PHILIPPGROUP

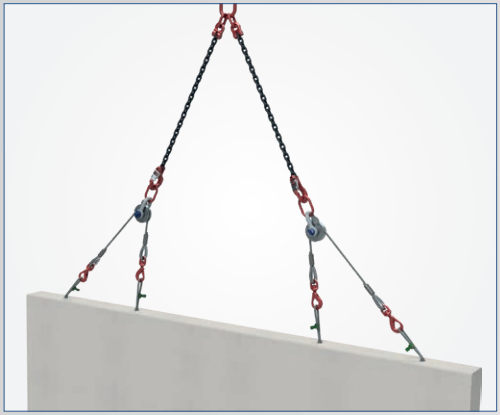
PHILIPP Transport anchor systems

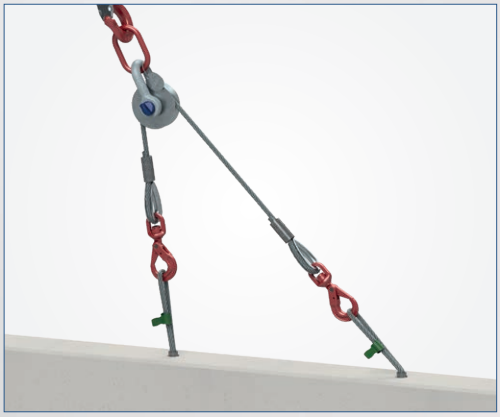
VBS HP-001.en - 03/22 - PDF

Everything at a glance

Design assistance

PHILIPP Suspension rig





- Bearing capacities:
  from 4.200 kg to 25.000 kg
- Wire rope length starting with 2.5 m
- Working length variable, acc. to customers' need
- Single or pairwise use
- Balanced distribution of the load to each attachment point

Do you want more information or an individual offer? We are happy about your response!

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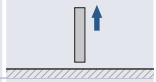
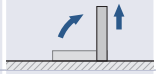
Transport		-	Threaded transport anchor - straight tail Threaded transport anchor - long wavy tail	Page 6
Tilt-up				Page 7
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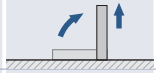
Tilt-up				Page 9
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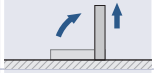
Tilt-up				Page 13
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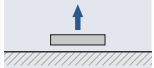
Transport		4-leg sling without balancer	Threaded transport anchor - short wavy tail Screw anchor Compact anchor - short	Page 16
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General notes

Axial tension:

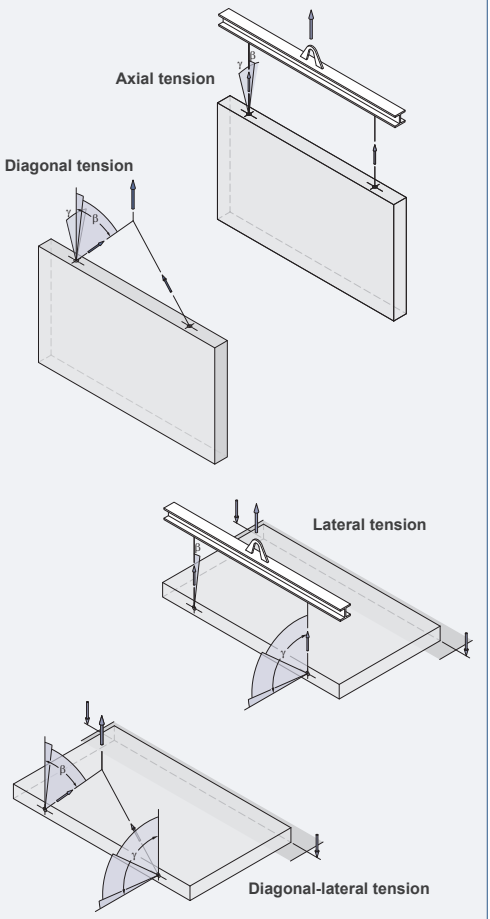
An anchor is loaded along its longitudinal axis.

Diagonal tension:

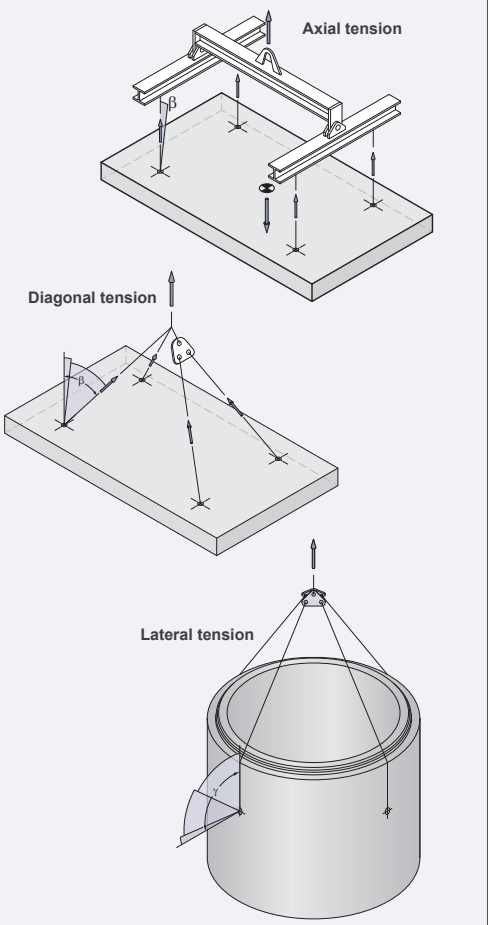
The load application takes effect under an angle of inclination β to the longitudinal axis of the anchor. In general, this diagonal tension occurs when the anchor is installed in the face side of a panel.

Lateral tension:

An anchor installed at the face side of a panel is loaded with lateral tension if the inclination is under an angle γ to the panel plane. The extreme case (90°-inclination) occurs if a lying manufactured unit must be tilted up. When tilting with a 2-leg sling a combination of diagonal and lateral tension occurs. This load case is called diagonal-lateral tension.



Picture 1 Face-sided installation of the anchors



Picture 2 Plane-sided installation of the anchors

General notes

Design assistance

This Design assistance is only an extract of the Installation and Application Instructions of the following transport anchors. It is only valid in combination with the Installation and Application Instruction of the specific anchors and the General Installation and Application Instruction for PHILIPP transport anchor systems.

Information about further bearing capacities as a function of the concrete strength and element thickness are given in the Installation and Application Instructions of the specific transport anchors.

Dynamic factor

An important criterion for the determination of the actual anchor loads is dynamic forces. These forces occur during hoisting and transport of the concrete unit. For the determination of the forces acting on the transport anchor all conditions during lifting and handling at the construction site must be considered. The worst case, i.e. highest hoisting coefficient, must be taken into account.

For the calculation of the element weight G in this brochure a dynamic factor of 1.3 is used ψ_{dyn}.

Table 1: Dynamic factor ψ_{dyn} acc. to VDI / BV-BS 6205 (crane speed class H1)

Boundary condition	Dynamic factor ψ_{dyn}
Tower cranes, portal cranes, mobil cranes Hoisting speed ≤ 90 m/min	1.3
Lifting and transporting on level ground (e. g. with excavator)	2.5
Lifting and transporting on uneven terrain (e. g. with excavator)	≥ 4.0

The dead load of the precast concrete element has to be multiplied with the dynamic factor ψ_{dyn}.

Formwork adhesion

Lifting the unit out of the formwork can result in much higher forces than the actual unit weight. This increase of the load depends on the formwork type and the contact area between unit and formwork.

Table 2: Minimum values of formwork adhesion q_{adh}

Formwork type and surface finish	q_{adh} [kN/m²]
Oiled steel formwork	≥ 1.0
Lacquered wooden formwork	≥ 2.0
Raw wooden formwork	≥ 3.0

With highly structured formworks (e.g. ribbed slabs) the values for formwork adhesion can be two times and more of the value (q_{adh}). The calculated load increase must be added to the unit weight. Decisive for the calculation is the result of dead weight and dynamic factor or dead weight and formwork adhesion.

The load case formwork adhesion is not considered in this Design assistance.

Concrete strength

Given concrete strengths f_{cc} are based on concrete cube strengths at the time of first lifting.

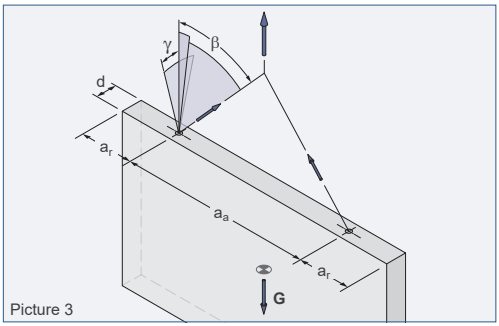
All resistances given in this document apply to normal concrete acc. to EN 206.

Lifting of a panel

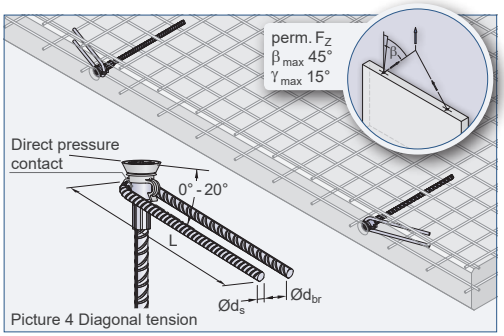
Boundary conditions:

2 anchors symmetrical to the centre of gravity (**Threaded transport anchor straight tail or long wavy tail**)

- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension β_{max} 45° / γ_{max} 15°**
- Additional reinforcement: **reinforcement for diagonal tension if β > 12.5°**
- Minimum concrete strength: **15 N/mm²**



Picture 3



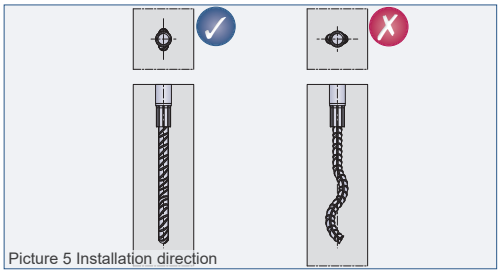
Picture 4 Diagonal tension

Table 3: Lifting of a panel

Type RD	Max. element weight **G** if f_{cc} 15 N/mm²			Minimum dimensions			Surface reinforcement	Reinforcement for diagonal tension					
								if β_{max} 30°			if β_{max} 45°		
	β_{max} 12.5° γ_{max} 15° [t]	β_{max} 30° γ_{max} 15° [t]	β_{max} 45° γ_{max} 15° [t]	d [mm]	a_r [mm]	a_a [mm]	$a_{sx} = a_{sy}$ [mm²/m]	$Ød_s$ [mm]	L [mm]	$Ød_{br}$ [mm]	$Ød_s$ [mm]	L [mm]	$Ød_{br}$ [mm]
12	**0.75**	**0.66**	**0.54**	60	150	300	2 × #131	6	150	24	6	150	24
14	**1.20**	**1.06**	**0.87**	60	200	400	2 × #131	6	200	24	6	200	24
16	**1.80**	**1.59**	**1.30**	80	200	400	2 × #131	6	250	24	8	200	32
18	**2.40**	**2.13**	**1.74**	100	250	500	2 × #188	8	200	32	8	250	32
20	**3.00**	**2.66**	**2.17**	100	275	550	2 × #188	8	250	32	8	300	32
24	**3.75**	**3.33**	**2.71**	120	300	600	2 × #188	8	300	32	10	300	40
30	**6.00**	**5.32**	**4.35**	140	350	650	2 × #188	10	350	40	12	400	48
36	**9.46**	**8.39**	**6.85**	200	400	800	2 × #188	12	450	48	14	550	56
42	**12.01**	**10.65**	**8.70**	240	500	1000	2 × #188	14	600	56	16	600	64
52	**18.77**	**16.65**	**13.59**	275	600	1200	2 × #188	16	700	67	20	750	140

Position of the anchor bending

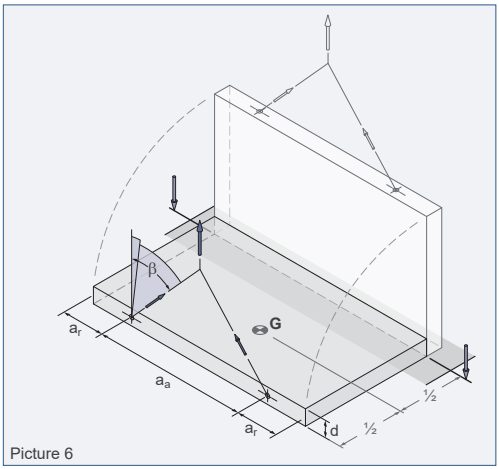
The position of the anchor bending shall be checked during installation process. Make sure to position it in parallel to the concrete element surface (picture 5).


Picture 5 Installation direction

Tilt-up of a panel with contact to the ground and following transport

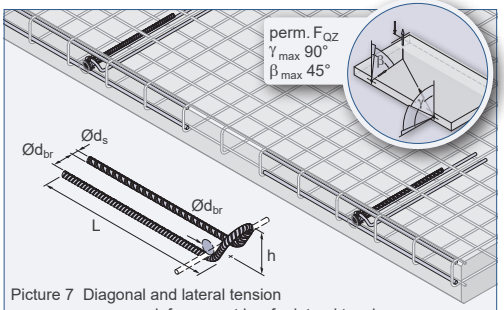
Boundary conditions:

2 anchors symmetrical to the centre of gravity
(**Threaded transport anchor straight tail or long wavy tail**)



Picture 6

- Dynamic factor: **ψ_{dyn} = 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load of anchor during tilt-up: **combination of diagonal and lateral tension γ_{max} 90° / β_{max} 45°**,
  Load of anchor during lifting:
  diagonal tension β_{max} 45° / γ_{max} 15°
- Additional reinforcement:
  reverse reinforcement bar for lateral tension
  (covers diagonal tension also)
- Minimum concrete strength: **15 N/mm²**



Picture 7 Diagonal and lateral tension reverse reinforcement bar for lateral tension

Table 4: Tilt-up of a panel with contact to the ground and following transport

Type RD	Max. element weight **G** if f_{cc} 15 N/mm²			Minimum dimensions			Surface reinforcement ②	Longitudinal reinforcement		Reverse reinforcement bar ①			
	γ_{max} 90° β_{max} 12.5° [t]	γ_{max} 90° β_{max} 30° [t]	γ_{max} 90° β_{max} 45° [t]	d [mm]	a_r [mm]	a_a [mm]	$a_{sx} = a_{sy}$ [mm²/m]	Ø [mm]	Length [mm]	$Ød_s$ [mm]	L [mm]	h [mm]	$Ød_{br}$ [mm]
12	**0.75**	**0.66**	**0.54**	80	150	300	2 × #131	10	850	6	270	35	24
14	**1.20**	**1.06**	**0.87**	80	200	400	2 × #131	10	850	6	350	42	24
16	**1.80**	**1.59**	**1.30**	80	200	400	2 × #131	10	850	8	420	49	32
18	**2.40**	**2.13**	**1.74**	100	250	500	2 × #188	12	850	8	460	55	32
20	**3.00**	**2.66**	**2.17**	100	275	550	2 × #188	12	850	10	490	64	40
24	**3.75**	**3.33**	**2.71**	120	300	600	2 × #188	12	850	12	520	75	48
30	**6.00**	**5.32**	**4.35**	140	350	650	2 × #188	16	1000	12	570	92	48
36	**9.46**	**8.39**	**6.85**	200	400	800	2 × #188	16	1000	14	690	118	56
42①	**12.01**	**10.65**	**8.70**	240	500	1000	2 × #188	16	1000	16	830	143	64
52①	**18.77**	**16.65**	**13.59**	275	600	1200	2 × #188	20	1200	20	930	174	140

① Additional reinforcement Ø14, length = 600 mm for type 42 and 52 required (picture 7)
② To be installed with a double-bended mesh (picture 7)

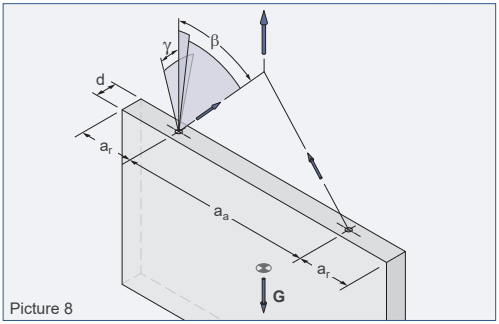
If the element is laid down again after tilt-up, the same side must come to rest. If this cannot be guaranteed a double reinforcement bar for lateral tension must be installed (pls. refer to the Installation and Application Instruction).

Lifting of a panel

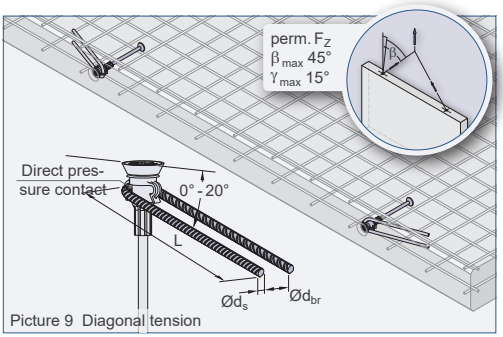
Boundary conditions:

2 anchors symmetrical to the centre of gravity (**Compact anchor**)

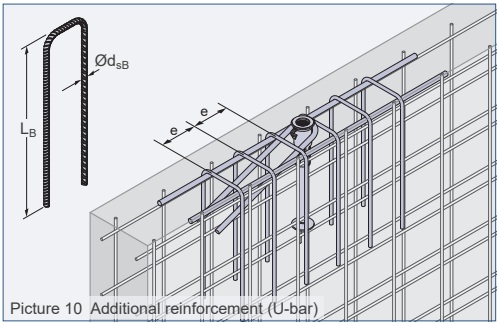
- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension β_{max} 45° / γ_{max} 15°**
- Additional reinforcement: **reinforcement for diagonal tension if β > 12.5°**
- Minimum concrete strength: **15 N/mm²**



Picture 8



Picture 9 Diagonal tension



Picture 10 Additional reinforcement (U-bar)

Table 5: Lifting of a panel

Type RD	Anchor length [mm]	Max. element weight **G** if f_{cc} 15 N/mm² β_{max} 30° γ_{max} 15° [t]	Max. element weight **G** if f_{cc} 15 N/mm² β_{max} 45° γ_{max} 15° [t]	Minimum dimensions ① d [mm]	a_r [mm]	a_a [mm]	Surface reinforcement $a_{sx} = a_{sy}$ [mm²/m]	Reinforcement for diagonal tension ② if β_{max} 45° $Ød_s$ [mm]	L [mm]	$Ød_{br}$ [mm]	U-bar ② No. [pcs.]	$Ød_s$ [mm]	L [mm]	e [mm]	Longitudinal reinforcement ② Ø [mm]	Length [mm]
12	100	**0.66**	**0.54**	70	150	300	1 × #131	6	150	18	-	-	-		-	-
14	105	**1.06**	**0.87**	80	200	400	1 × #188	8	200	24	-	-	-		-	-
16	130	**1.49**	**1.21**	80	200	400	1 × #188	8	200	24	-	-	-		-	-
18	150	**2.13**	**1.74**	90	250	500	1 × #188	10	250	30	-	-	-		-	-
20	185	**2.66**	**2.17**	100	300	600	2 × #188	10	300	40	-	-	-		-	-
24	200	**3.33**	**2.71**	120	300	600	2 × #188	10	300	40	-	-	-		-	-
30	275	**5.32**	**4.35**	130	350	700	2 × #257	12	350	48	6	8	350	130	12	800
36	334	**8.39**	**6.85**	160	400	800	2 × #257	14	400	56	6	8	400	150	12	800
42	385	**10.65**	**8.70**	160	500	1000	2 × #257	14	500	56	6	8	500	150	12	1000
52	550	**16.65**	**13.59**	200	600	1200	2 × #257	20	600	86	6	10	600	150	12	1200

① Only with axial load (β ≤ 12.5°) smaller element thicknesses are possible (pls. refer to corresponding Installation and Application Instruction)
② Only required if β > 12.5°

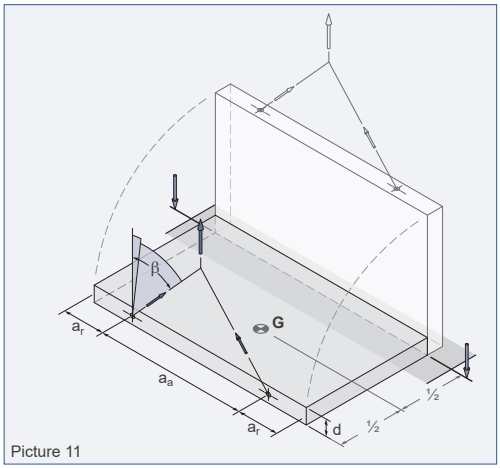
Tilt-up of a panel with contact to the ground and following transport

Boundary conditions:

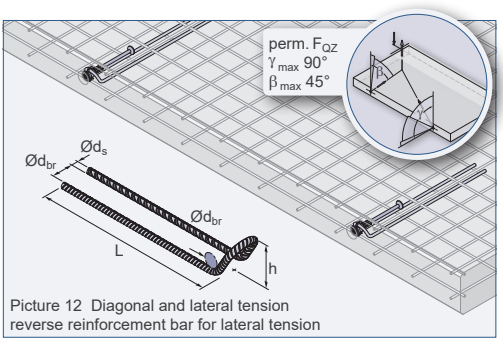
2 anchors symmetrical to the centre of gravity (**Compact anchor**)

- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load of anchor during tilt up: **combination of diagonal and lateral tension γ_{max} 90° / β_{max} 45°**, Load of anchor during lifting: **diagonal tension β_{max} 45° / γ_{max} 15°**
- Additional reinforcement: **reverse reinforcement bar for lateral tension** (covers diagonal tension also)
- Minimum concrete strength: **15 N/mm²**

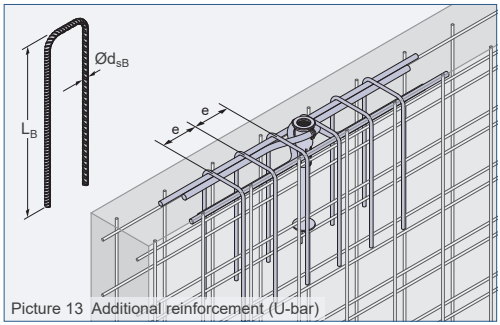
If the element is laid down again after tilt-up, the same side must come to rest. If this cannot be guaranteed a double reinforcement bar for lateral tension must be installed (pls. refer to the Installation and Application Instruction).



Picture 11



Picture 12 Diagonal and lateral tension reverse reinforcement bar for lateral tension



Picture 13 Additional reinforcement (U-bar)

Table 6: Tilt-up of a panel with contact to the ground and following transport

Type RD	Anchor length	Max. element weight **G** if f_{cc} 15 N/mm²		Minimum dimensions			Surface reinforcement ①	Reverse reinforcement bar				U-bar				Longitudinal reinforcement	
		γ_{max} 90° β_{max} 12.5° [t]	γ_{max} 90° β_{max} 45° [t]	d [mm]	a_r [mm]	a_a [mm]	$a_{sx} = a_{sy}$ [mm²/m]	$Ød_s$ [mm]	L [mm]	h [mm]	$Ød_{br}$ [mm]	No. [pcs.]	$Ød_s$ [mm]	e [mm]	L [mm]	Ø [mm]	Length [mm]
12	100	**0.75**	**0.54**	80	150	300	1 × #131	6	150	34	24	-	-	-	-	-	-
14	105	**1.08**	**0.78**	80	200	400	1 × #188	8	200	39	32	-	-	-	-	-	-
16	130	**1.32**	**0.95**	80	200	400	1 × #188	8	200	39	32	-	-	-	-	-	-
18	150	**2.40**	**1.74**	100	250	500	2 × #188	10	250	48	40	4	6	150	250	10	500
20	185	**3.00**	**2.17**	110	300	600	2 × #188	12	300	55	48	4	8	150	300	12	600
24	200	**3.75**	**2.71**	120	300	600	2 × #188	12	300	73	48	4	8	150	300	12	600
30	275	**6.00**	**4.35**	150	350	700	2 × #257	14	350	88	56	6	8	130	350	16	700
36	334	**9.46**	**6.85**	200	400	800	2 × #257	14	400	115	56	6	8	150	400	16	800
42	385	**12.01**	**8.70**	220	500	1000	2 × #257	16	500	123	64	8	8	130	500	16	1000
52	550	**18.11**	**13.11**	280	600	1200	2 × #257	20	600	170	140	8	10	150	600	20	1200

① Single-layer mesh reinforcement can be placed centred of the concrete element

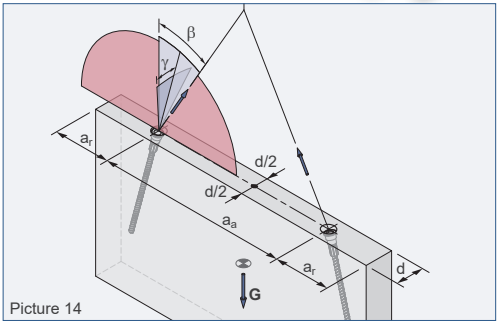
Lifting of a panel (using the Nailing plate for diagonal tension system)

Boundary conditions:

2 anchors symmetrical to the centre of gravity
(**Threaded transport anchor straight tail**)

- Recess formers: **72KHN__-SZ15, 72KHN__-SZ15ST**
- Dynamic factor: **ψ_{dyn} = 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension β_{max} 30° / γ_{max} 7.5°**
- Minimum concrete strength: **15 N/mm²**

A lateral load direction of the anchors higher than γ_{max} 7.5° is not allowed during transport! Only when the element is produced on a tilt-up table an angle up to γ_{max} 15° is possible.

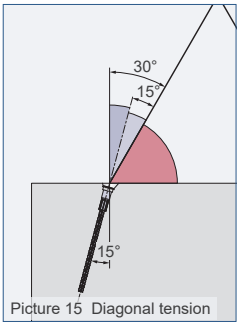


Picture 14

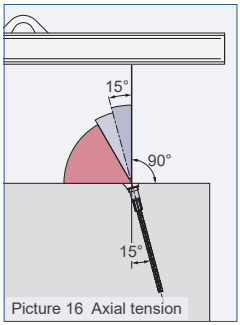
Table 7: Lifting of a panel using the Nailing plate for diagonal tension system

Type RD	Max. element weight **G** with f_{cc} 15 N/mm² β_{max} 30° γ_{max} 7.5° [t]	17.5 N/mm² β_{max} 30° γ_{max} 7.5° [t]	20 N/mm² β_{max} 30° γ_{max} 7.5° [t]	22.5 N/mm² β_{max} 30° γ_{max} 7.5° [t]	Minimum dimensions d [mm]	a_r [mm]	a_a [mm]	Surface reinforcement 1 $a_{sx} = a_{sy}$ [mm²/m]	Longitudinal reinforcement 2 No. [pcs.]	Ø [mm]	Length [mm]
16	**1.21**	**1.30**	**1.39**	**1.39**	60	200	400	1 × #188	-	-	-
20	**2.51**	**2.66**	**2.66**	**2.66**	100	300	600	2 × #188 ①	-	-	-
24	**3.27**	**3.33**	**3.33**	**3.33**	100	300	600	2 × #188 ①	-	-	-
30	**5.14**	**5.32**	**5.32**	**5.32**	120	350	700	2 × #188 ①	-	-	-
36	**8.06**	**8.39**	**8.39**	**8.39**	120	450	900	2 × #188 ①	-	-	-
42	**9.33**	**10.09**	**10.40**	**10.40**	140	550	1100	2 × #188 ①	-	-	-
	9.33	**10.09**	**10.65**	**10.65**				2 × #257 ①	-	-	-
52	**-**	**11.57**	**12.37**	**12.65**	150	600	1200	2 × #188 ①	-	-	-
	16.65	**16.65**	**16.65**	**16.65**				2 × #257 ①	2	10	1100

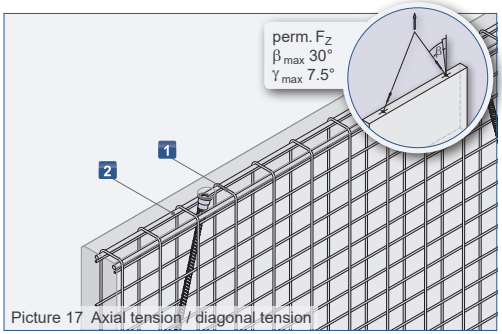
① The mesh reinforcement shall be arranged as a double-bended mesh or with equivalent stirrups.



Picture 15 Diagonal tension



Picture 16 Axial tension



Picture 17 Axial tension / diagonal tension

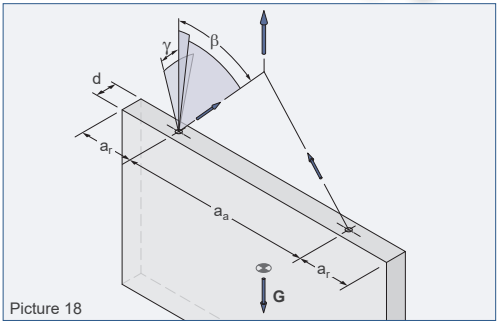
There is no need for a rebar for diagonal tension anymore when a straight tail anchor in combination with the Nailing plate for diagonal tension system is used. All boundary conditions for this (element thicknesses, centre and edge distances) as well as information about the recess former SZ15 are given in the corresponding Installation and Application Instruction.

Lifting of a panel with small element thickness or high load

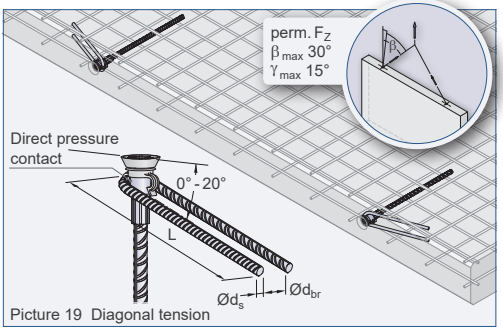
Boundary conditions:

2 anchors symmetrical to the centre of gravity
(**Threaded transport anchor straight tail**)

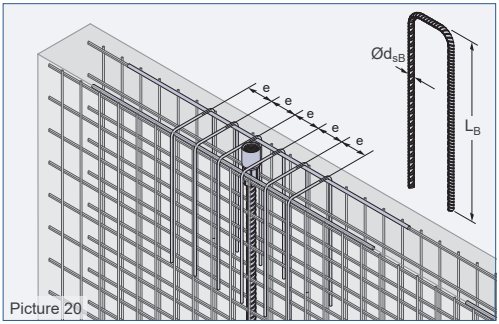
- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension β_{max} 30° / γ_{max} 15°**
- Additional reinforcement: **reinforcement for diagonal tension if β > 12.5°**
- Minimum concrete strength: **15 N/mm²**
- Lateral tension not permitted, panel must be tilted up with a tilting table!



Picture 18



Picture 19 Diagonal tension



Picture 20

Table 8: Lifting of a panel with small element thickness or high load

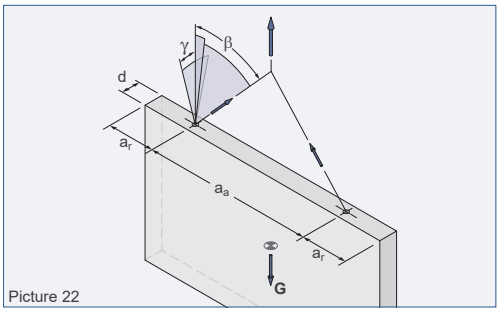
Type RD	Max. element weight G		Minimum dimensions			Surface reinforcement	Longitudinal reinforcement		U-bar			Reinforcement for diagonal tension if β_{max} 30°		
	β_{max} 12.5° γ_{max} 15° [t]	β_{max} 30° γ_{max} 15° [t]	d [mm]	a_r [mm]	a_a [mm]	$a_{sx} = a_{sy}$ [mm²/m]	Ø [mm]	Length [mm]	No. / $Ød_{sB}$ [mm]	L_B [mm]	e [mm]	$Ød_s$ [mm]	L [mm]	$Ød_{br}$ [mm]
Minimum concrete strength f_{cc}: **15 N/mm²**														
12	**0.75**	**0.66**	60	150	300	2 × #131	-	-	-	-	-	6	150	24
14	**1.20**	**1.06**	60	200	400	2 × #131	-	-	-	-	-	6	200	24
16	**1.80**	**1.59**	65	200	400	2 × #131	-	-	-	-	-	6	250	24
18	**2.40**	**2.13**	80	250	500	2 × #188	-	-	-	-	-	8	200	32
20	**3.00**	**2.66**	90	275	550	2 × #188	-	-	-	-	-	8	250	32
24	**3.75**	**3.33**	100	300	600	2 × #188	-	-	-	-	-	8	300	32
30	**6.00**	**5.32**	120	350	650	2 × #188	-	-	-	-	-	10	350	40
36	**9.46**	**8.39**	150	400	800	2 × #188	-	-	-	-	-	12	450	48
42	**12.01**	-	120	500	1000	2 × #257	10	1400	6 Ø6	400	150	-	-	-
	12.01	**10.65**	160			2 × #188	-	-	-	-	-	14	600	56
52	**18.77**	**16.65**	180	600	1200	2 × #188	-	-	-	-	-	16	700	67
56	**22.52**	**19.98**	280	1200	2000	2 × #378	14	1500	6 Ø10	600	125	25	750	175
60	**30.03**	**26.64**	280	1200	2000	2 × #513	14	1500	6 Ø10	600	125	25	900	175
Minimum concrete strength f_{cc}: **20 N/mm²**														
36	**9.46**	**8.39**	130	400	800	2 × #188	-	-	-	-	-	12	450	48
42	**12.01**	**10.65**	120	500	1000	2 × #257	10	1400	6 Ø6	400	150	12	450	48
	12.01	**10.65**	140	500	1000	2 × #188	-	-	-	-	-	14	600	56
52	**18.77**	**16.65**	150	600	1200	2 × #188	-	-	-	-	-	16	700	67

Lifting of a panel (Power System SL)

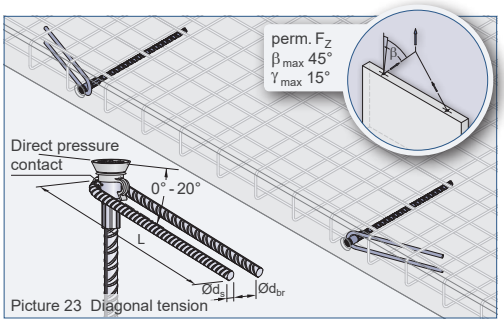
Boundary conditions:

2 anchors symmetrical to the centre of gravity (**Threaded transport anchor SL straight tail**)

- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension β_{max} 45° / γ_{max} 15°**
- Additional reinforcement: **reinforcement if β > 12.5°**
- Minimum concrete strength: **15 N/mm²**
- Lateral tension not permitted, panel must be tilted up with a tilting table!



Picture 22



Picture 23 Diagonal tension

Table 9: Lifting of a panel with Threaded transport anchor SL straight tail

Type SL	Max. element weight **G** if 15 N/mm² β_{max} 12.5° γ_{max} 15° [t]	if 15 N/mm² β_{max} 30° γ_{max} 15° [t]	if 15 N/mm² β_{max} 45° γ_{max} 15° [t]	if 25 N/mm² β_{max} 12.5° γ_{max} 15° [t]	if 25 N/mm² β_{max} 30° γ_{max} 15° [t]	if 25 N/mm² β_{max} 45° γ_{max} 15° [t]	Minimum dimensions d [mm]	a_r [mm]	a_a [mm]	Surface reinforcement $a_{sx} = a_{sy}$ [mm²/m]	Additional reinforcement for diagonal tension if β_{max} 45° $Ød_s$ [mm]	L [mm]	$Ød_{br}$ [mm]
16	**3.00**	**2.15**	**1.76**	**3.00**	**2.55**	**2.08**	80	465	930	① 2 × #188	10	300	24
	3.00	**2.17**	**1.77**	**3.00**	**2.55**	**2.08**	100						
	3.00	**2.19**	**1.79**	**3.00**	**2.55**	**2.08**	120						
24	**7.50**	**5.66**	**4.62**	**7.50**	**5.66**	**4.62**	100	590	1180	2 × #188	12	550	34
	7.50	**5.66**	**4.62**	**7.50**	**5.66**	**4.62**	120						
	7.50	**5.66**	**4.62**	**7.50**	**5.66**	**4.62**	140						
	7.50	**5.66**	**4.62**	**7.50**	**5.66**	**4.62**	160						
30	**11.43**	**8.19**	**6.69**	**12.01**	**8.84**	**7.22**	120	760	1520	2 × #188	16	700	41
	11.98	**8.59**	**7.01**	**12.01**	**8.84**	**7.22**	140						
	12.01	**8.84**	**7.22**	**12.01**	**8.84**	**7.22**	160						
	12.01	**8.84**	**7.22**	**12.01**	**8.84**	**7.22**	180						
42	**21.77**	**15.45**	**12.61**	**21.77**	**15.45**	**12.61**	160	1115	2230	2 × #188	20	1000	64
	21.77	**15.45**	**12.61**	**21.77**	**15.45**	**12.61**	180						
	21.77	**15.45**	**12.61**	**21.77**	**15.45**	**12.61**	200						
	21.77	**15.45**	**12.61**	**21.77**	**15.45**	**12.61**	220						
	21.77	**15.45**	**12.61**	**21.77**	**15.45**	**12.61**	240						
52	**27.29**	**19.77**	**11.41**	**30.03**	**25.52**	**14.74**	200	1215	2430	2 × #257	20	1000	140

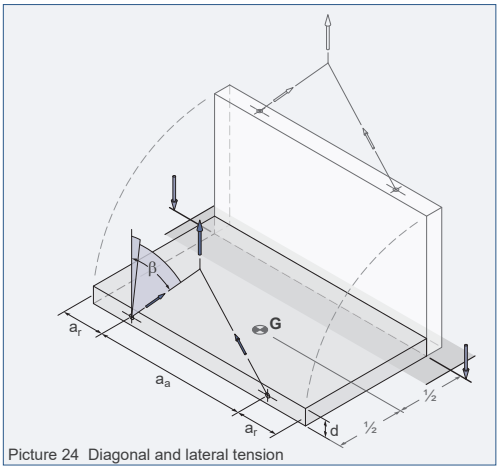
① With an element thickness of 80 mm only a single-layer mesh reinforcement Q188 centred is required.
② To be installed with a double-bended mesh (picture 23)

Tilt-up of a panel with contact to the ground (Power System SL)

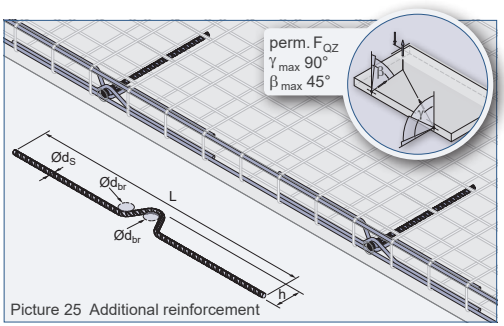
Boundary conditions:

2 anchors symmetrical to the centre of gravity
(**Threaded transport anchor SL straight tail**)

- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **combination of diagonal and lateral tension β_{max} 45° / γ_{max} 90°**
- Additional reinforcement: double reinforcement bar
- Minimum concrete strength: **15 N/mm²**



Picture 24 Diagonal and lateral tension



Picture 25 Additional reinforcement

Table 10: Tilt-up of a panel with contact to the ground with Threaded transport anchor SL straight tail

Type SL	Max. element weight **G** if f_{cc} 15 N/mm² γ_{max} 90° β_{max} 12.5° [t]	if f_{cc} 15 N/mm² γ_{max} 90° β_{max} 30° [t]	if f_{cc} 15 N/mm² γ_{max} 90° β_{max} 45° [t]	if f_{cc} 25 N/mm² γ_{max} 90° β_{max} 12.5° [t]	if f_{cc} 25 N/mm² γ_{max} 90° β_{max} 30° [t]	if f_{cc} 25 N/mm² γ_{max} 90° β_{max} 45° [t]	Minimum dimensions d [mm]	a_r [mm]	a_a [mm]	Surface reinforcement ② $a_{sx} = a_{sy}$ [mm²/m]	Additional reinforcement Reinforcement for lateral tension $Ød_S$ [mm]	$Ød_{br}$ [mm]	h [mm]	L [mm]	Longitudinal reinforcement Ø [mm]	Length [mm]
	1.62	**1.43**	**1.17**	**2.10**	**1.86**	**1.52**	80			①			40		-	-
12	**2.31**	**2.05**	**1.67**	**3.00**	**2.66**	**2.17**	100	465	930	2×#188	10	32	50	800	2Ø10	930
	3.09	**2.74**	**2.24**	**3.99**	**3.54**	**2.89**	120						60			
	3.18	**2.82**	**2.30**	**4.11**	**3.65**	**2.98**	100						57			
	4.14	**3.67**	**3.00**	**5.34**	**4.74**	**3.87**	120						67			
24	**5.25**	**4.66**	**3.80**	**6.78**	**6.02**	**4.91**	140	590	1180	2×#188	12	48	77	1000	2Ø12	1180
	6.48	**5.75**	**4.69**	**8.38**	**7.43**	**6.07**	160						87			
	4.77	**4.23**	**3.45**	**6.15**	**5.46**	**4.46**	120						76			
	6.09	**5.40**	**4.41**	**7.87**	**6.98**	**5.70**	140						86			
30	**7.54**	**6.68**	**5.46**	**9.73**	**8.63**	**7.04**	160	760	1520	2×#188	16	48	96	1200	2Ø14	1520
	9.10	**8.07**	**6.59**	**11.77**	**10.44**	**8.52**	180						106			
	8.23	**7.30**	**5.96**	**10.60**	**9.40**	**7.68**	160						107			
	9.94	**8.82**	**7.20**	**12.82**	**11.37**	**9.29**	180						117			
42	**11.89**	**10.55**	**8.61**	**15.35**	**13.61**	**11.11**	200	1115	2230	2×#188	20	64	127	1800	2Ø14	2230
	13.90	**12.33**	**10.07**	**17.96**	**15.93**	**13.01**	220						137			
	16.16	**14.33**	**11.70**	**20.84**	**18.49**	**15.09**	240						147			
52	**8.86**	**7.86**	**6.41**	**13.72**	**12.17**	**9.94**	200	1215	2430	2×#257	20	140	120	1800	2Ø14	2800

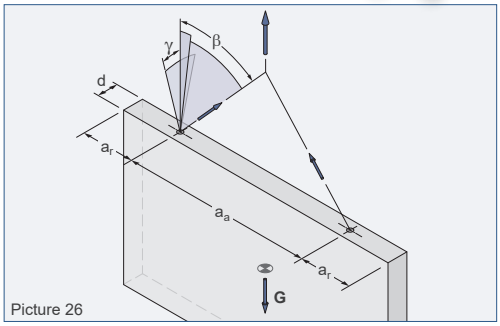
① With an element thickness of 80 mm only a single-layer mesh reinforcement (#188) centred is required.
② To be installed with a double-bended mesh (picture 25)

Lifting of a panel

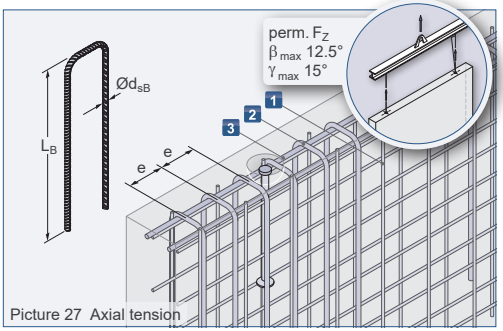
Boundary conditions:

2 anchors symmetrical to the centre of gravity
Spherical head transport anchor

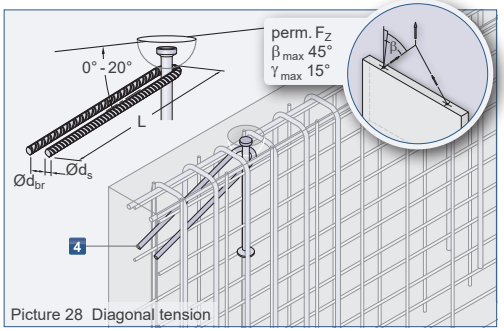
- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension β_{max} 45° / γ_{max} 15°**
- Additional reinforcement: **reinforcement for diagonal tension if β > 12.5°**
- Minimum concrete strength: **15 N/mm²**



Picture 26



Picture 27 Axial tension



Picture 28 Diagonal tension

Table 11: Lifting of a panel

Type KK	Anchor length	Max. element weight **G**			Minimum dimensions			Surface reinforcement 1	U-bar ① 2		Longitudinal reinforcement 3	Additional reinf. for diagonal tension if β_{max} 30° 4			
		β_{max} 12.5° γ_{max} 15°	β_{max} 30° γ_{max} 15°	β_{max} 45° γ_{max} 15°	d	a_r	a_a		no. / $Ød_{sB}$ / e	L_B		No.	$Ød_s$	L	d_{br}
	[mm]	[t]	[t]	[t]	[mm]	[mm]	[mm]	$a_{sx} = a_{sy}$ [mm²/m]		[mm]	No. / Ø	[pcs.]	[mm]	[mm]	[mm]
Minimum concrete strength f_{cc}: **15 N/mm²**															
1.3 ②	120	**1.95**	**1.73**	**1.41**	100	195	390	2 × #131	6Ø8/100	600	2Ø10	1	8	200	32
2.5 ②	170	**3.75**	**3.33**	**2.71**	120	275	550	2 × #131	6Ø8/100	600	2Ø10	1	10	320	40
4.0 ②	210	**6.00**	**5.32**	**4.35**	160	340	680	2 × #131	6Ø8/100	600	2Ø10	1	14	350	56
5.0 ②	240	**7.50**	**6.66**	**5.43**	180	385	770	2 × #131	6Ø8/125	600	2Ø10	1	16	400	64
7.5 ②	300	**11.26**	**9.99**	**8.15**	240	475	950	2 × #221	6Ø8/125	600	2Ø10	1	20	500	140
10.0 ②	340	**15.01**	**13.32**	**10.87**	260	535	1070	2 × #257	6Ø10/125	1000	2Ø14	1	20	650	140
15.0 ②	400	**22.52**	**19.98**	**16.31**	280	625	1250	2 × #378	6Ø10/125	1000	2Ø14	1	25	750	175
20.0 ②	500	**30.03**	**26.64**	**21.75**	280	775	1550	2 × #513	6Ø10/125	1000	2Ø14	1	25	950	175
Minimum concrete strength f_{cc}: **25 N/mm²**															
32.0	700	**48.06**	**42.63**	**34.81**	340	1085	2170	2 × #524	10Ø12/125	1400	2Ø16	2	25	1200	160
Minimum concrete strength f_{cc}: **35 N/mm²**															
32.0	700	**48.06**	**42.63**	**34.81**	300	1085	2170	2 × #524	10Ø12/125	1400	2Ø16	2	25	1200	160

① The first U-Bar in the anchor area shall be arranged as close as possible to the anchor.

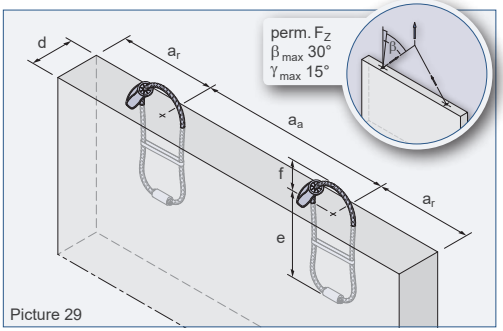
② The reinforcement for diagonal tension is not necessary if the concrete strength is at least f_{cc} 30 N/mm² .

Transport of beams or wall-like elements

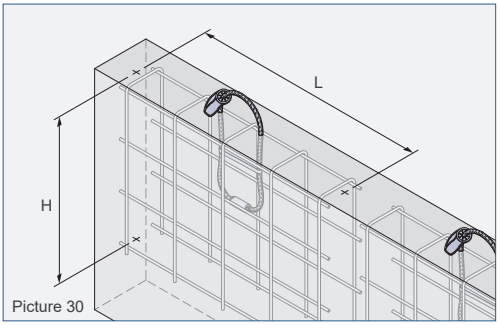
Boundary conditions:

2 anchors symmetrical to the centre of gravity (**Cast-in lifting hoop**)

- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension β_{max} 30° / γ_{max} 15°**
- Minimum concrete strength: **30 N/mm²**



Picture 29



Picture 30

Table 12: Lifting of beams

Type AS	Max. element weight **G** f_{cc} 30 N/mm² β_{max} 12.5° γ_{max} 15° [t]	Max. element weight **G** f_{cc} 30 N/mm² β_{max} 30° γ_{max} 15° [t]	Max. element weight **G** f_{cc} 35 N/mm² β_{max} 12.5° γ_{max} 15° [t]	Max. element weight **G** f_{cc} 35 N/mm² β_{max} 30° γ_{max} 15° [t]	Max. element weight **G** f_{cc} 45 N/mm² β_{max} 12.5° γ_{max} 15° [t]	Max. element weight **G** f_{cc} 45 N/mm² β_{max} 30° γ_{max} 15° [t]	Minimum dimensions d [mm]	a_r [mm]	a_a [mm]	e [mm]	f [mm]	Surface reinforcement (square) [mm²/m]	L [mm]	H ③ [mm]
0.8	**1.20**	**1.06**	**1.20**	**1.06**	**1.20**	**1.06**	60	300	600	150	85	1 × #188 ①	600	710
1.2	**1.80**	**1.59**	**1.80**	**1.59**	**1.80**	**1.59**	60	320	640	160	75	1 × #188 ①	640	720
1.6	**2.20**	**1.59**	**2.38**	**1.71**	**2.40**	**1.94**	80	330	660	165	70	2 × #188	660	725
2.0	**2.73**	**1.95**	**2.94**	**2.11**	**3.00**	**2.39**	90	400	800	200	70	2 × #188	800	760
2.5	**3.27**	**2.83**	**3.54**	**3.06**	**3.75**	**3.33**	100	460	920	230	80	2 × #188	920	790
4.0	**5.10**	**3.66**	**5.51**	**3.95**	**6.00**	**4.49**	150	480	960	240	100	2 × #188 ②	960	800
5.2	**6.81**	**4.90**	**7.35**	**5.28**	**7.81**	**5.99**	190	520	1040	260	105	2 × #188 ②	1040	820
6.3	**9.46**	**8.20**	**9.46**	**8.39**	**9.46**	**8.39**	220	560	1120	280	100	2 × #188 ②	1120	840
8.0	**10.90**	**8.20**	**11.77**	**8.46**	**12.01**	**9.59**	270	640	1280	320	120	2 × #188 ②	1280	880
10.0	**14.71**	**10.57**	**15.01**	**11.43**	**15.01**	**12.95**	330	780	1560	390	125	2 × #188 ②	1560	950
12.5	**18.77**	**16.65**	**18.77**	**16.65**	**18.77**	**16.65**	390	840	1680	420	150	2 × #257 ②	1680	1080
16.0	**20.89**	**16.65**	**22.57**	**16.65**	**24.03**	**18.38**	430	900	1800	450	155	2 × #524 ②	1800	1390
20.0	**25.51**	**18.33**	**27.56**	**19.79**	**30.03**	**22.45**	480	1100	2200	550	180	2 × #524 ②	2200	1490
25.0	**37.54**	**33.30**	**37.54**	**33.30**	**37.54**	**33.30**	530	1160	2320	580	200	2 × #524 ②	2320	1520

① Centred arranged reinforcement
② Mesh reinforcement shall be done as a double-bended mesh!
③ Required H if f_{cc} 15 N/mm². H can be reduced, if the required anchorage length of the reinforcement acc. to EC 2 is extended beyond the embedment depth e.

More information about further concrete strengths, element thicknesses and load bearing capacities are given in the Installation and Application Instructions for Cast-in lifting hoops.

In order to guarantee the correct transition radii for the Cast-in lifting hoop, we recommend to use our special PHILIPP Wire protection pulley. For more details, please refer to the Application Instruction of the PHILIPP Wire protection pulley.

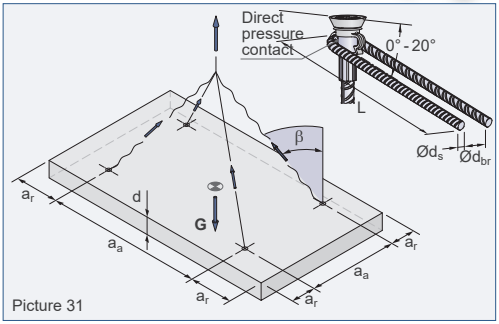
Lifting of slabs with a 4-leg sling without balancer

Boundary conditions:

4 anchors symmetrical to the centre of gravity, **2 load bearing anchors** (Threaded transport anchor - short wavy tail (**KW**), Screw anchor (**SA**), Compact anchor - short (**KA-K**))

- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension β_{max} 45°**
- Additional reinforcement: **reinforcement for diagonal tension if β > 12.5°**
- Minimum concrete strength **15 N/mm²**

If a balancing element is used the max. element weight G can be increased to two times.



Picture 31

Table 13: Lifting of slabs with a 4-leg sling without balancer

Type RD	Anchor	Max. element weight **G** f_{cc} 15 N/mm² β_{max} 12.5° [t]	β_{max} 30° [t]	β_{max} 45° [t]	Minimum dimensions d [mm]	a_r [mm]	a_a [mm]	Surface reinforcement $a_{sx} = a_{sy}$ [mm²/m]	Reinforcement for diagonal tension if β_{max} 30° Ød$_s$ [mm]	L [mm]	Ød$_{br}$ [mm]	if β_{max} 45° Ød$_s$ [mm]	L [mm]	Ød$_{br}$ [mm]
12	**KW**	**0.75**	**0.66**	**0.54**	140	95	200	2 × #131	6	150	24	6	150	24
	SA				80	180	360	-						
14	**KW**	**1.20**	**1.06**	**0.87**	160	115	200	2 × #131	6	200	24	6	200	24
	SA				90	210	420	-						
16	**KW**	**1.80**	**1.59**	**1.30**	195	135	260	2 × #131	6	250	24	8	200	32
	SA ①				100	240	480	-						
18	**KW**	**2.40**	**2.13**	**1.74**	202	155	300	2 × #188	8	200	32	8	250	32
	SA ①				110	270	540	-						
20	**KW**	**3.00**	**2.66**	**2.17**	215	170	350	2 × #188	8	250	32	8	300	32
	SA ①				120	300	600	-						
24	**KW**	**3.75**	**3.33**	**2.71**	270	220	440	2 × #188	8	300	32	10	300	40
	SA ②				135	345	690	-						
30	**KW**	**6.00**	**5.32**	**4.35**	390	275	550	2 × #188	10	350	40	12	400	48
	SA ②				170	450	900	-						
36	**KW**	**9.46**	**8.39**	**6.85**	410	300	600	2 × #188	12	450	48	14	550	56
	KA-K				220	500	1000	2 × #257	14	450	56		450	
42	**KW**	**12.01**	**10.65**	**8.70**	480	400	800	2 × #188	14	600	56	16	600	64
	KA-K				250	550	1100	2 × #257		500		14	500	56
52	**KA-K**	**18.77**	**16.65**	**13.59**	350	600	1200	2 × #335	20	600	92	20	600	92

① In case of diagonal tension β ≤ 30° the reinforcement for diagonal tension is not necessary if:
- there is a single-layer mesh reinforcement (#188) and
- the Screw anchor is installed with a recess former (KHN system) in recessed position

② Diagonal tension β ≤ 30° the reinforcement for diagonal tension is not necessary if:
- there is a double-layer mesh reinforcement (#188) and
- the Screw anchor is installed with a recess former (KHN system) in recessed position

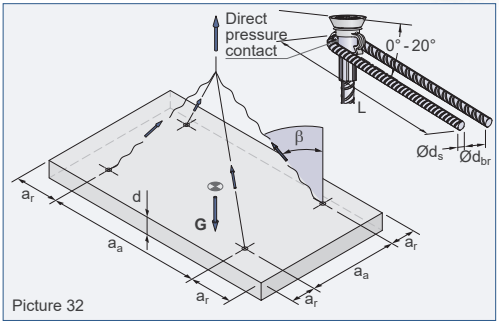
Lifting of slabs with a 4-leg sling without balancer

Boundary conditions:

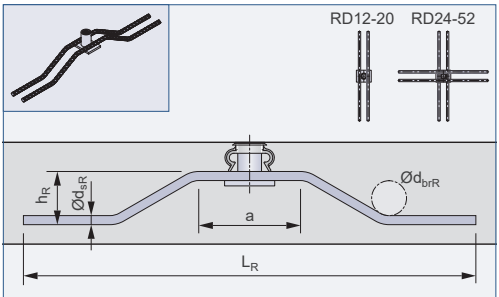
4 anchors symmetrical to the centre of gravity, **2 load bearing anchors** (Capped end anchor (**FL**), Capped end anchor - long version (**FL-L**))

- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension** β_{max} **45°**
- Additional reinforcement: **reinforcement for diagonal tension if β > 12.5°**
- Minimum concrete strength: **15 N/mm²**

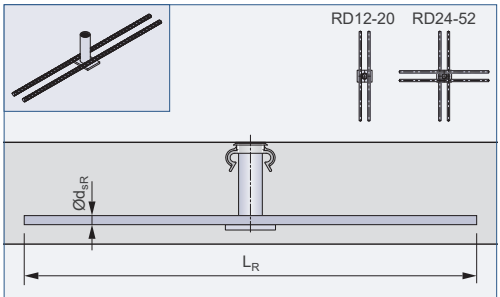
If a balancing element is used the max. element weight **G** can be increased to two times.



Picture 32



Picture 33 Capped end anchor (**FL**)



Picture 34 Capped end anchor - long version (**FL-L**)

Table 14: Lifting of slabs with a 4-leg sling without balancer

Type RD	Anchor	Max. element weight G f_{cc} 15 N/mm² β_{max} 12.5° [t]	Max. element weight G f_{cc} 15 N/mm² β_{max} 45° [t]	Minimum dimensions d [mm]	Minimum dimensions a_r [mm]	Minimum dimensions a_a [mm]	Surface reinforcement $a_{sx} = a_{sy}$ [mm²/m]	Reverse reinforcement No. [pc.]	Reverse reinforcement $Ød_{sR}$ [mm]	Reverse reinforcement L_R [mm]	Reverse reinforcement a [mm]	Reverse reinforcement h_R [mm]	Reverse reinforcement $Ød_{brR}$ [mm]	Reinforcement for diagonal tension ① if β_{max} 45° $Ød_s$ [mm]	Reinforcement for diagonal tension ① if β_{max} 45° L [mm]	Reinforcement for diagonal tension ① if β_{max} 45° $Ød_{br}$ [mm]
12	FL	0.75	0.54	70	190	380	1 × #257	2	8	250	60	32	32	6	150	24
	FL-L	0.75	0.54													
14	FL	1.14	0.87	80	250	500	1 × #257	2	8	330	90	39	32	8	190	32
16	FL	1.42	1.26	90	300	600	1 × #257	2	8	400	90	47	32	8	200	32
	FL-L	1.80	1.30													
18	FL	1.81	1.47	95	330	660	2 × #257	2	10	450	90	46	40	8	240	32
20	FL	2.22	1.69	100	360	720	2 × #257	2	10	500	90	48	40	8	250	32
	FL-L	2.71	2.17													
24	FL	3.75	2.71	120	440	880	2 × #335	4	12	600	90	63	48	10	300	40
	FL-L	3.75	2.71													
30	FL	6.00	4.35	140	520	1040	2 × #424	4	14	700	140	68	56	12	420	48
	FL-L	6.00	4.35													
36	FL	9.46	6.85	160	590	1180	2 × #424	4	16	800	140	78	64	14	400	56
	FL-L	8.38	6.85													
42	FL	12.01	8.70	180	640	1280	2 × #524	4	20	840	170	90	140	16	450	64
	FL-L	10.84	8.70													
52	FL	15.93	13.38	220	720	1440	2 × #524	4	20	900	170	111	140	20	500	140
	FL-L	15.77	12.67													

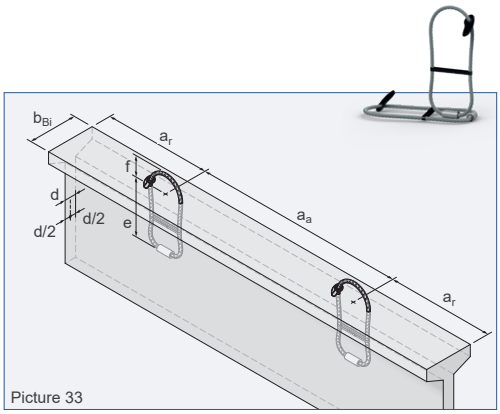
① For diagonal tension β ≤ 30° a smaller rebar for diagonal tension can be used (pls. refer to the corresponding Installation and Application Instruction).

Lifting of narrow beams

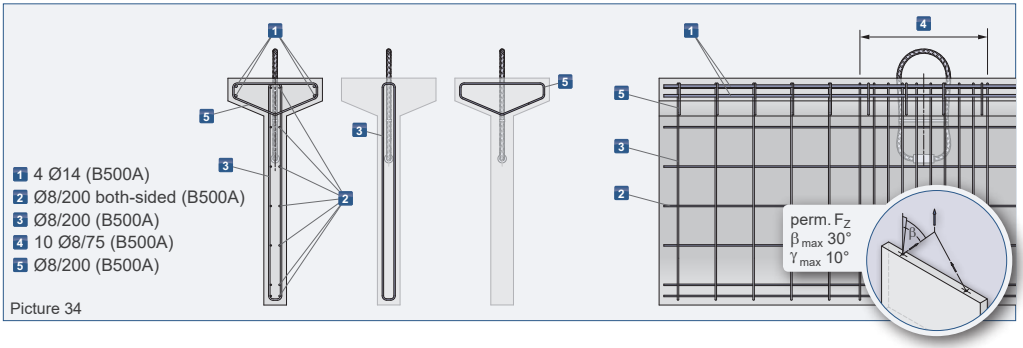
Boundary conditions:

2 anchors symmetrical to the centre of gravity (**Cast-in lifting hoop**)

- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor: **diagonal tension** β_{max} **30° /** γ_{max} **10°**
- Minimum concrete strength: **15 N/mm²**



Picture 33



Picture 34

Table 15: Lifting of narrow beams

Type	Max. element weight **G**				Minimum dimensions					
	f_{cc} 25 N/mm²		f_{cc} 30 N/mm²							
AS	β_{max} 12.5° γ_{max} 10° [t]	β_{max} 30° γ_{max} 10° [t]	β_{max} 12.5° γ_{max} 10° [t]	β_{max} 30° γ_{max} 10° [t]	d [mm]	b_{Bi} [mm]	a_r [mm]	a_a [mm]	e [mm]	f [mm]
16.0	**24.03**	**21.31**	**24.03**	**21.31**	120	≥400	1400	2000	450	165
20.0	**30.03**	**26.64**	**30.03**	**26.64**	120	≥400	1400	2000	550	180
25.0	**37.02**	**32.84**	**37.54**	**33.30**	120	≥400	1400	2000	600	180

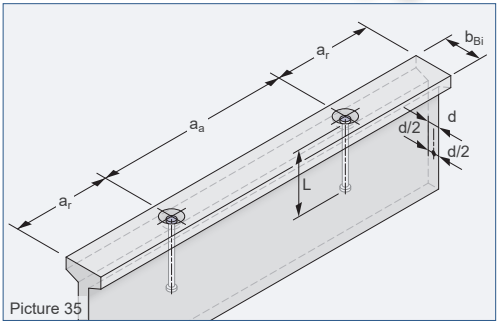
In order to guarantee the correct transition radii for the Cast-in lifting hoop, we recommend to use our special PHILIPP Wire protection pulley. For more details, please refer to the Application Instruction of the PHILIPP Wire protection pulley.

Lifting of narrow beams

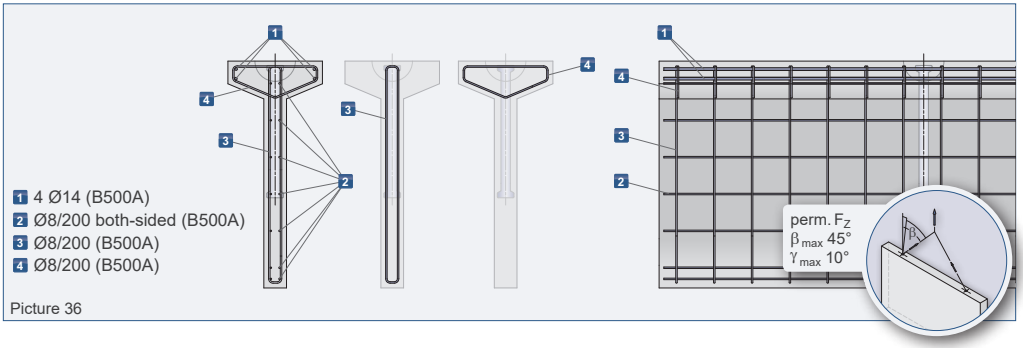
Boundary conditions:

2 anchors symmetrical to the centre of gravity (**Spherical head double-head anchor**)

- Dynamic factor: ψ_{dyn} **= 1.3** ($v_H \leq 90$ m/min)
- Formwork adhesion: **not included**
- Load per anchor:
  axial tension β_{max} 12.5° / γ_{max} 10°,
  diagonal tension β_{max} 45° / γ_{max} 10°
- Minimum concrete strength: **25 N/mm²** ①



Picture 35



1 4 Ø14 (B500A)
2 Ø8/200 both-sided (B500A)
3 Ø8/200 (B500A)
4 Ø8/200 (B500A)

Picture 36

Table 16: Lifting of narrow beams

Type	Anchor length	Max. element weight **G**						Minimum dimensions			
		f_{cc} 25 N/mm² ①		f_{cc} 35 N/mm² ①		f_{cc} 45 N/mm² ①					
KK	L [mm]	β_{max} 12.5° γ_{max} 10° [t]	β_{max} 45° γ_{max} 10° [t]	β_{max} 12.5° γ_{max} 10° [t]	β_{max} 45° γ_{max} 10° [t]	β_{max} 12.5° γ_{max} 10° [t]	β_{max} 45° γ_{max} 10° [t]	d [mm]	a_r [mm]	a_a [mm]	b_{Bi} [mm]
20.0	500	**20.20**	**13.17**	**23.91**	**15.58**	**27.11**	**17.66**	120	1400	2000	≥ 400
		21.02	**13.70**	**24.88**	**16.21**	**28.22**	**18.39**	140			
		21.86	**14.25**	**25.86**	**16.86**	**29.33**	**19.12**	160			
		22.69	**14.79**	**26.85**	**17.50**	**30.03**	**19.84**	180			
		23.52	**15.32**	**27.83**	**18.13**	**30.03**	**20.57**	200			
		24.34	**15.87**	**28.80**	**18.77**	**30.03**	**21.28**	220			
		25.17	**16.41**	**29.78**	**19.41**	**30.03**	**21.75**	240			
		25.99	**16.94**	**30.03**	**20.06**	**30.03**	**21.75**	260			
		26.82	**17.49**	**30.03**	**20.69**	**30.03**	**21.75**	280			
32.0	700	**25.39**	**16.55**	**30.05**	**19.59**	**34.08**	**22.21**	120	1400	2000	≥ 500
		26.84	**17.49**	**31.75**	**20.70**	**36.00**	**23.46**	140			
		28.26	**18.42**	**33.44**	**21.80**	**37.92**	**24.72**	160			
		29.70	**19.36**	**35.14**	**22.91**	**39.84**	**25.97**	180			
		31.13	**20.29**	**36.84**	**24.01**	**41.78**	**27.23**	200			
		32.57	**21.23**	**38.54**	**25.12**	**43.70**	**28.49**	220			
		34.00	**22.17**	**40.23**	**26.22**	**45.63**	**29.74**	240			
		35.44	**23.10**	**41.93**	**27.33**	**47.55**	**31.00**	260			
		36.88	**24.04**	**43.63**	**28.44**	**48.06**	**32.25**	280			

① A linear interpolation between the concrete strengths is possible

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