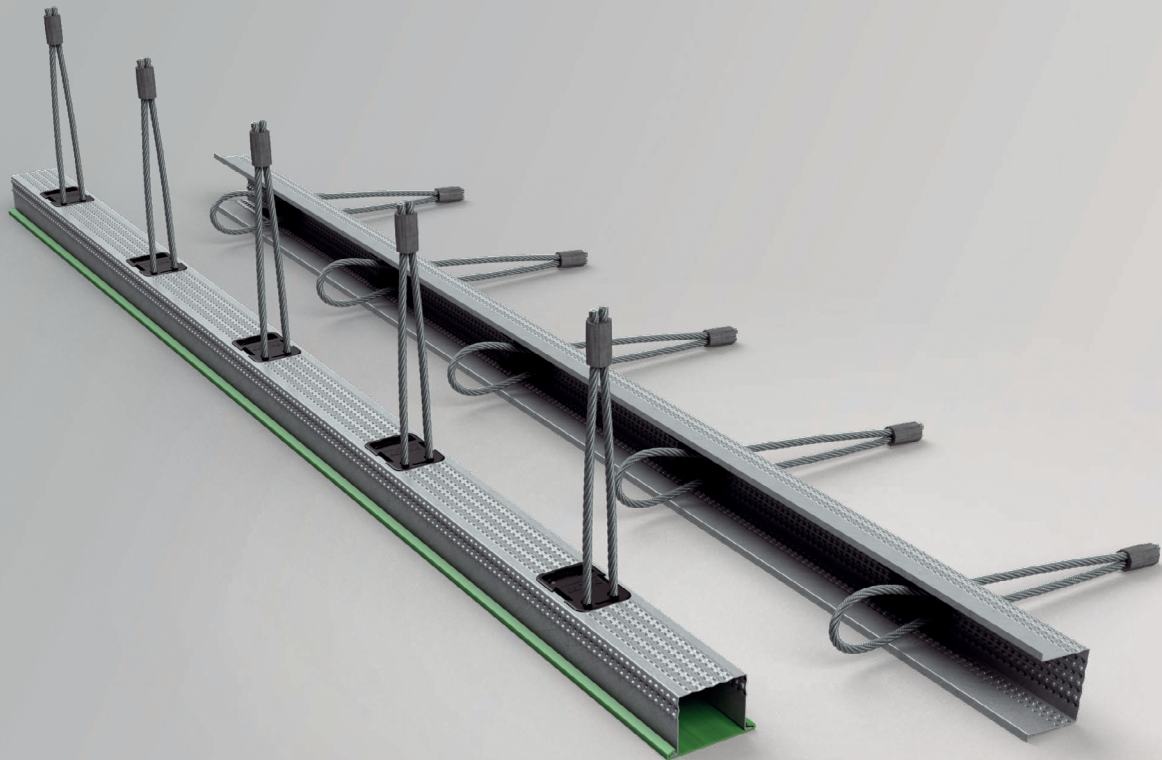


Power One System



Installation Instruction

Our products from the division BUILDING SOLUTIONS

SERVICES

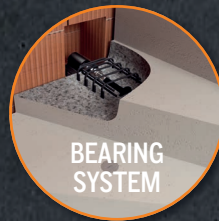
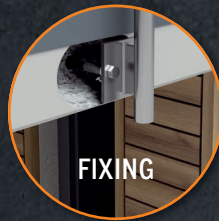
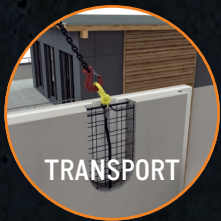
- » On-site tests -> we ensure that your requirements are properly covered by our planning.
- » Test reports -> for your safety and documentation.
- » Trainings -> the knowledge of your employees from planning and production is enhanced by our experts on site, online or via webinar.
- » Planning support -> latest design software, planning documents, CAD data and much more can be downloaded any time from www.philipp-group.de.

HIGH DEMANDS ON PRODUCT SAFETY AND PRACTICALITY

- » Close cooperation with notified bodies and - if necessary - approval of our solutions.

TECHNICAL DEPARTMENT

- » Our expert-team will support you at any time during your planning phase with detailed advice.

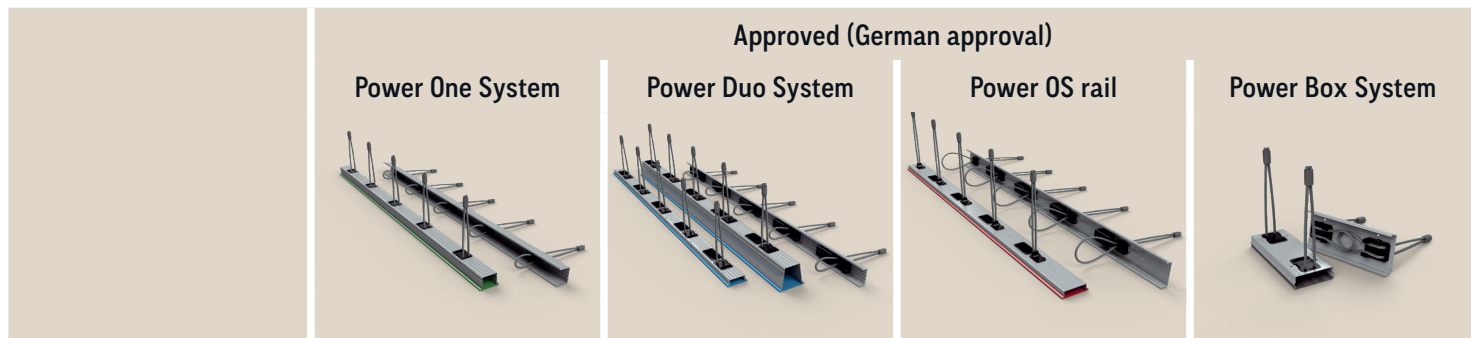


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PHILIPP Connecting rails and loop systems

PRODUCT CHARACTERISTICS - OVERVIEW



LOAD DIRECTIONS / MAX. DESIGN RESISTANCES

$v_{Rd,II}$ (kN/m)	60.0	90.0	80.0	105.0
$v_{Rd,\perp}$ (kN/m)	37.5	37.5	35.7	28.6
Z_{Rd} (kN/loop)	10.0	10.0	10.0	-

AREA OF APPLICATION (RECOMMENDED)

Precast building	✓	✓	✓	✓
In-situ concrete constructions	-	-	✓	-
Wall / wall	✓	✓	✓	✓
Wall / wall (T-connection)	-	✓	✓	✓
Wall / column	-	✓	✓	-
Minimum wall thickness (cm)	10	12 / 14 ①	14	14
Concrete strength precast unit	C30/37	C25/30 ② / C30/37	C25/30	C30/37

TECHNICAL INFORMATION

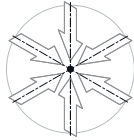
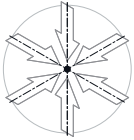
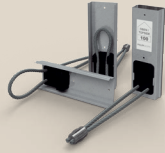
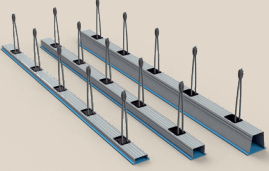
Technical basis	National technical approval (abZ)	National technical approval (abZ)	National technical approval (abZ)	National technical approval (abZ)
Max. fire resistance	F 180	Firewall (REI 90-M) and also F 180	F 180	F 180
Mortar grouting	Grouting mortar	Thixo- or grouting mortar	Normal weight concrete	Grouting mortar
Manufacturer of mortar	BETEC	BETEC / P&T	-	P&T

① with P&T / ② with BETEC

Constructive

Connecting rails

Connecting loop



-

-

-

-

-

-

✓

✓

✓

✓

✓

✓

✓

✓

✓

✓

-

-

-

-

F 180

F 180

Mortar or normal weight concrete

Mortar or normal weight concrete

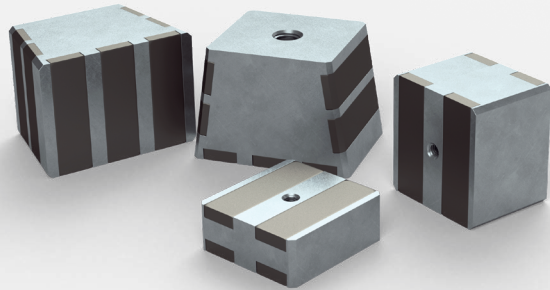
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Accessories

for Connecting rails and loop systems

Magnetic fastener



Mortar


 BETEC Grouting

 BETEC Thixo

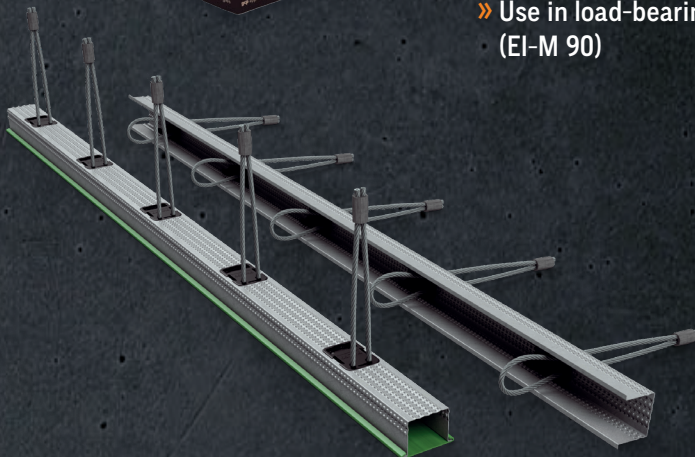
 EuroGrout Varix

 EuroGrout Universalfüller

 EuroGrout 04

PHILIPP Power One System

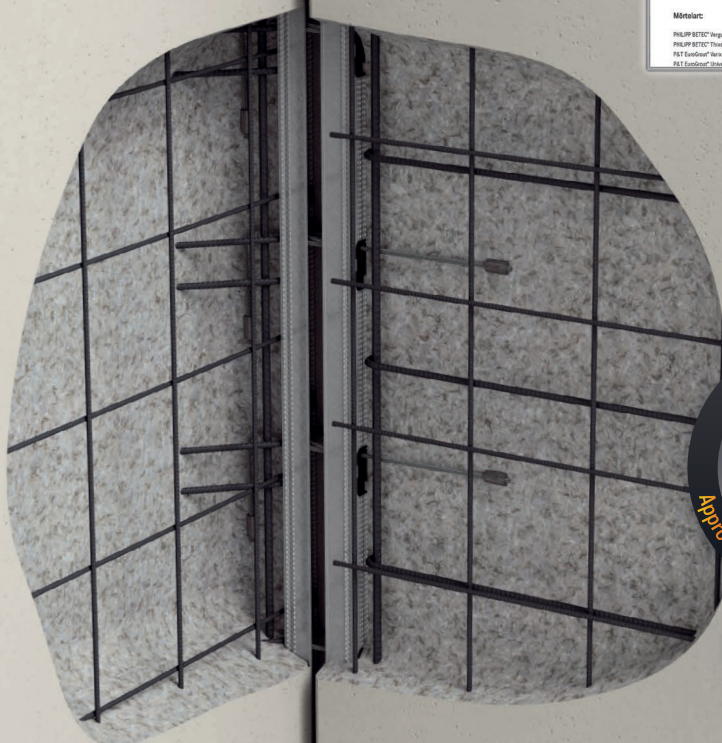
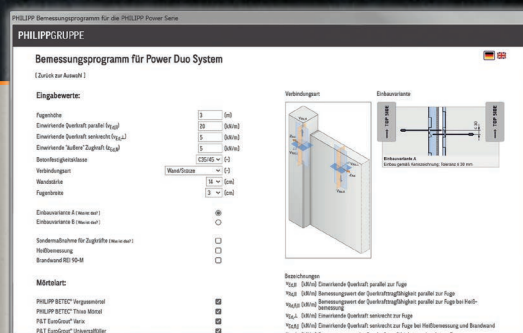
POWER ONE RAIL WITH GERMAN APPROVAL



YOUR BENEFITS AT A GLANCE:

- » Small wall thicknesses from 10 cm possible
- » No installation direction because of symmetrical rail design
- » No risk of mix-up, as only one rail type is used
- » Forces in all directions transferable
 - tensile forces, shear forces parallel and right-angled to the joint
- » Tested and certified system with German approval
- » Use in load-bearing, fire-stressed walls (REI) and non-load-bearing fire walls (EI-M 90)

Our design software you will find at www.philipp-software.de

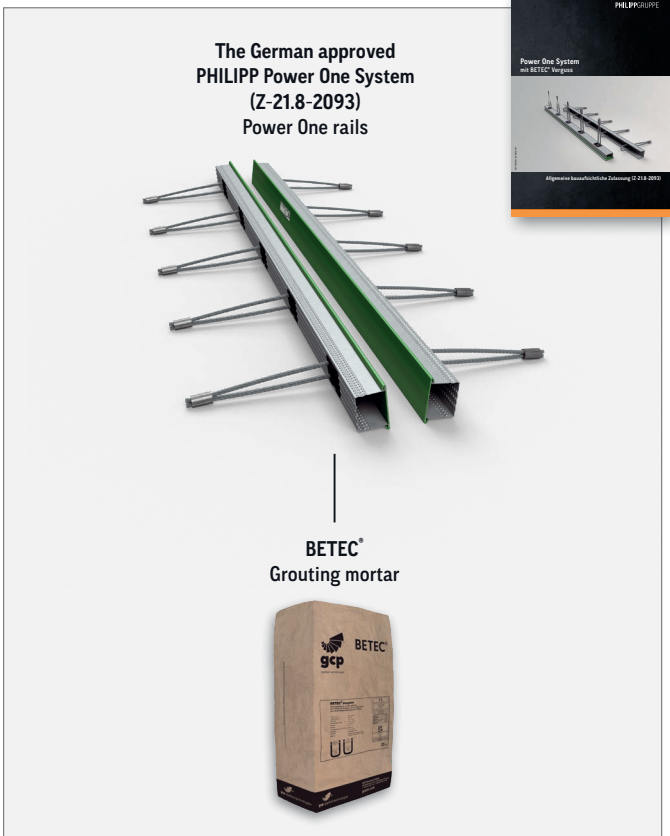


SYSTEM COMPONENTS

SYSTEM COMPONENTS AND DIMENSIONS

The Power One System is used to connect precast concrete units, e.g. thin concrete panels, where high static forces have to be transferred and proofed. It is able to transfer shear and tensile forces plane to the wall (stiffening, support reactions) as well as shear forces right-angled to the wall (wind pressure, earth pressure). A simple installation and the joint geometry pre-defined by the rail guarantee an easy application.

The Power One system consists of only one profiled and galvanized rail. It is equipped with galvanized steel wire loops with a distance of 250 mm each. The rail is installed flush with the surface on the opposite side of each particular concrete unit. There is no need to check the direction of the rail as it is symmetrical. After demoulding, the plastic cover is removed and the loops are folded out right-angled to the rail. The ability to quickly connect wall elements together results in advantageous short construction times. Finally, the joints are filled with a belonging grouting mortar (page 21) to generate a force transmitting and form-fit connection.



NOTE THE APPROVAL!

This Installation Instruction provides necessary technical information. In any case the requirements of the national German approval must be considered!

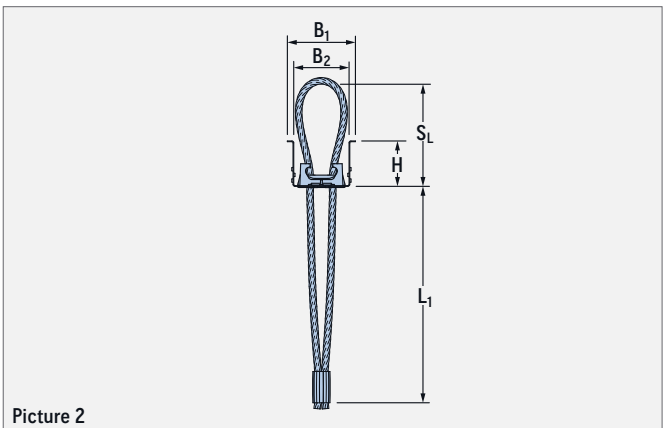
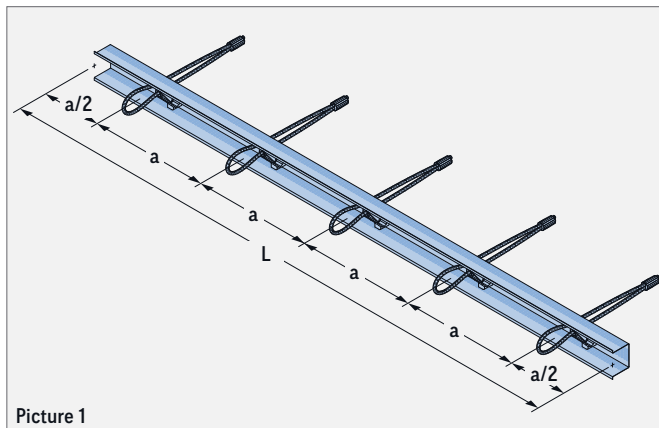


TABLE 1: DIMENSION OF THE POWER ONE RAIL

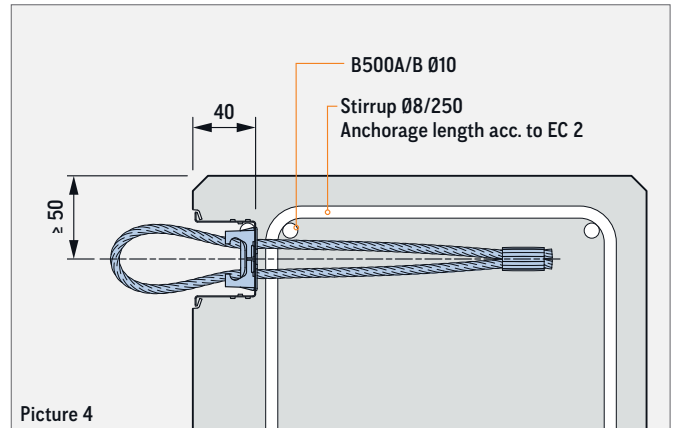
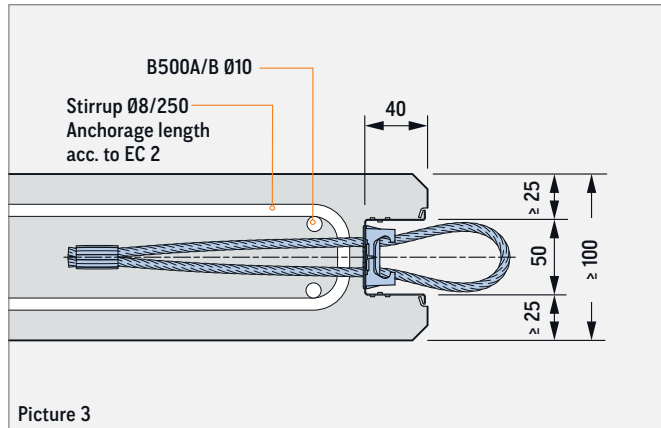
Ref. no.	Dimensions							Weight per rail (kg)
	B ₁ (mm)	B ₂ (mm)	H (mm)	L (mm)	L ₁ (mm)	S _L (mm)	a (mm)	
84PONE400905	60	50	40	1250	190	90	250	1.55

APPLICATION

DIMENSIONS OF CONCRETE UNITS

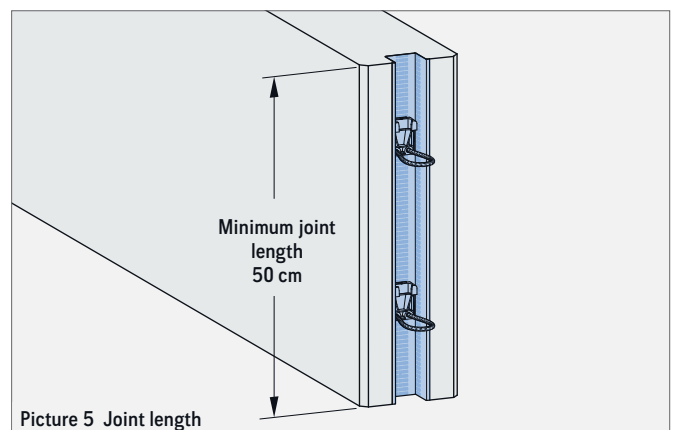
Due to the required concrete cover of 25 mm for the Power One rail the min. resulting wall thickness is 100 mm (picture 3).

In the following pictures only the required reinforcement for the Power One system is shown!



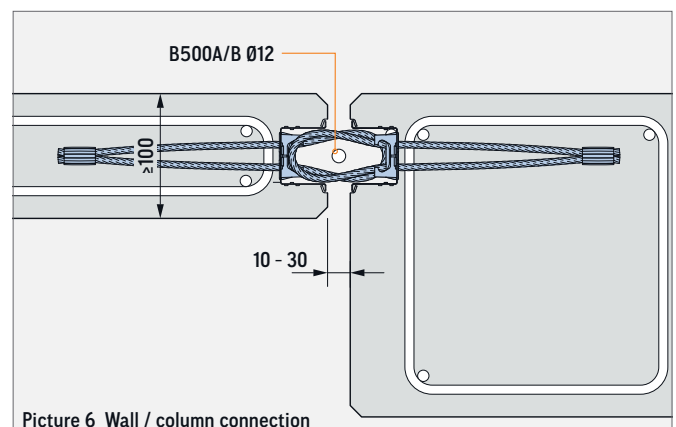
JOINT LENGTH

The minimum length of a joint must be 50 cm for the Power One system (minimum 2 loops are required so that a strut-and-tie-model can work). So, it is possible to install the Power One rails in shorter parts (page 19).

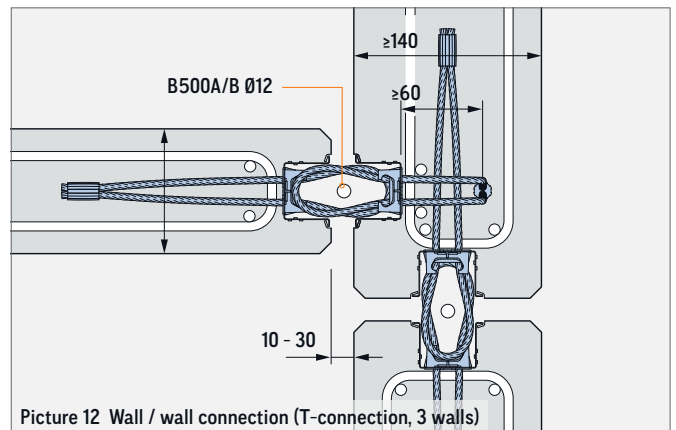
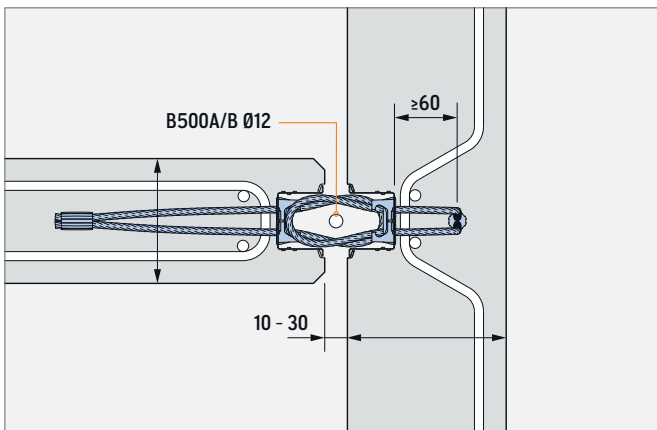
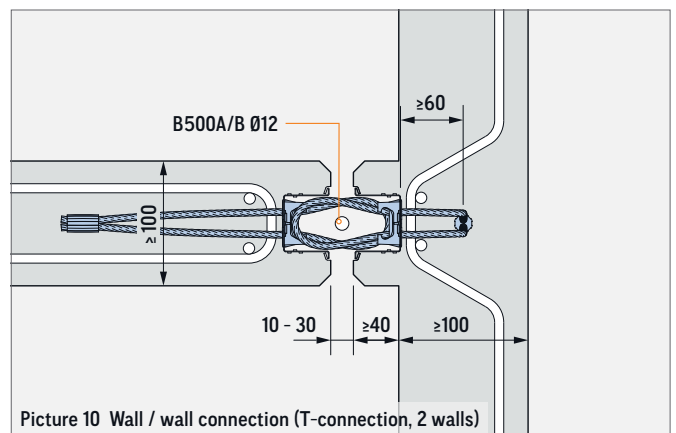
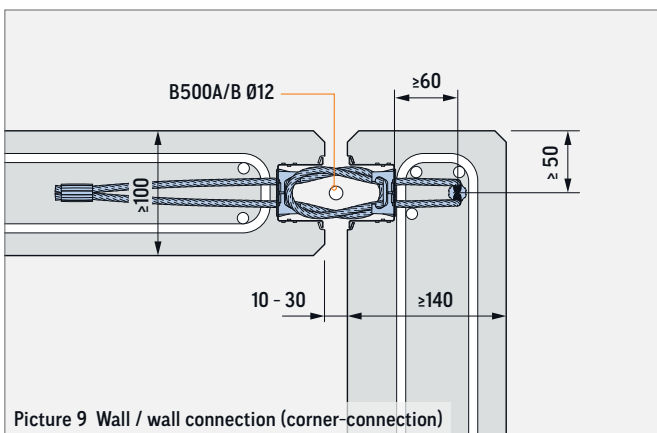
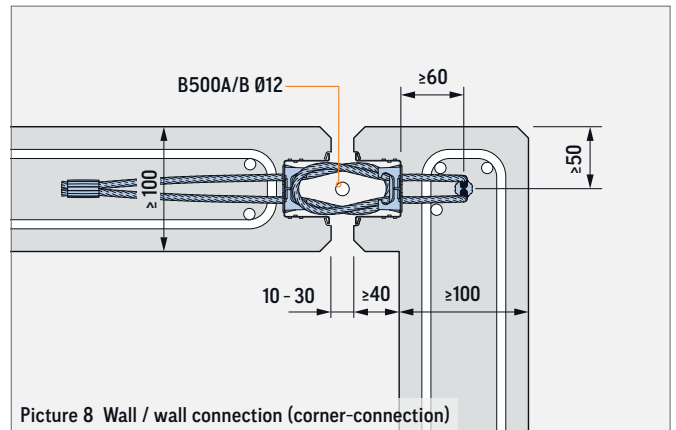
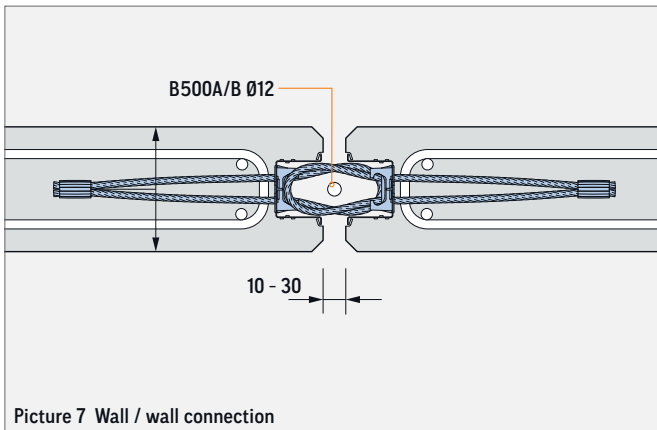


RANGE OF APPLICATIONS

The Power One system can be used for various connections of reinforced concrete elements. It transfers primarily static shear forces parallel and right-angled to the wall as well as tensile forces from predominantly static loads.



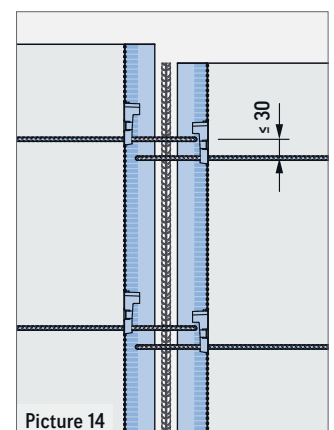
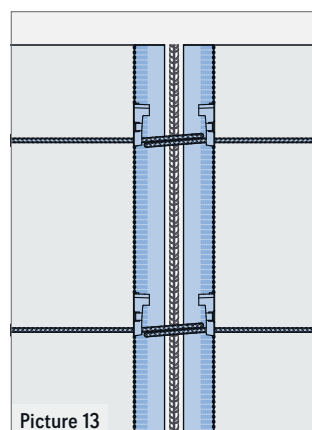
APPLICATION



INSTALLATION OF THE RAILS

The installation of the Power One rails is not dependent on the direction. As only one rail type is used, there is no risk of mix-up.

Tolerances of the wire rope loops in vertical direction are covered up to 30 mm by the approval (picture 14).



APPLICATION IN CASE OF FIRE

REQUIREMENTS

The Power One system can be used to meet all the requirements for fire resistance.

CONSTRUCTION

In addition to the range of application, the precast reinforced concrete connections using the Power One system may be considered as equivalent to the connections regulated in the German standard DIN 4102-4:2016-05, para. 5.12.5 to 5.12.7.

TABLE 2: FIRE RESISTANCE CLASS

Requirement	acc. to Eurocodes or EN 13501	acc. to DIN 4102
Fire-retardant	R 30	F 30
	REI 30	
	EI 30	
Highly fire-retardant	R 60	F 60
	REI 60	
	EI 60	
Fire-resistant	R 90	F 90
	REI 90	
	EI 90	
Firewall	EI-M 90	F 90

FIRE RESISTANT WALLS

For the design of a requirement listed in table 3, the temperature at the wire loops must be known first. This can be determined from the temperature profile acc. to EN 1992-1-2:2012, picture A.2. With

this temperature the reduction factor (picture 15) and the final load capacity of the wire rope loops (table 3) are resulting.

TABLE 3: DESIGN FOR FIRE RESISTANT WALLS

Requirement	Fire resistance class		Shear force parallel to the joint $V_{Rd,II}$ [kN/m]	Tensile force Z_{Rd} [kN/m]
	acc. to Eurocodes or EN 13501	acc. to DIN 4102		
Fire-retardant	R 30	F 30	$V_{Rd,fi,II} = \alpha_{fi} \times V_{Rd,II}$	$Z_{Rd,fi} = \alpha_{fi} \times Z_{Rd,II}$
	REI 30			
	EI 30			
Highly fire-retardant	R 60	F 60		
	REI 60			
	EI 60			
Fire-resistant	R 90	F 90		
	REI 90			
	EI 90			
Firewall	EI-M 90	F 90		

α_{fi} : Reduction factor depending on the wire rope loop temperature, see diagram in picture 15

$V_{Rd,II}$: Design value of the shear force bearing capacity parallel to the joint according to table 5

Z_{Rd} : Design value of the tensile force bearing capacity according to table 6 (4 loops per metre)

PROOFS:

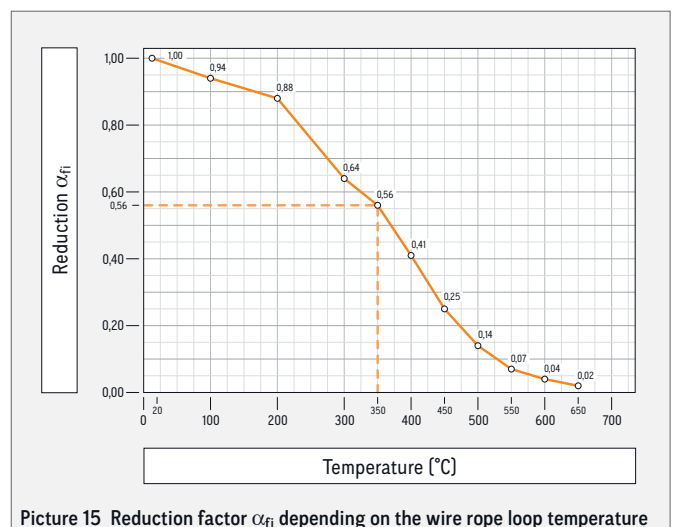
SHEAR FORCE PARALLEL TO THE JOINT:

$$V_{Rd,fi,II} \geq V_{Ed,II}$$

TOTAL TENSILE FORCE:

For a design example of a fire-resistant wall please refer to page 16.

$$Z_{Rd,fi} \geq Z_{Ed,N}$$



Picture 15 Reduction factor α_{fi} depending on the wire rope loop temperature

APPLICATION IN CASE OF FIRE

TABLE 4: SUITABLE MORTARS FOR THE CASE OF FIRE

Requirement	Fire resistance class		Mortar type Grouting mortar BETEC® Grouting mortar
	acc. to Eurocodes or EN 13501	acc. to DIN 4102	
Fire-retardant	R 30	F 30	✓
	REI 30		
	EI 30		
Highly fire-retardant	R 60	F 60	✓
	REI 60		
	EI 60		
Fire-resistant	R 90	F 90	✓
	REI 90		
	EI 90		
Firewall	EI-M 90	F 90	✓

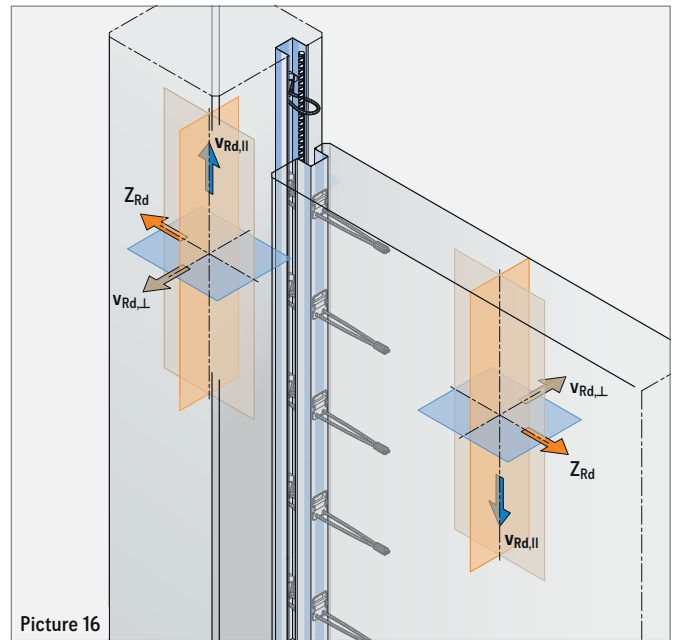
DESIGN AND CONSTRUCTION

The precast concrete units to be connected must be designed according to EC 2. They have to be made of normal weight concrete with a strength class of at least C30/37 according to EN 206.

It is part of the structural engineer to design the units and prove the joint connections according to the national German approval. In table 5 shear loads parallel to the joint ($v_{Rd,||}$) and in table 7 shear loads right-angled to the joint ($v_{Rd,\perp}$) are listed according to the approvals.

If shear loads parallel and right-angled to the joint appear at the same time, the load-bearing capacities have to be reduced according to the diagram in picture 18.

Table 6 shows the bearing capacities for tensile forces (Z_{Rd}). Because of the different load directions single components of tensile forces result, which act in the direction of the wire rope loops. The sum of these single components has to be smaller than the tensile load capacity (Z_{Rd}). Finally, the verification of the total tensile force must be done.



Picture 16

HERE THE FOLLOWING CASES HAVE TO BE DIFFERENTIATE:

Case 1: (Design example see page 16)

No constructive solution, which takes the acting tensile force (table 8).

$$Z_{Ed,ges} = Z_{Ed,N} + 0.5 \times v_{Ed,||} + 0.25 \times v_{Ed,\perp}$$

Case 2: (Design example see page 14)

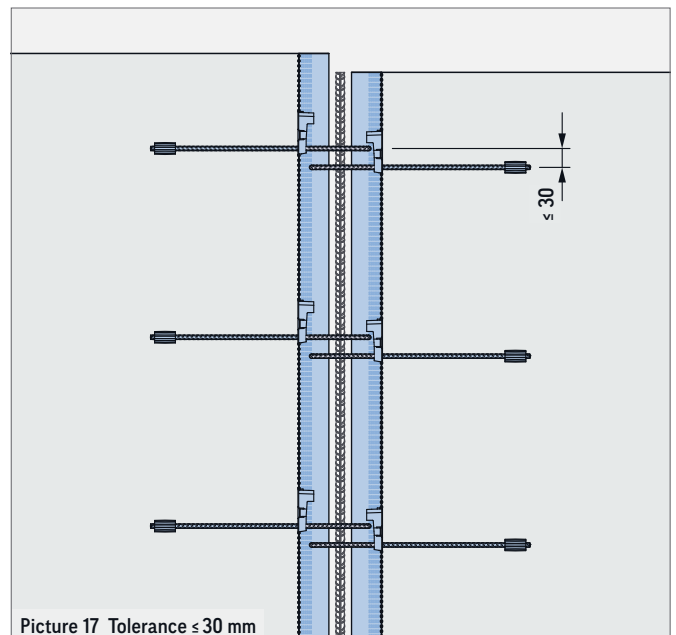
Constructive solution, which takes the acting tensile force (table 9).

$$Z_{Ed,ges} = Z_{Ed,N} + 0.25 \times v_{Ed,\perp}$$

Case 3: (Design example see page 14)

No constructive solution, which takes the acting tensile force in case of fire (table 10).

$$Z_{Ed,ges} = v_{Rd,fi,||} (\alpha_{fi} \times v_{Rd,||}) + Z_{Rd,fi,||} (\alpha_{fi} \times Z_{Rd,||})$$



Picture 17 Tolerance ≤ 30 mm

DESIGN AND CONSTRUCTION

TABLE 5: DESIGN VALUE OF THE SHEAR FORCE BEARING CAPACITY PARALLEL TO THE JOINT

Wall thickness h (cm)	Design value of the shear force bearing capacity $v_{Rd, }$ (kN/m)			
	C30/37	C35/45	C40/50	C45/55
≥ 10	60.0			

TABLE 6: DESIGN VALUE OF THE TENSILE FORCE BEARING CAPACITY PER WIRE ROPE LOOP Z_{RD}

Wall thickness h (cm)	Design value of the tensile force bearing capacity Z_{Rd} (kN/loop)			
	C30/37	C35/45	C40/50	C45/55
≥ 10	10.0			

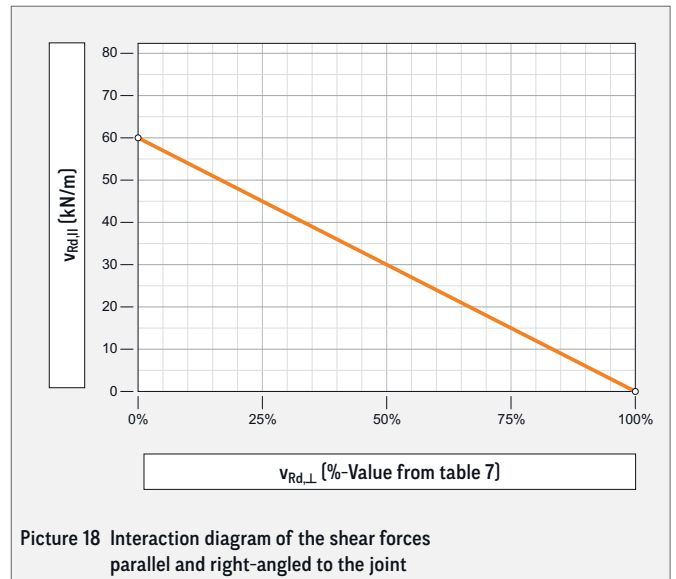
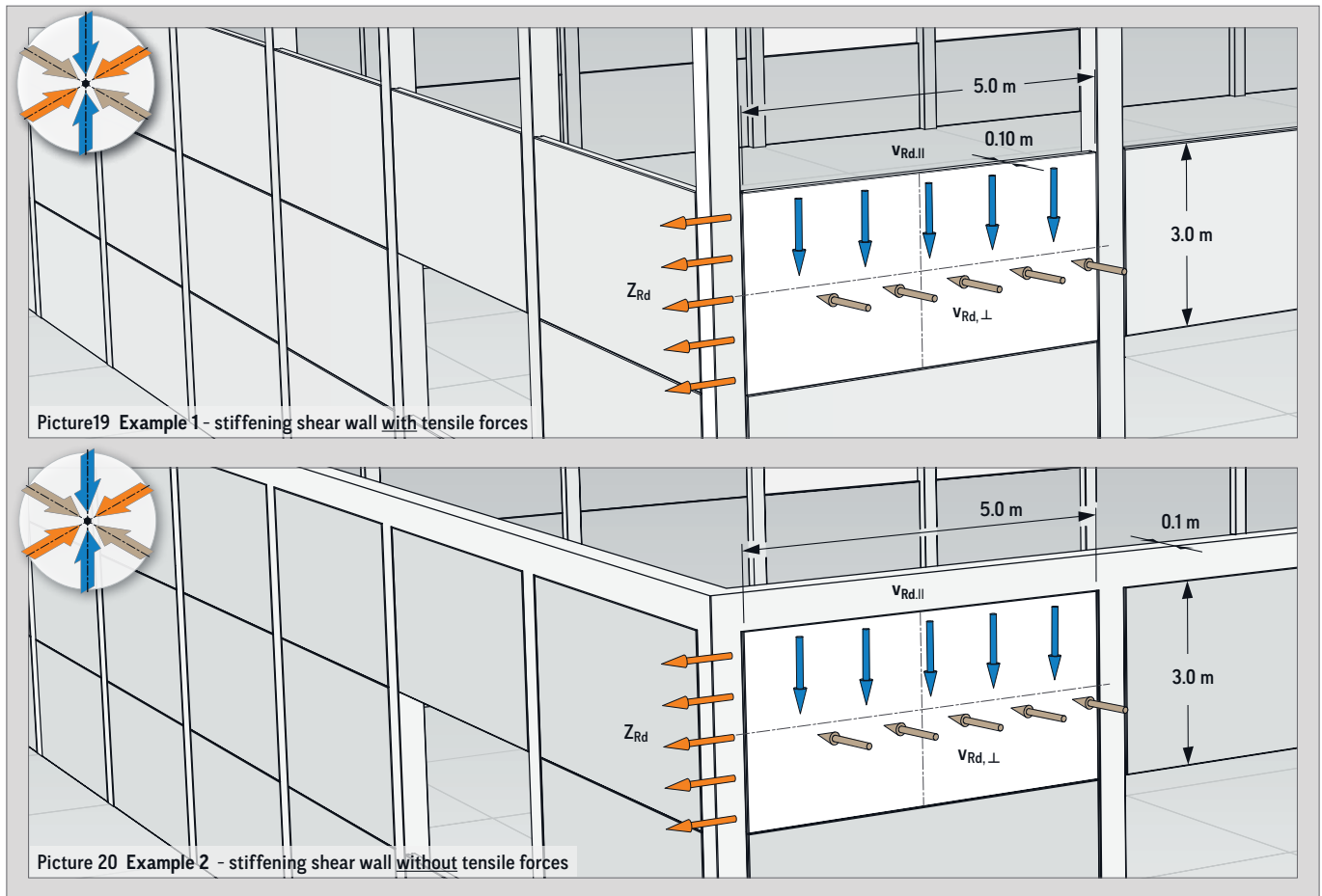


TABLE 7: DESIGN VALUES OF THE SHEAR FORCE BEARING CAPACITY RIGHT-ANGLED TO THE JOINT

Wall thickness h (cm)	Design value of the shear force bearing capacity $v_{Rd,⊥}$ (kN/m)			
	C30/37	C35/45	C40/50	C45/55
10 ①	4.5	5.2	5.5	5.9
11 ①	5.7	6.5	7.0	7.4
12 ①	7.0	8.0	8.5	9.1
13 ①	8.3	9.5	10.2	10.8
14	9.7	11.1	11.9	12.6
15	11.2	12.7	13.7	14.5
16	12.7	14.4	15.5	16.5
17	14.2	16.2	17.4	18.6
18	15.9	18.1	19.4	20.7
19	17.5	20.0	21.4	22.8
20	19.3	21.9	23.5	25.1
21	21.0	24.0	25.7	27.4
22	22.8	26.0	27.9	29.7
23	24.7	28.1	30.2	32.2
24	26.6	30.3	32.5	34.6
25	28.5	32.5	34.9	37.2
26	30.5	34.8	37.3	37.5
27	32.5	37.1	37.5	37.5
28	34.6	37.5	37.5	37.5
29	36.7	37.5	37.5	37.5
≥ 30	37.5	37.5	37.5	37.5

① Consideration of shear load capacities $v_{Rd,⊥}$ for wall thicknesses $h < 14$ cm only permissible from joint lengths ≥ 1.0 m

EXAMPLE 1/2 - STIFFENING SHEAR WALL WITH / WITHOUT TENSILE FORCES



This example shows a wall, which shall be installed as a stiffening member. The resulting shear forces parallel to the joint are taken by the Power One system with Thixo mortar and added with shear forces right-angled to the joint caused by wind.

Example 1 shows a design without constructive solutions and in example 2 the tensile force component caused by shear force parallel to the joint is taken by a constructive solution.

ACTIONS / BOUNDARY CONDITIONS:

- » From wind
- building height ≤ 10 m, wind load zone 3, midland, according to EC 1
- $WD = 1.5 \times (0.8 \text{ kN/m}^2 \times 1.0) = 1.2 \text{ kN/m}^2$
- » Loads caused by the shear wall: 59.06 kN/m
- » Wall thickness: 10 cm
- » Concrete strength: C30/37
- » Tensile force: $z_{Ed,N} = 10 \text{ kN/m}$
- » Wall dimensions: $L = 5.0 \text{ m}$; $H = 3.0 \text{ m}$
- » Design resistance values for grouting mortar:
 - > $v_{Rd,II} = 60 \text{ kN/m}$ (value from table 5)
 - > $v_{Rd,\perp} = 4.5 \text{ kN/m}$ (value from table 7)

TABLE 8: COMPONENTS OF TENSILE FORCE

Load from	Shear force parallel $v_{Ed,II}$	Shear force right-angled $v_{Ed,\perp}$	External tensile force
Component of tensile force	$z_{Ed,VI} = 0.5 \times v_{Ed,II}$	$z_{Ed,VI} = 0.25 \times v_{Ed,\perp}$	$z_{Ed,N}$

EXAMPLE 1/2 – STIFFENING SHEAR WALL WITH / WITHOUT TENSION FORCES

PROOF OF LATERAL FORCES

$$v_{Ed,II} = 59.06 \text{ kN/m} / 2 / \times 4.0 \text{ m} = 9.84 \text{ kN/m}$$

$$v_{Ed,L} = (1.2 \text{ kN/m}^2 \times 5.00 \text{ m} \times 3.0 \text{ m}) / 2 / 3.0 \text{ m} = 3.0 \text{ kN/m per joint}$$

If both forces occur at the same time, the interaction (picture 18) must be considered:

Percentage of shear force parallel:

$$v_{Ed,II} / v_{Rd,II} = 9.84 \text{ kN/m} / 60 \text{ kN/m} = 16.4 \%$$

The linear interaction results in a permissible shear force right-angled to the joint: $100 \% - 16.4 \% = 83.6 \%$

THE REDUCED SHEAR FORCE RIGHT-ANGLED TO THE WALL CAN BE SET TO 83.6 %:

$$\text{red. } v_{Rd, \perp} = 0.836 \times 4.5 \text{ kN/m} = 3.76 \geq 3.0 \text{ kN/m} \rightarrow \text{OK}$$

It is shown that the interaction of both shear forces can be absorbed.

VERIFICATION OF TENSILE FORCES:

DESIGN EXAMPLE 1: (NO LOAD TRANSFER OF TENSILE FORCES BY CONSTRUCTIVE SOLUTIONS)

Because of the different load directions (shear force parallel and right-angled to the joint) single components of tensile forces result, which can act in the direction of the wire rope. The sum of these single components (total tensile force) is verified on a basis of the tensile force resistance Z_{Rd} of the loops according to table 6.

Verification of the total force: $n \times Z_{Rd} \geq z_{Ed,VII} + z_{Ed,V \perp} + z_{Ed,N}$

n (1/m) : Numbers of wire rope loops per metre of joint, $n = 4$ loops/metre

Z_{Rd} (kN) : Design value of tensile force bearing capacity per wire rope loop acc. to table 6

$z_{Ed,N}$ (kN/m) : Acting „external“ tensile force per metre of joint

$z_{Ed,VII}$ (kN/m) : Expansion force resulting from shear force parallel per metre of joint

$z_{Ed,V \perp}$ (kN/m) : Expansion force resulting from shear force right-angled per metre of joint

PROOF OF TOTAL TENSILE FORCE:

$$n \times Z_{Rd} \geq z_{Ed,VII} + z_{Ed,V \perp} + z_{Ed,N} \quad (n = 4 \text{ loops per metre})$$

$$Z_{Rd} = 10.0 \text{ kN/loop (table 6)}$$

$$z_{Ed,N} = 10 \text{ kN/m}$$

$$z_{Ed,VII} = 0.5 \times 9.84 \text{ kN/m} = 4.92 \text{ kN/m}$$

$$z_{Ed,V \perp} = 0.25 \times 2.40 \text{ kN/m} = 0.75 \text{ kN/m}$$

$$40 \text{ kN/m} \geq 4.92 \text{ kN/m} + 0.75 \text{ kN/m} + 10 \text{ kN/m} = 15.67 \text{ kN/m}$$

DESIGN EXAMPLE 2: LOAD TRANSFER OF THE TENSILE FORCES BY CONSTRUCTIVE SOLUTIONS E.G. RING BEAM

Proof of total tensile force:

$$z_{Ed,ges} = z_{Ed,V \perp} + z_{Ed,N}$$

$z_{Ed,ges}$ (kN/m) : Total tensile force per metre of joint

$z_{Ed,N}$ (kN/m) : Acting „external“ tensile force per metre of joint

$z_{Ed,V \perp}$ (kN/m) : Expansion force resulting from shear force right-angled per metre of joint

Proof of total tensile force:

$$z_{Ed,ges} = z_{Ed,V \perp} + z_{Ed,N} \quad (\text{kN/m})$$

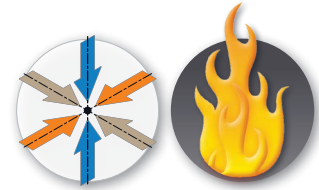
$$z_{Ed,V \perp} = 0.25 \times 2.4 \text{ kN/m} = 0.75 \text{ kN/m}$$

$$z_{Ed,N} = 10.0 \text{ kN/m}$$

$$z_{Ed,ges} = 0.75 \text{ kN/m} + 10 \text{ kN/m} = 10.75 \text{ kN/m}$$

The calculated tensile force $z_{Ed,ges}$ must be absorbed e.g. by a ring beam or other constructive solutions.

EXAMPLE 3 - FIRE RESISTANT WALL



Actions / boundary conditions:

- » Wall thickness: $d = 140 \text{ mm}$
- » Joint height: $h = 3.0 \text{ m}$
- » Concrete strength: C30/37
- » Outer shear force parallel to the joint: $v_{Ed,II} = 30 \text{ kN/m}$ (e. g. stiffening loads)
- » Outer tensile force: $z_{Ed,N} = 2 \text{ kN/m}$
- » No load transfer of tensile forces by constructive solutions!
- » Installation of the rails with vertical tolerance $\leq 30 \text{ mm}$
- » Fire exposure R 90 one-sided fire stress

TABLE 9: LOAD-BEARING CAPACITIES IN CASE OF FIRE

Load from	Shear force parallel $v_{Rd,fi,II}$	Tensile force $z_{Rd,fi}$
Design value of the load bearing capacity	$v_{Rd,fi,II} = \alpha_{fi} \times v_{Rd,II}$	$z_{Rd,fi,II} = \alpha_{fi} \times z_{Rd,II}$

DETERMINATION OF THE TEMPERATURE AT THE WIRE ROPE:

Distance x from the fire-stressed surface:

- » Wall thickness $d = 140 \text{ mm}$
- » Width of the loop $b = 50 \text{ mm}$

$$x = (d - b) / 2 = (140 - 50) / 2 = 45 \text{ mm}$$

Reading the temperature at the wire rope θ (°C) in diagram EN 1992-1-2, picture A.2

Determined temperature: θ (°C) = 350 °C

ACTIONS

Tensile force components caused by shear loads:

$$z_{Ed,VII} = 0.5 \times v_{Ed,II} = 0.5 \times 30 \text{ kN/m} = 15 \text{ kN/m}$$

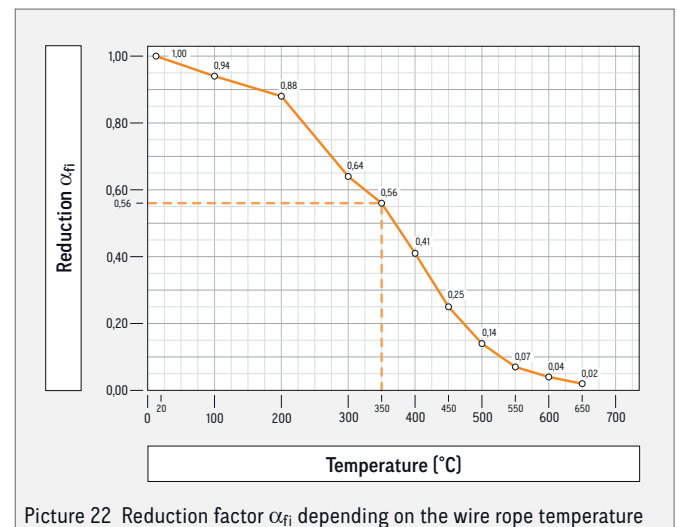
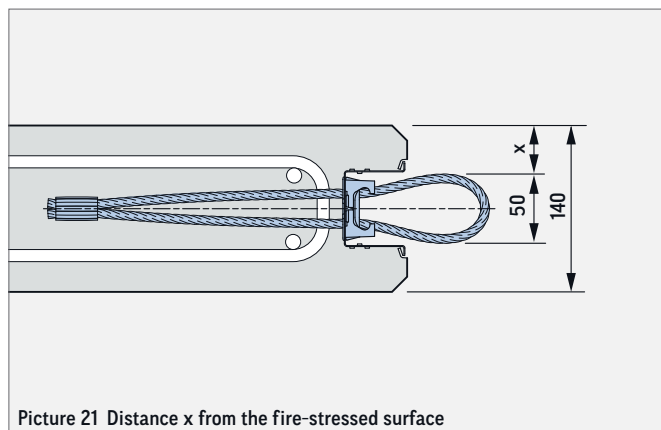
Total tensile force:

$$z_{Ed,fi} = z_{Ed,VII} + z_{Ed,N} = 15 + 2 = 17 \text{ kN/m}$$

REDUCED LOAD BEARING CAPACITIES IN CASE OF FIRE:

$$v_{Rd,fi,II} = v_{Rd,II} \times \alpha_{fi} = 60 \text{ kN/m} \times 0.56 = 33.6 \text{ kN/m}$$

$$z_{Rd,fi} = z_{Rd} \times \alpha_{fi} = 40 \text{ kN/m} \times 0.56 = 22.4 \text{ kN/m}$$



VERIFICATIONS:

SHEAR FORCE PARALLEL TO THE JOINT:

$$v_{Rd,fi,II} = 33.6 \text{ kN/m} \geq 30 \text{ kN/m} = v_{Ed,II}$$

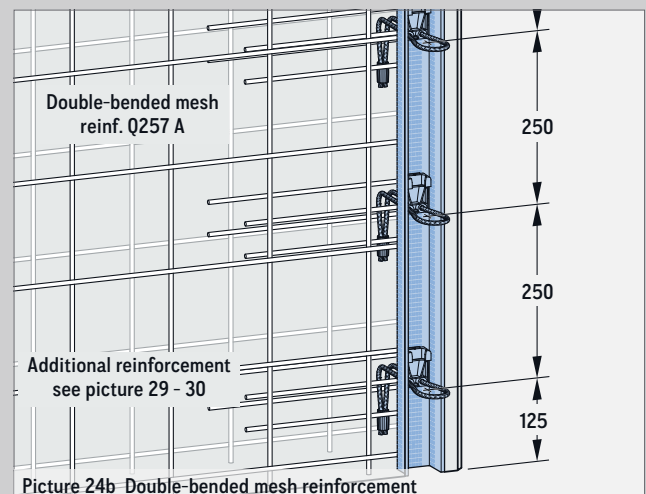
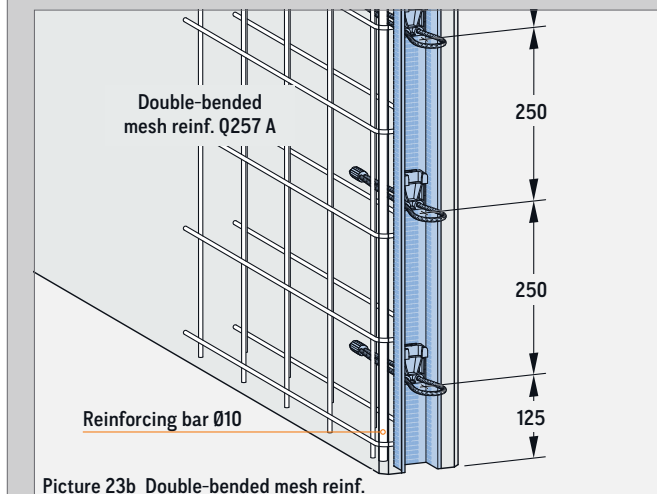
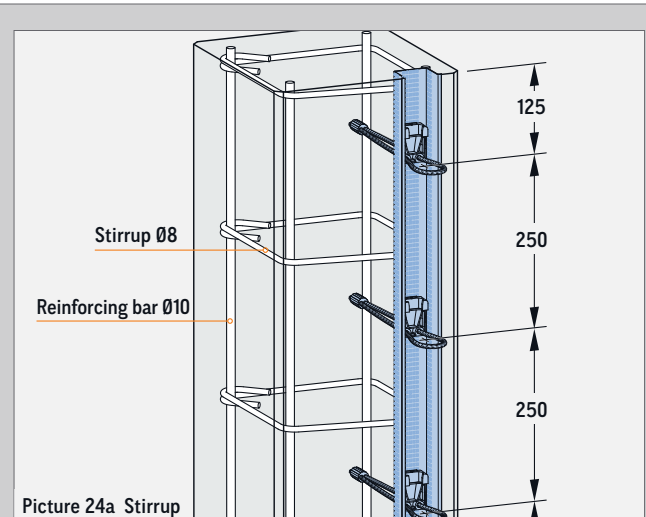
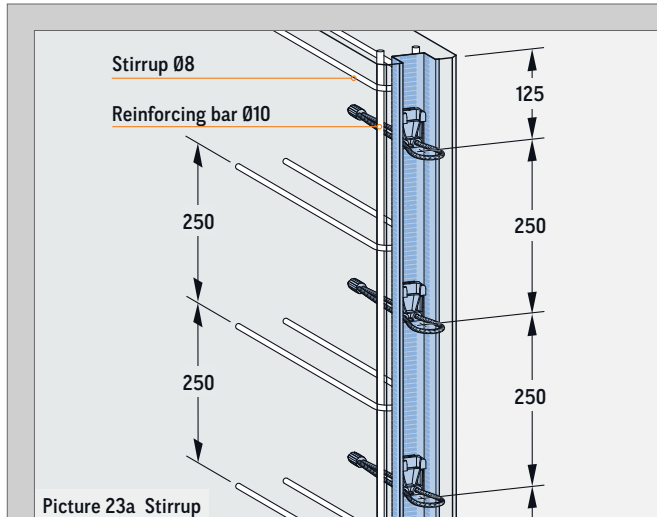
TOTAL TENSILE FORCE:

$$z_{Rd,fi} = 22.4 \text{ kN/m} \geq 17 \text{ kN/m} = z_{Ed}$$

REINFORCEMENT

If the Power One rails are installed flush all requirements of the German approval for the edge distances are met (picture 23a, 23b, 24a, 24b). In the range of the Power One rails the precast elements

must be provided with a minimum reinforcement. This reinforcement shall be stirrups $\varnothing 8/25$ for each wire rope loop and longitudinal reinforcement $\varnothing 10$ (picture 23a, 24a).



PLEASE NOTE THE APPROVAL!

Alternatively the stirrups can be replaced by a comparable mesh reinforcement (picture 23b and 24b).

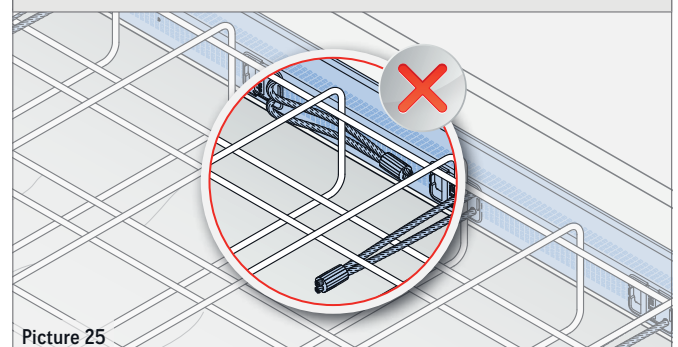
This requirement is fulfilled by a mesh reinforcement e.g. type Q257 A (equal $2.57 \text{ cm}^2/\text{m}$). Existing reinforcement can be taken into account.

The anchorage of the connecting loops in the precast element must be aligned in an angle of 90° to the Power One rails. With a vertical installation in the formwork the stability of the rope ends in the precast unit shall be ensured by tying them to the reinforcement with wire.



END ANCHORAGE OF THE WIRE ROPE

A bending of the end anchorage by the reinforcement is not permissible.



REINFORCEMENT

BENDING OF THE END ANCHORAGE

If the anchorage of the wire rope loop is bent, attention must be paid that the horizontal anchorage part is ≥ 60 mm (picture 26 and 27). Depending on the installation situation an additional reinforcement as shown in picture 26 or 27 must be provided.

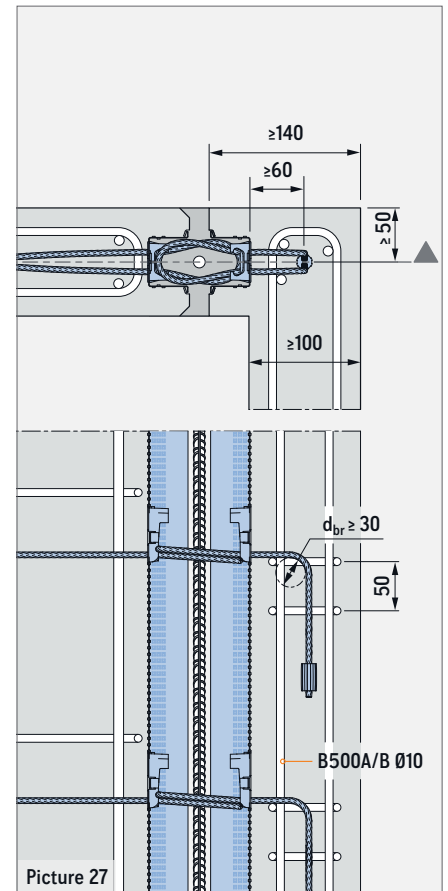
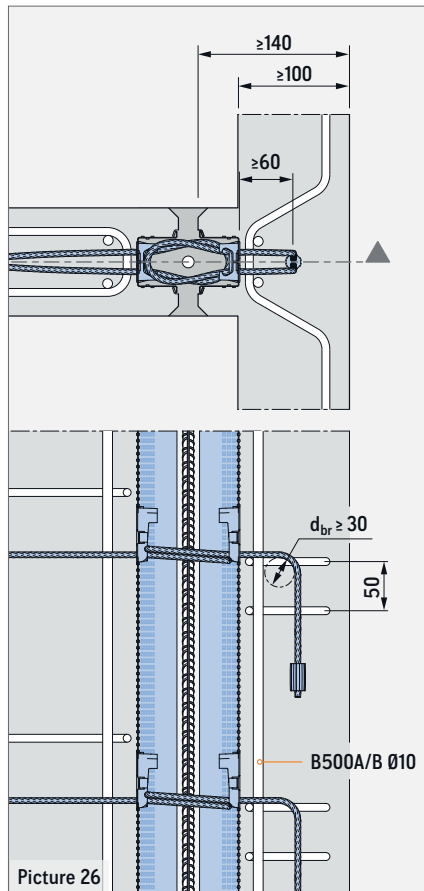
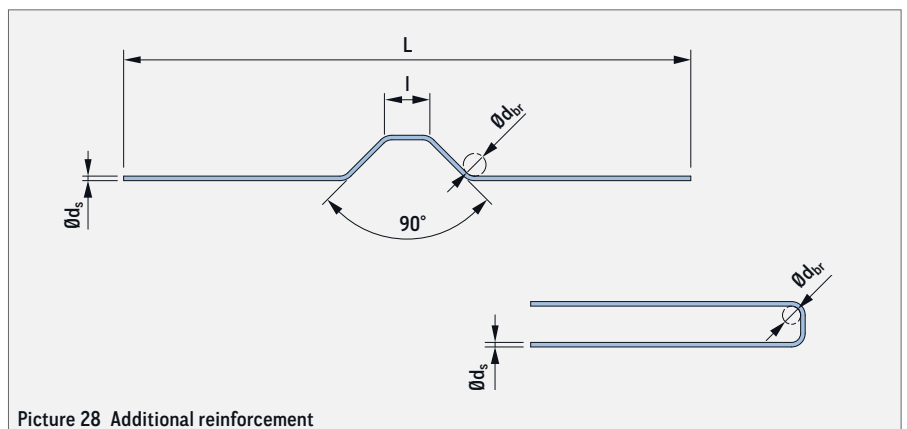


TABLE 10: REINFORCEMENT (B500A/B)

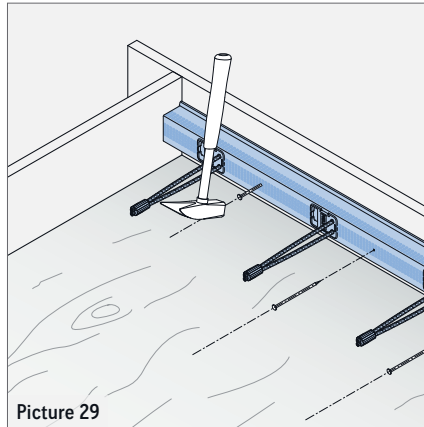
$\varnothing d_s$ (mm)	L (mm)	l (mm)	$\varnothing d_{br}$ (mm)
Ø8	1000	70	Ø32



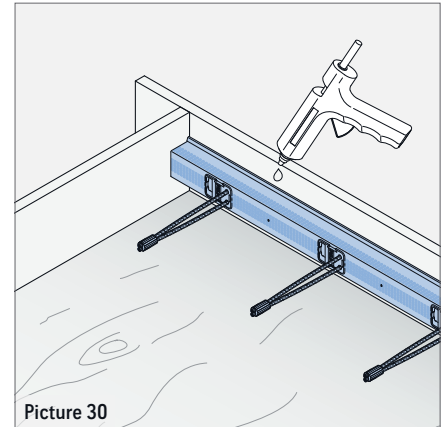
INSTALLATION

INSTALLATION OF THE POWER ONE RAILS

A fixation of the Power One rails to the formwork is possible by nailing as well as hot bonding (picture 29 and picture 30).



Picture 29



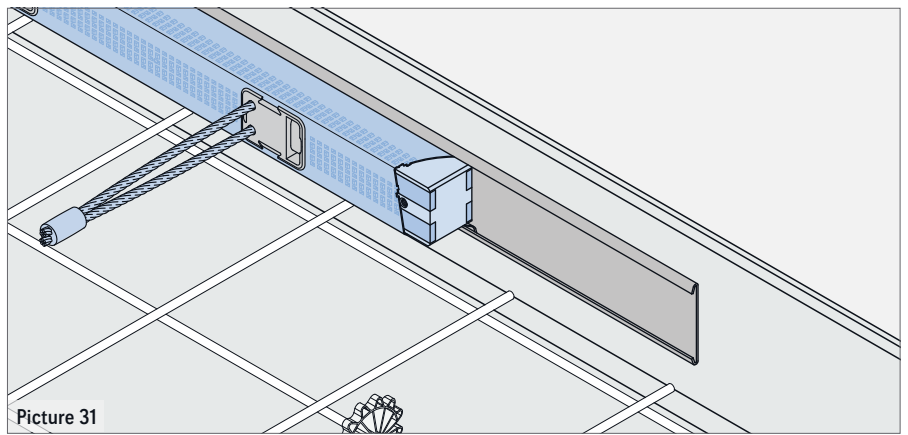
Picture 30

By using the PHILIPP Magnetic fasteners all Power one rails can be fixed to steel formworks fast and easily.



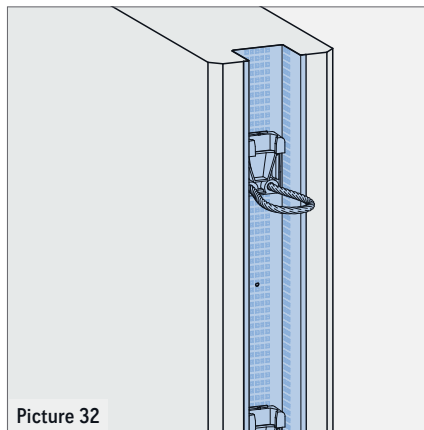
MAGNETIC FASTENER

For more information about the Magnetic fastener please refer to the separate Application Instruction.

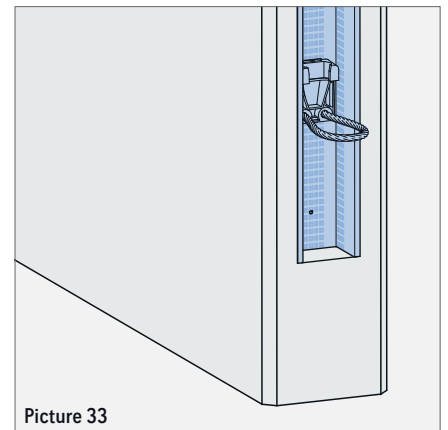


Picture 31

It is recommended to start the installation at the top element edge if you have elements with the same height (picture 32). This allows a concreting of the rail-free part at the bottom element edge (picture 33).



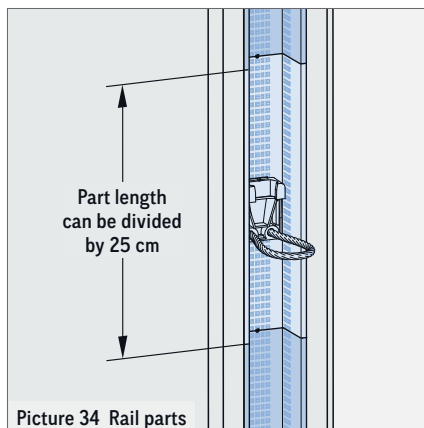
Picture 32



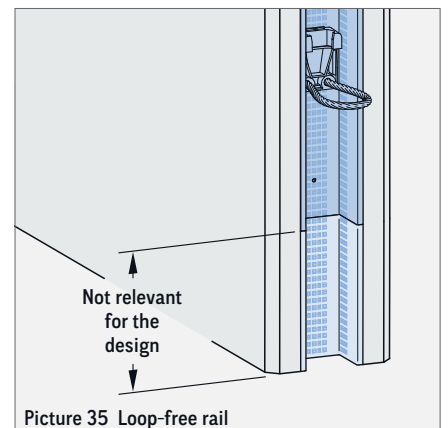
Picture 33

In order to get a continuous poured joint it is also possible to arrange the Power One rails in parts. However, these rail parts should be divided only in steps of 25 cm length. Thus, joints with Power One rails are only possible in steps of 25 cm length.

If the joint length cannot be divided by 25 cm the rest can be completed with a loop-free rail (ref. no. 84VS40, picture 35) or timber (picture 36) to create a channel.



Picture 34 Rail parts

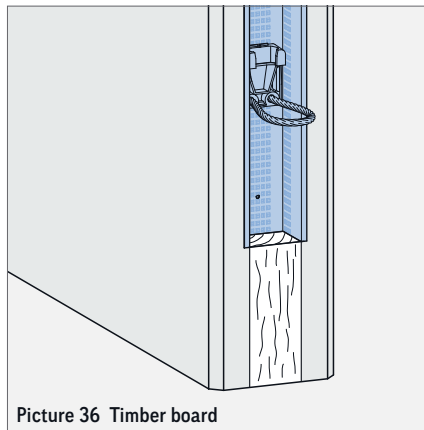


Picture 35 Loop-free rail

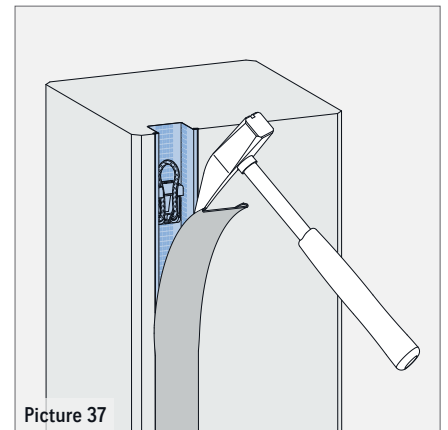
INSTALLATION / MOUNTING

PREPARATION FOR MOUNTING

The plastic cover of the installed rail must be released at one end. Then, it can be removed easily from the complete rail (picture 37).

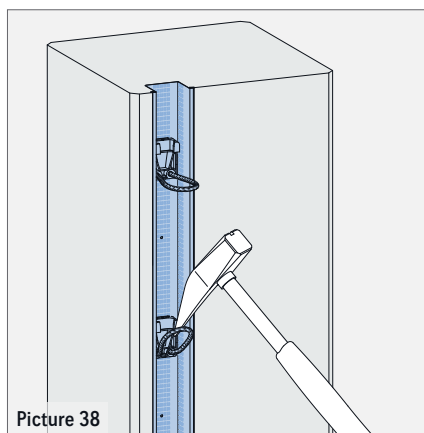


Picture 36 Timber board



Picture 37

Now, the wire rope loops of the rail have to be folded out right-angled to the rail (picture 38).



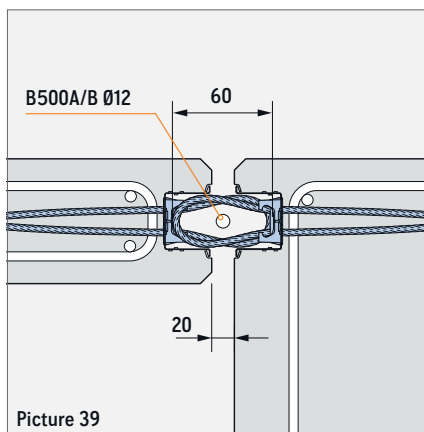
Picture 38

MOUNTING OF THE PRECAST ELEMENTS

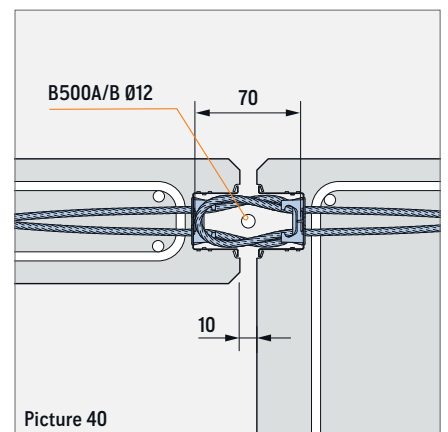
If the Power One rails are installed correctly, the loops overlap horizontally with the nominal dimension of 60 mm as shown in picture 39 and lie on top of each other in vertical direction.

Nevertheless, the Power One system approval already considers horizontal and vertical mounting tolerances. The maximum permissible horizontal tolerances are shown in picture 40 and 41.

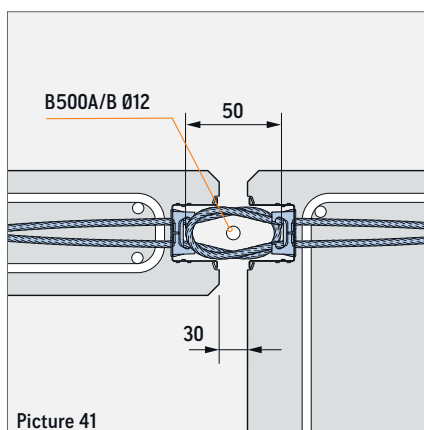
Prior the filling of the joint a reinforcing bar ($\varnothing 12$ mm) shall be positioned along the entire joint length through the overlapping loops. The correct installation is to be checked visually.



Picture 39

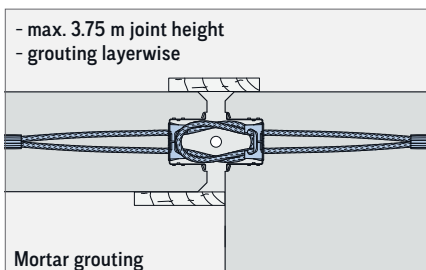
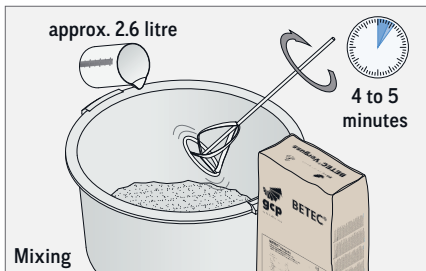
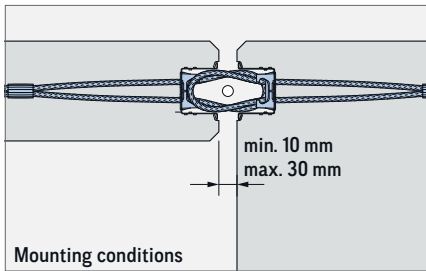
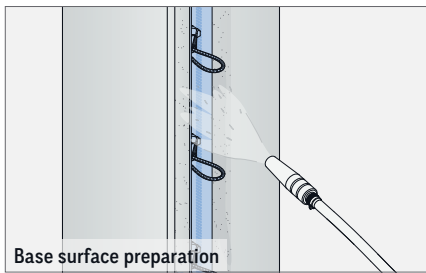


Picture 40



Picture 41

PHILIPP-BETEC® GROUTING MORTAR



GROUTING

Bear in mind when grouting air must be able to leak. A careful vibration can avoid entrapped air. The processing time is about 30 minutes at 20 °C.

GROUTING WITH PHILIPP-BETEC® GROUTING MORTAR

The PHILIPP-BETEC® system-approved, high-quality grouting mortar is a ready-to-use mortar. It consists of approved raw material components.

BASE SURFACE PREPARATION

The concrete surface has to be cleaned from dirt, grease and adhesion-reducing parts and layers until the core concrete is exposed. A pre-watering of the concrete surface must be done until the water saturation is reached. At the time of the joint filling the concrete surface shall only look pale damp, stagnant water must be removed.

PROPERTIES

The grouting mortar is free of chlorides. Because of the controlled swelling the mortar is shrink-free and thus guarantees a force-fit connection. It has a good adhesion to steel and concrete and shows no signs of segregation. Furthermore, it has a good pumpability as well as resistance to frost and de-icing salt. The grouting mortar is produced always in constant quality and is easy to process. Due to its flowable consistency the mortar is self-levelling and fills all accessible ventilated voids.

MIXING

Mixing can be done:

- » by a separated mixing in a compulsory mixer first and following pumping of the mixture with a suitable screw pump. A mixing time of approximately 4 - 5 minutes is to be aimed. First 4/5 of the water amount has to be given, the powder added and after 2 - 3 minutes the balance of the water added until the requested consistency is reached and a homogeneous matrix of mortar satisfies.
- » or by using a suitable continuous mixer. Hereby it must be proved that no reduction of the strength can arise.

MORTAR GROUTING

Both sides of the joint are sealed before the grouting mortar is filled into. Here, the use of a grouting hose with a hopper eases the process considerably. To reduce the concreting pressure it is recommended to fill in the grouting mortar in sections. (When using a joint tape be careful that it does not impede the grouting section or reduces the required concrete cover for the Power One system).

PROCESSING TEMPERATURE

The processing temperature of the grouting mortar is at least +5 °C and maximum +30 °C. With lower temperatures specific measures in wintertime must be started.

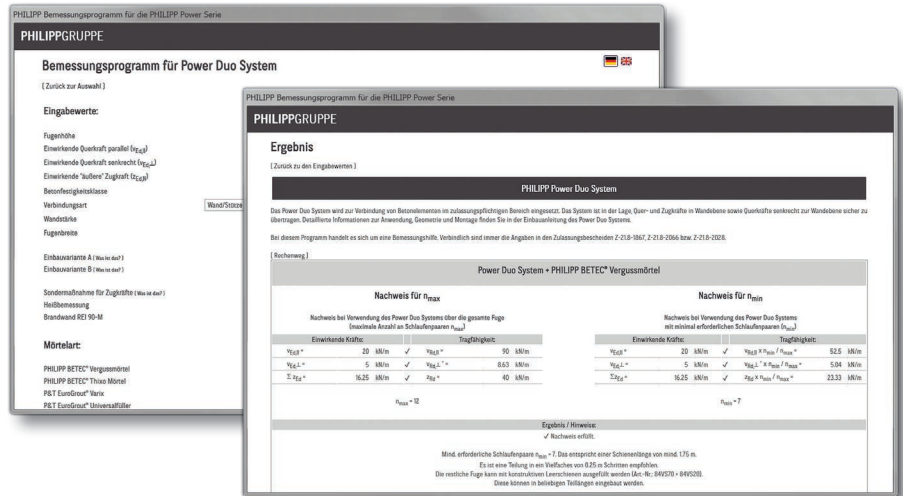
AFTERTREATMENT

It shall be prevented that the grouting mortar dries up too fast for at least three days after application. Appropriate measures are covering with plastic sheets, wet tissues or watering.

SOFTWARE / CAD

DESIGN

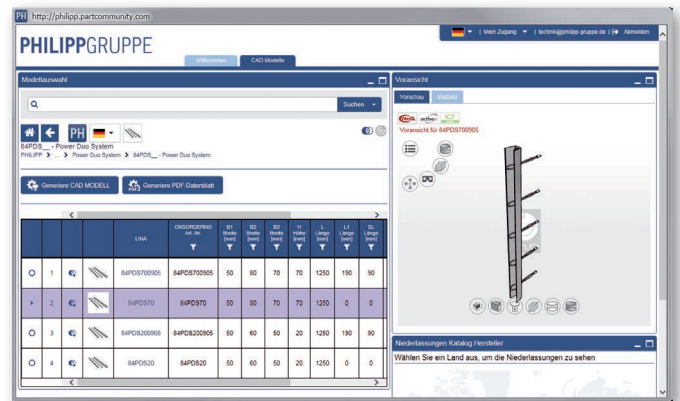
In order to design connections with the PHILIPP Power One system you can find an online design tool on our website (www.philipp-software.de), easy-to-use and understandable.



3-D MOUNTING PARTS

Time-saving during the planning process and support for the Building Information Modelling (BIM) method are becoming more and more important. This is the reason why the universal PHILIPP CAD library helps to work efficiently on these matters.

- » More than 1,200 PHILIPP products are available as 3-D model
- » Universal CAD library with many export formats compatible for all CAD systems (e. g. IFC, DWG)
- » Free offer for all people involved in precast building
- » Time-saving in the design process because of ready-made models and views
- » Simply structured catalogue
- » More product details are provided
- » Standard PartCommunity: philipp.partcommunity.com
- » BIM specific PartCommunity: [3Dfindit](http://3Dfindit.com)

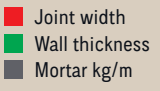


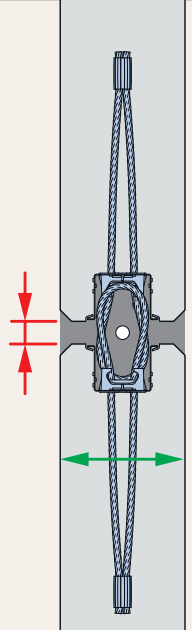
GENERAL NOTES

TABLE 11: SITE CHECK LIST

Step	What	Comment	
1	Open the rail	Remove cover	✓
2	Check of joint	Pay attention to a clean surface, when necessary clean again	✓
3	Fold-out the connecting loops	Pay attention to the 90° position	✓
4	Align concrete units	Pay attention to admissible tolerances	✓
5	Install joint reinforcement	Along the entire length of the joint	✓
6	Pre-wetting of joints	Improvement of adhesion	✓
7	Sealing on both sides	Use formwork, timber boards or joint tapes	✓
8	Mortar grouting	Pay attention to the required ambient temperature, compacting as well as processing time and instructions	✓
9	Demoulding	After hardening of the mortar	✓
10	Aftertreatment of joint	Protection against too fast drying	✓

TABLE 12: MORTAR CONSUMPTION PER 1 M OF JOINT (KG/M)

Wall thickness (cm)	BETEC® Grouting mortar			
	1.0	2.0	3.0	
10	9.3	11.2	13.1	
11	9.5	11.6	13.7	
12	9.6	12.0	14.3	
13	9.8	12.3	14.8	
14	10.0	12.7	15.4	
15	10.2	13.1	16.0	
16	10.4	13.5	16.6	
17	10.6	13.9	17.1	
18	10.8	14.3	17.7	
19	11.0	14.6	18.3	
20	11.2	15.0	18.9	
21	11.4	15.4	19.5	
22	11.6	15.8	20.0	
23	11.8	16.2	20.6	
24	12.0	16.6	21.2	
25	12.1	17.0	21.8	
26	12.3	17.3	22.3	
27	12.5	17.7	22.9	
28	12.7	18.1	23.5	
29	12.9	18.5	24.1	
30	13.1	18.9	24.6	



Given consumption data are only guide values.

TABLE 13: PACKING UNIT (BETEC®)

Mortar Type	PU (kg)	Finished volume (l)
Grouting mortar	25	13.0

GCP Germany GmbH

Phone: +49 201 86 147-0

E-mail: info.betec@gcpat.com

Website: <https://gcpat.de/de-de>



Please refer also to the approval of the Power One system. You can find it at www.philipp-group.de or is available on request.

For further information about the mortar, please follow the link given:



[BETEC Grouting](#)

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