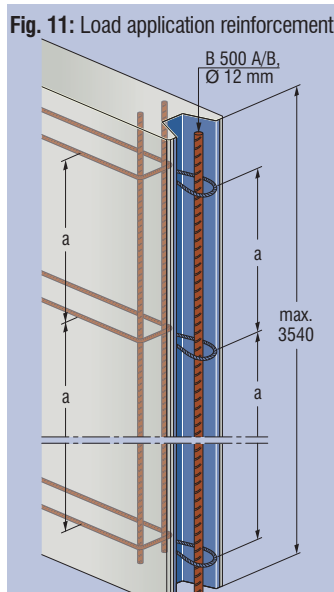
Installation and usage

Bending the anchoring loop

When the elements have small dimensions, the anchoring loop of the VS® Long Boxes can be bent. The crucial factor here are the bending dimensions given, for example, in Figures 8 to 10. At a corner joint, a Ø 8 mm stirrup is recommended in the region of the bent loop.



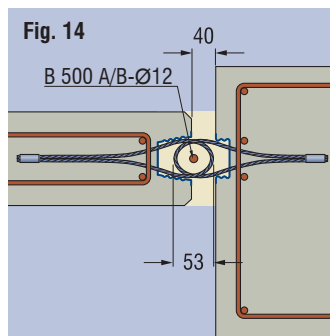
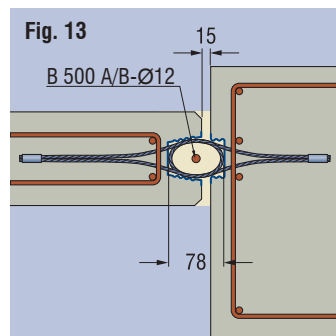
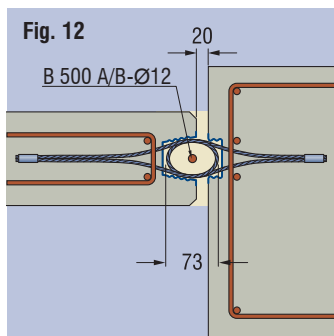
Reinforcement



Reinforcement according to Figures 6, 7 and 11 is recommended in the reinforced concrete precast elements for the VS® rail systems. Other national regulations have local priority over this recommendation, and if they exist it is essential that they are observed.

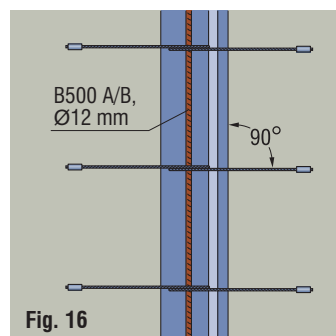
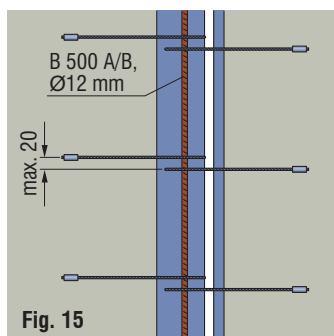
! Notice: As an alternative to the stirrups, a suitable mesh cap can also be installed.

Element joints



Standard joint = 20 mm (Fig. 12)
Minimum joint = 15 mm (Fig. 13)
Maximum joint = 40 mm (Fig. 14)

Installation tolerances



The planning must not provide for any offsets between the loops over the length of the joint. The loops must therefore be installed in such a way that they are in contact and lie directly on top of one another (Figure 16). If the joints extend over a number of floors, it may in some circumstances be useful to set regular zero points for orientation of the rail sections. Maximum vertical height tolerance from standard construction variations of 20 mm is admissible (Figure 15).

! Note: Due to the geometrical arrangement of the loops, a greater distance between the loops is achieved for the variants with 6 and 7 loops when impacting between two profiles.

Manufacture of the steel reinforced concrete precast elements

When a precast element connection is established using the VS[®] Rail and Long Box system, the casting channel is automatically formed by rail profiles. This means that it is not necessary to provide any additional recessing blocks, depressions or the like. When inserting the VS[®] profiles into the formwork, it is necessary to ensure that the wire rope ends are threaded as straight as possible between the reinforcement. Starting from the lowest point of the element, the profiles are then simply nailed into place with the loops at the same height for both elements (Figure 18), or attached with hot-melt adhesive in the case of steel formwork. Fixing the loops to the reinforcing mat with wire prevents the rails and loops from slipping out of place. The anchorages for the wire rope ends are to be arranged at 90 ° to the joint. They are to be positioned in such a way that the heights of facing loops correspond precisely.

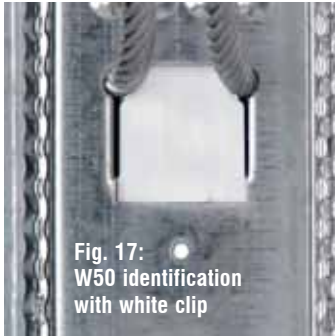


Fig. 17:
W50 identification
with white clip

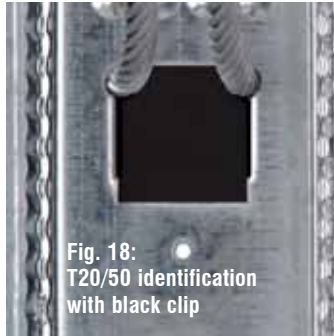


Fig. 18:
T20/50 identification
with black clip



Caution: Install the rails in the two elements that are to be joined with the loops at the same height. No profiles with different clip colors may be combined.

After demoulding

The flexible covering foil is simply pulled off after demoulding (Figure 19) The inside of the VS[®] profiles is then exposed, and the wire rope loops are visible. The wire rope loop can easily be folded out (Figure 20). The wire rope loop should protrude perpendicularly from the element, and should spring back to this position again even after having been pushed aside when assembling the elements. This is important in order to ensure the correct overlap. The wall elements are now ready for final installation on site.

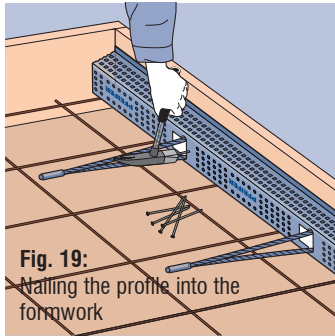


Fig. 19:
Nailing the profile into the
formwork

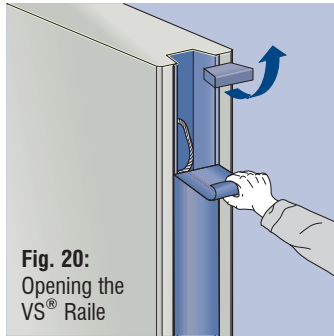


Fig. 20:
Opening the
VS[®] Raile

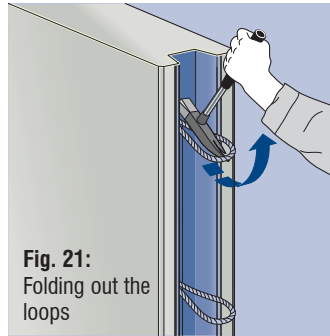


Fig. 21:
Folding out the
loops



Notice: PFEIFER application consultation service should be consulted if **increased formwork pressure** is to be expected as a result of vertical formwork.

Assembling the precast elements

The joints, the rail profiles and the loops must be free from dirt or from separative fluids. With the permitted connection method, the wall elements are either placed on a bed of mortar or on levelling plates. The elements must be levelled so that their position and heights are in accordance. Within the framework of the approval, the spacing of the joint may be between 15 mm and 40 mm. Vertically, the loops should lie in contact one the other, or may have a distance of no more than 20 mm between them.

The optimum joint material for every application

VS® PAGEL® -GROUT

- Highly penetrating
- Simple handling
- High design resistance
- No feed pump required
- Even relatively few joints can be filled economically

This high-strength, extremely well-flowing casting mortar flows perfectly into the recesses of the PFEIFER VS® Box systems. As a result there are no strength-limiting faults. In combination with the PFEIFER-VS® FDS Joint Pressure Formwork, this mortar makes it possible to fabricate extremely high-quality joint casting quickly and securely.



VS® -P PAGEL® -JOINT FILLING MORTAR

- Plastic and stable in the joint without formwork
- Less preparatory work is required
- Mixing and conveying can be done in one step
- Pump conveying to the joint

The PFEIFER-VS® rail systems have an optimised profile without awkward depressions. It is therefore possible to use a mortar that is plastic and that stands in the joint independently. The big advantage of this is that only very little formwork is needed here. This technology offers significant savings, particularly on large building sites with many metres of joint.



Joint filler for VS® Box

Information and notes

The properties of the grout in the joint play an important role in a load-bearing connection of precast concrete elements with the PFEIFER-VS® system elements. The specially developed VS® PAGEL® GROUT has proven its suitability in combination with PFEIFER-VS® systems in extensive tests.

Grout properties

- ✓ Very free-flowing for at least 90 minutes
- ✓ Shrinkage-compensated
- ✓ Resistant to frost and de-icing salt
- ✓ Can be pumped with mixing and conveying pumps
- ✓ Corrosion inhibiting
- ✓ Production certified according to DIN ISO 9001
- ✓ Delivered as bagged goods (25 kg bags)



Mixing VS® PAGEL® GROUT

The VS® PAGEL® GROUT is delivered ready-to-pour, and only requires the addition of water according to the PAGEL® mixing instructions printed on the bag. The material is then immediately ready to use.

Joint filling

The grout is added continuously until the planned height (max. 3.54 m) is reached. The formwork must be able to withstand the pressure created in this way. Compaction is not necessary. Nevertheless, air removal by poking with the reinforcing steel bar or the application of an internal vibrator is recommended. The grout sets very quickly, and allows work to continue promptly. The joint can be subjected to the approved load after the appropriate setting time.

Joint formwork variants

1. Board formwork

In order to completely fill joints between precast elements with VS® PAGEL® GROUT, a shuttering board (Figure 1) is attached on both sides. It is recommended that foam rubber is applied to the shuttering boards in order to compensate for unevenness. When the shuttering boards are properly fastened and it has been ensured that casting mortar cannot escape anywhere, the joint can be filled as described in the "Joint filling" section. The formwork can be removed, cleaned and reused after the material has hardened.

2. Mortar seal

Another variant makes it possible to close the joint flanks with the plastic VS®-P PAGEL® JOINT FILLING MORTAR (Figure 2). After this mortar has hardened, the core of the joint can be filled with VS® PAGEL® GROUT, and the higher performance of the systems can be achieved.

3. VS® FDS Joint Pressure Formworks

The joint pressure formwork consists of two hoses, 4 m long. These are very slightly inflated, and pressed into the slot of the joint, so that the casting space of the loops is not impaired. After the hose has been inserted over the full height of the joint, the hoses are brought up to the rated pressure, and the joint is sealed (Figure 3). The casting mortar can now be introduced from above, over the full height of at most 3.54 m. After the casting mortar has hardened, the air pressure can be released and the hose removed. It can be reused after cleaning. Please follow the detailed installation instructions.

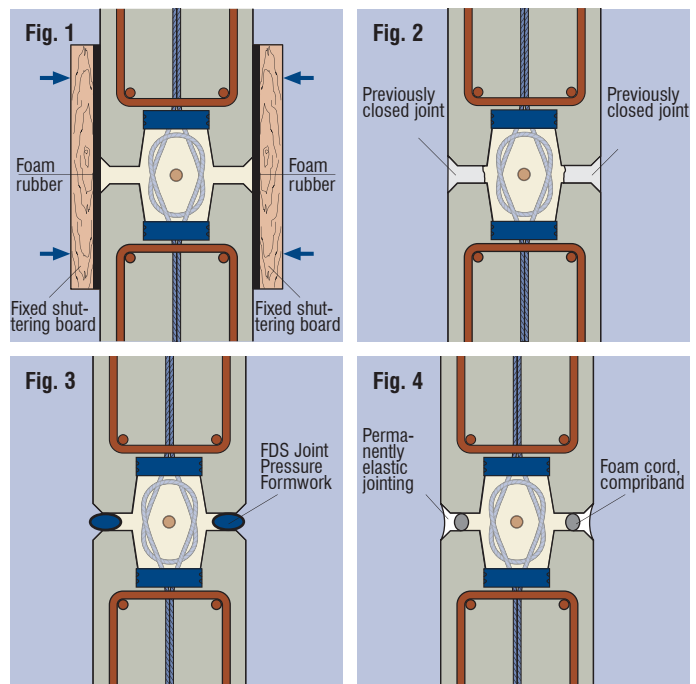
4. Sealed compriband

Another way to cast the joints with the VS® PAGEL® GROUT is the variant sketched in Figure 4. In this case, prior to casting, a foam cord/compriband is inserted into the joint in a defined manner, after which a permanently elastic jointing is applied.

When this jointing has completely hardened, the grouting can be carried out without any additional formwork measures. The pressure that arises during casting must, however, be considered. This should be determined by the processing company, allowing suitable casting sections to be chosen to avoid the jointing from being pushed out.

Caution: The VS® PAGEL® GROUT is manufactured and marketed by PAGEL Spezialbeton GmbH & Co. KG in Essen, Germany. The casting mortar must therefore always be handled properly in accordance with the manufacturer's data.

Caution: If joint pressure formwork or pre-compressed strips are to be pressed into the side joints without affecting the casting space, the effective lateral concrete coverage of the rail and the wire rope loop is reduced. The remaining cross-section must satisfy the applicable minimum requirements.



Consumption of VS® PAGEL® GROUT

The VS® software calculates the volume of grout for the selected grouted joint, using the true quantities and dimensions of the project that has been entered. It outputs the number of sacks required, and, if wanted, creates an enquiry fax for PAGEL.

Table 4 to the right makes it possible to calculate an estimate of the fully-filled joints; an average grout consumption per metre of joint, based on walls that are 3.5 m high, is given.

Table 4 – grout volumes for standard joint (20 mm)

Wall thickness [cm]	10	12	14	16	18	20	22	24
VS®-Box:	-	-	10.7	11.1	11.5	11.9	12.3	12.7

Consumption in l/m; about 2 kg material are required for each litre; The volume of grout is significantly affected by the number of boxes. The maximum possible number of boxes per metre is applied here.

VS[®] rail system joints with grouting material

Information and tips

The properties of the grout in the joint play an important role in a load-bearing connection of precast concrete elements with the PFEIFER-VS[®] system elements. The specially developed grouting materials have proven their suitability in combination with the PFEIFER VS[®] rails system in elaborate tests. These grouts are approved within the framework of the building authority approvals.

Grout characteristics

- ✓ Highly free flowing
- ✓ Shrinkage-compensated
- ✓ Resistant to frost and de-icing salt
- ✓ Can be pumped with mixing and feed pumps
- ✓ Corrosion-resistant
- ✓ Production certified to DIN ISO 9001
- ✓ Supplied as a bagged product (bags of 25 kg)

Mixing

The material is delivered as a ready-to-mix product and only needs to be mixed with water according to the instructions printed on the packaging. The material is then immediately ready to use.

Casting the joint

The grout is poured in continuously until the desired level (max. 3.54 m) is reached. The formwork must be able to absorb the stress that arises from this. Compacting is not necessary. Degassing by poking with the reinforced concrete steel bar or the fitting of a vibrator is, however, recommended. The grout bonds very quickly and allows rapid continuation of work. After the corresponding bonding times, the joint can be loaded to the permitted scope.

Joint formwork variants

1. Board formwork

In order to completely fill joints between precast elements, a shuttering board (Figure 28) is to be attached on both sides. It is recommended that foam rubber

Notice: The grout used must be handled exclusively in accordance with the instructions provided by the manufacturer: Pagel[®]-Spezialbeton GmbH & Co. KG or P&T Technische Mörtel GmbH & Co. KG.

Caution: When the air tube form or precompressed tapes are pressed into the lateral joints without adversely affecting the casting space, the effective lateral concrete cover for the rails and for the rope loop is reduced. The residual cross-section must be at least 14 cm.



is applied to the shuttering boards in order to compensate for unevenness. If the shuttering boards are correctly fixed and it is assured that the grout material cannot escape, the joint can be filled as described in the section entitled "Filling the joint". After the material has hardened the formwork can be removed, cleaned and reused.

2. Mortar seal

Another variant makes it possible to close the joint flanks with a mortar (Figure 29). After this mortar has hardened, the core of the joint can be filled with grouting material and the higher performance of the systems can be achieved.

3. VS[®] FDS air tube form

The air tube form consists of two 4 m-long air tubes. These are very slightly pumped and pressed into the joint slot, so that the casting space of the loops is not adversely affected. After the air tube is applied over the entire joint height, the air tubes are brought to the nominal pressure and the joint is sealed. Now the joint can be cast from above across the entire height of 3.54 m. After the grout has hardened, the air pressure can be released and the air tube removed. After cleaning, it can be used again.

4. Sealed compriband

Another way to cast the joints with a grout is the variant sketched in Figure 31. In this case, prior to casting, a foam cord/compriband is inserted into the joint in a defined manner, after which a permanently elastic jointing is applied.

After the joint sealing has completely hardened on both sides, the grout can be used without additional formwork measures. However, the stresses that occur during casting must be taken into account here.

These should be determined by the construction company and the appropriate casting sections selected so that any squeezing out of the joint sealing is prevented.

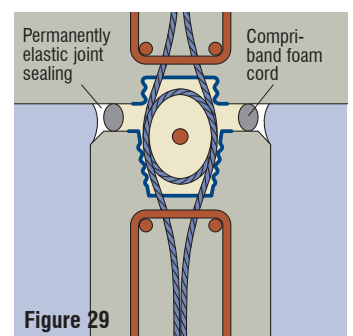
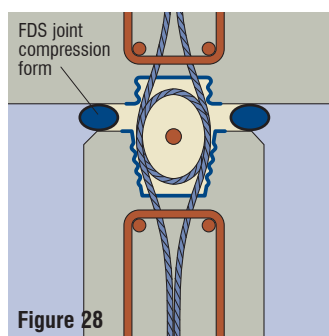
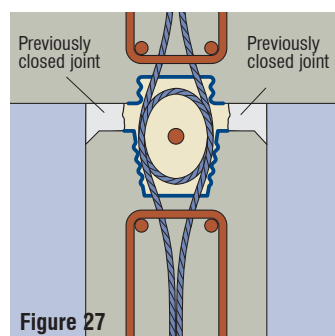
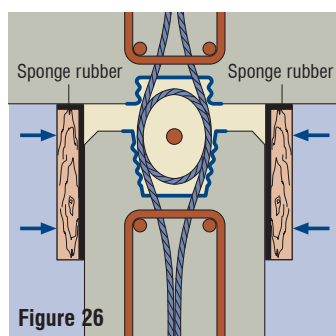
Consumption

The VS[®] software calculates the volume of grout for the selected grouted joint using the true quantities and dimensions of the project that has been entered. It outputs the number of sacks required and, if desired, creates an enquiry fax. For approximate calculations of the completely filled joints, the following table is used where an average casting consumption per running meter is specified based on 3.5 m high walls.

Table 5 – casting volume in case of standard joint (2 cm)

	Wall thickness [cm]					
	14	16	18	20	22	24
VS [®] T20/50	6.68	7.08	7.48	7.88	8.28	8.68
VS [®] W50	8.50	8.90	9.30	9.70	10.10	10.50

Amount in l/m for standard joint 2 cm;
approx. 2 kg of material are required per l



VS[®] rail system joint with plastic/thixotropic joint filling mortar

Information and notes

The advantage of the joint filling mortar is the filling of joints between pre-cast elements, where formwork can mostly be dispensed with. The optimised, plastic/thixotropic properties of this mortar means that it is stable after being poured in the joint, without the need for further measures. The approval for the VS[®] System 3D covers tensile and transversal shear forces acting both in parallel and vertically in relation to the joint.

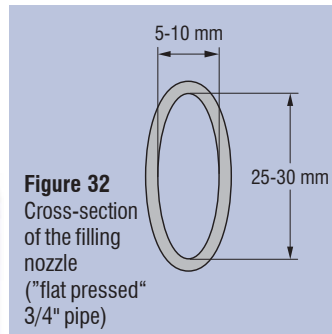
Mortar characteristics

- ✓ Non-shrinking with gel-type consistency
- ✓ Ease of production
- ✓ Can be pumped with commercially available screw pumps
- ✓ High initial and final hardening strengths
- ✓ Frost and de-icing salt resistant
- ✓ Impermeable to water
- ✓ Low water/cement ratio
- ✓ Production certified to DIN ISO 9001
- ✓ Externally and internally monitored
- ✓ Supplied as a bagged product (bags of 25 kg)



Nozzle manufacture

The filling nozzle, made of commercially available 22 mm (3/4") copper heating pipe (with the aid of a solder fitting for connecting to the pump air tube), can be attached (Figs 32 and 33).



! This information only applies to placing the material in the joint!

! **Caution: do not constrict filling space:** If pre-compressed strips are to be pressed into the side joints without affecting the grouting space, the effective lateral concrete coverage of the rail and the rope loop is reduced. This must also be taken into account by the planners in the dimensioning.

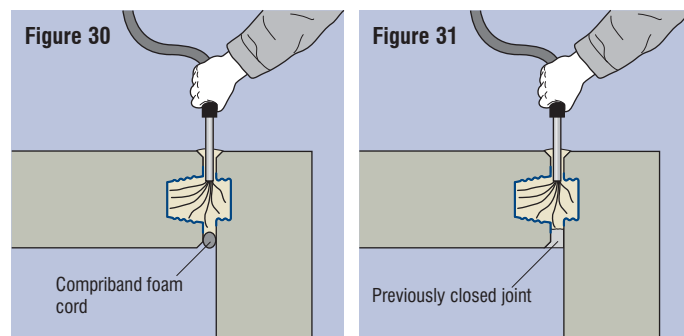
Mixing

The ready-to-use mortar supplied only needs to be mixed to a usable material by adding water. It is imperative to follow the mixing instructions on the bags.

Joint filling

First completely close off one joint flank using foam cord, profiled rubber (Figure 32) or alternatively using JOINT FILLING MORTAR (Figure 33). After closing with joint filling mortar, wait for the mortar to become stiff. After this, working from the other side, the remaining joint, which is now closed on one side, should be filled from the bottom to the top evenly and continuously. Gently poking the joint with the filling nozzle or the filling pipe ensures a proper result. The joint can easily be drawn flat after having been filled.

Joint formwork variants



! **Notice:** Not all VS[®] system products can be filled with every available mortar/grouting system. If in doubt, the combinations possible for the respective case can be taken from the currently valid building authority approvals.

The manufacturer's data must be observed for processing the VS[®] P PAGEL[®] CASTING MORTAR and VS[®] PAGEL[®] GROUT! Detailed instructions and a detailed equipment recommendation can also be found there. Technical data can also be found in the technical documentation provided by PAGEL[®].

PAGEL[®]
SPEZIAL-BETON GMBH & CO KG
Wolfbankring 9
D-45355 Essen
Telephone +49 (0) 201 685 040
Fax +49 (0) 201 685 0431
E-Mail info@PAGEL.com
Internet www.PAGEL.com

The manufacturer's data must be observed for processing the EuroGrout[®] universal filler and EuroGrout[®] Varix! Detailed instructions and a detailed equipment recommendation can also be found there. Technical data can also be found in the technical documentation provided by P & T.

P&T
Technische Mörtel
P & T Technische Mörtel GmbH & Co. KG
Bataverstraße 84
41462 Neuss
Telephone +49 (0) 2131 5669-0
Fax +49 (0) 2131 5669-22
E-Mail info@eurogrout.de
Internet www.eurogrout.de

The PFEIFER-VS[®] FDS Joint Pressure Formwork – for quick, perfect joins between double wall elements

Innovation

- Problem-free joint pressure formwork makes grouting precast element joints easy
- No more “belt and braces” solutions
- No need for special reinforcement
- Reusable

Quality

- High-quality materials for long-lasting elements
- Perfect joint appearance

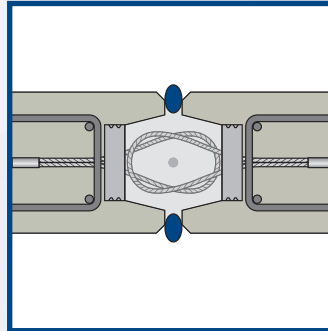
Efficiency

- Space-saving storage
- Long-lasting
- Fast to use
- Time-saving
- No reworking



The PFEIFER-VS[®] FDS Joint Pressure Formwork makes it possible to apply formwork to filling joints in the VS[®] FS system as quick as a flash for a perfect seal. Simple to fit and completely waste-free because joint pressure formwork can be reused.

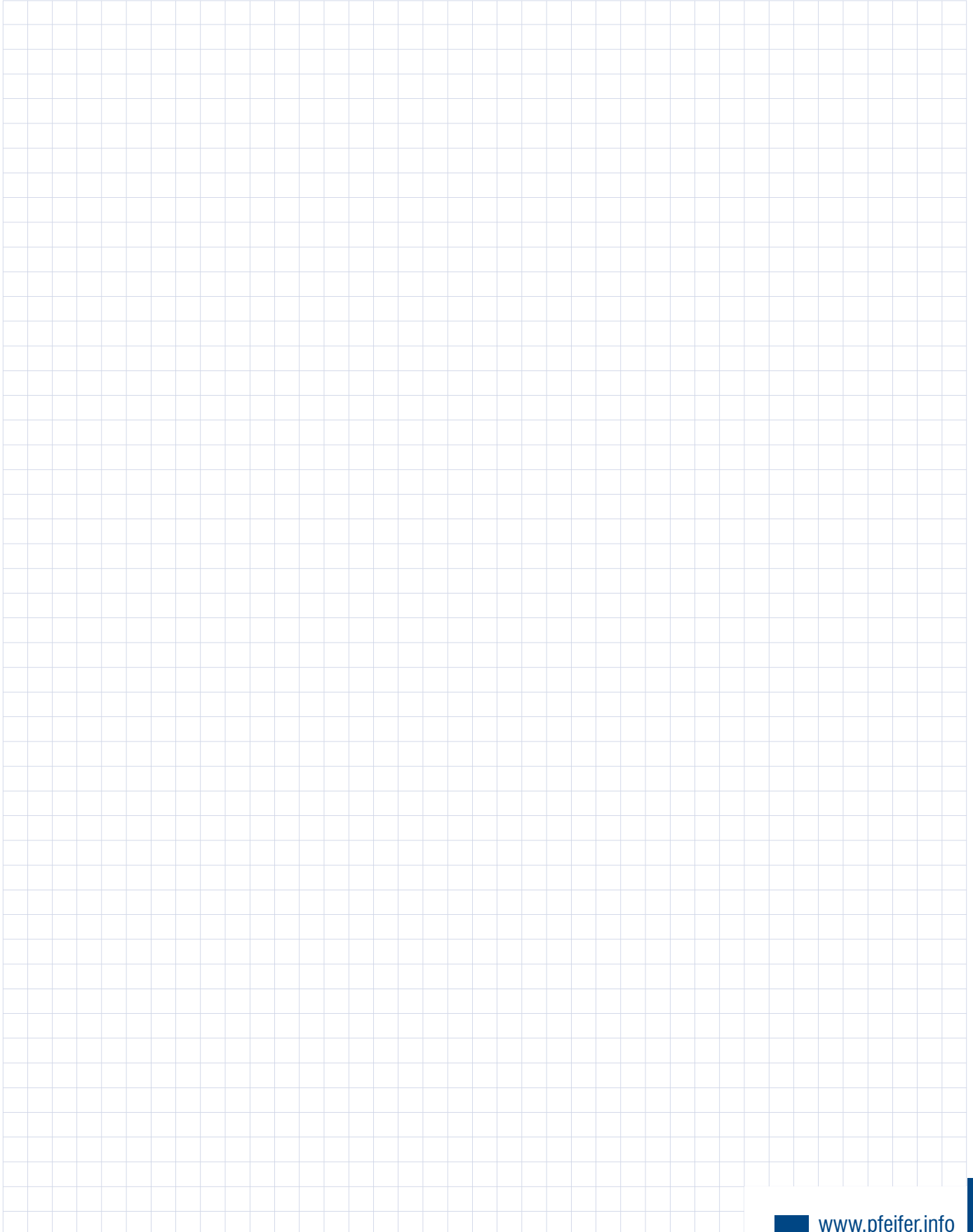
The joint pressure formwork guarantees a tight joint when casting up to 3.50 m in height. After the joint filling has hardened the air is released from the pressure formwork and it is removed, leaving a clean, recessed, slightly rounded smooth joint. This is especially useful for the permanent-ly elastic exterior seal of a building.



Notes



Notes





Lifting Anchor Systems
Thread System



Lifting Anchor Systems
BS Anchor System



Lifting Anchor Systems
WK Anchor System



Fixing Systems
DB Anchor 682
for Permanent Fixing



Fixing Systems
Socket Dowels
Polyamide Sockets



Fixing Systems
HK Assembly Anchor System



Connection Systems
Column Shoe System
Wall Shoe System



Connection Systems
Stell Bearing
Staircase Bearing VarioSonic



Connection Systems
Sandwich Anchor System
Delta Anchor System



Connection Systems
Concrete Earthing System BEB



Reinforcement Systems
VS®-Wire Rope Loop System



Reinforcement Systems
PH Reinforcement Continuity System



Cable Tension Members
Tension Rod System



Attachment Materials
(Wire Ropes, Chains, Textiles)



Lashing Systems



Grabs for Reinforcing Steel
Balancing Spreader Beams

This document is superseded when a new edition appears at www.pfeifer.info.

Germany Headquarters

PFEIFER SEIL- UND
HEBETECHNIK GMBH
Dr.-Karl-Lenz-Straße 66
D-87700 MEMMINGEN
Telefon +49 (0)8331-937-312
Telefax +49 (0)8331-937-342
E-Mail export-bt@pfeifer.de
Internet www.pfeifer.info

Fundlandstraße 29
D-45326 ESSEN
Tel. 0201-28966-0
Fax 0201-28966-20
E-Mail essen@jp-bautechnik.de

Markircher Straße 14
D-68229 MANNHEIM
Tel. 0621-4840340
Fax 0621-4840344
E-Mail mannheim@jp-bautechnik.de

Lechstraße 21
D-90451 NÜRNBERG
Tel. 0911-6427808
Fax 0911-6428472
E-Mail nuernberg@jp-bautechnik.de

Austria

PFEIFER SEIL- UND
HEBETECHNIK GMBH
Dr.-Karl-Lenz-Straße 66
D-87700 MEMMINGEN
Telefon +49 (0)8331-937-290
Telefax +49 (0)8331-937-342
E-Mail bautechnik@pfeifer.de

Denmark

JORDAHL & PFEIFER
Byggeteknik A/S
Risgårdvej 66,
DK-9640 Farsø
Tel. +45-9863-1900
E-Mail info@jordahl-pfeifer.dk

France

JORDAHL H-BAU France
Siège, 7 rue des Vallières Sud
25220 Chalezeule
Tél +33-3 81 25 04 65
Fax +33-3 81 25 07 96
E-Mail info@jordahl-hbau.fr

Spain

PFEIFER Cables y Equipos de
Elevación, SLU.
Avda. de los Pirineos,
25 - Nave 20
San Sebastián de los Reyes
ES-28703 MADRID
Tel. +34-916593185
Fax +34-916593139
E-Mail p-es@pfeifer.de

ES-08820 BARCELONA
Tel./Fax +34-93-6364662
Móvil +34-64-9154948
E-Mail frieda@pfeifer.de

Russia

000 PFEIFER
KANATI & PODJÖMNIE TEHNOLOGII
RU-119017 MOSCOW
Pyzhevskiy pereulok,
h.5, bld.1, office 108
Tel. +7-495-363-01-27
Fax +7-495-363-01-28
E-Mail info@pfeiferrussia.ru

Ukraine

JORDAHL & PFEIFER
TECHNIKA BUDOWLANA
ul. Pawłyka 17a
76-018 IVANO-FRANKIVSK
Tel. +380 67 442-85-78 (Eastern Region)
Tel. +380 67 442-85-79 (Western Region)
E-Mail info@j-p.com.ua

Hungary

PFEIFER GARANT KFT.
Gyömrői út 128
HU-1103 BUDAPEST
Tel. +36-1-2601014
Fax +36-1-2620927
E-Mail info@pfeifer-garant.hu

Singapore

J&P BUILDING SYSTEMS PTE LTD.
No. 48 Toh Guan Road East
#08-104 Enterprise Hub
SG-SINGAPORE 608586
Tel. +65-6569-6131
Fax +65-6569-5286
E-Mail info@jnp.com.sg

UAE

EMIRATES GERMAN BUILDING
MATERIALS TRADING (LLC)
P.O. Box 18917
UAE-DUBAI
Tel. +971-4-2676644
Fax +971-4-2676646
E-Mail info@emirategerman.com

Switzerland

Pfeifer Seil- und Hebeteknik GmbH
Kurt Styger
Gebietsverkaufsleitung
Schweiz Bautechnik
Dr.-Karl-Lenz-Strasse 66
D-87700 Memmingen
Telefon: +41 (0)797254931
Email: kstyger@pfeifer.de

United Kingdom

J&P BUILDING SYSTEMS LTD.
Unit 5 Thame Forty
Jane Morbey Road
GB-THAME, OXON OX9 3RR
Tel. +44-1844-215200
Fax +44-1844-263257
E-Mail enquiries@jp-uk.com

Czechia

JORDAHL & PFEIFER
STAVEBNÍ TECHNIKA S.R.O.
Bavorská 856/14
CZ-15500 PRAHA 5
Tel. +420-272700701
Fax +420-272703737
E-Mail info@jpcz.cz

Romania

S.C. JORDAHL & PFEIFER
TEHNICĂ DE ANCORARE S.R.L.
Str. Malului Nr. 7, et.1
RO-550197 SIBIU JUD. SIBIU
Tel. +40 269 246 098
Fax +40 269 246 099
E-Mail info@jordahl-pfeifer.ro

Poland

JORDAHL & PFEIFER
TECHNIKA BUDOWLANA SP. Z O.O.
ul. Wrocławska 68
55-330 KREPICE k/Wrocławia
Tel. +48 71 39 68 264
Fax +48 71 39 68 105
E-Mail biuro@jordahl-pfeifer.pl

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