

PHILIPP GROUP

PHILIPP Transport anchor systems



VE3-TP-001-en - 04/18

Everything at a glance

Design assistance

Transport and mounting systems for prefabricated units

■ Technical department

Our staff will be pleased to support your planning phase with suggestions for the installation and use of our transport and mounting systems for precast concrete construction.

■ Special designs

Customized to your particular needs.

■ Practical tests on site

We ensure that our concepts are tailored precisely to your requirements.

■ Inspection reports

For documentation purposes and your safety.

■ On-site service

Our engineers will be pleased to instruct your technicians and production personnel at your plant, to advise on the installation of precast concrete parts and to assist you in the optimisation of your production processes.

■ High safety level when using our products

Close cooperation with federal materials testing institutes (MTIs), and official approvals for the use of our products and solutions whenever necessary.

■ Software solutions

The latest design software, animated videos and CAD libraries can always be found under www.philipp-group.de.

■ Engineering contact

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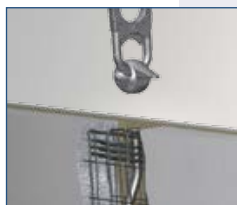
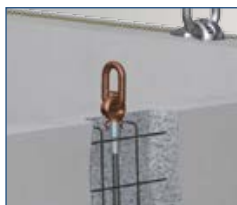
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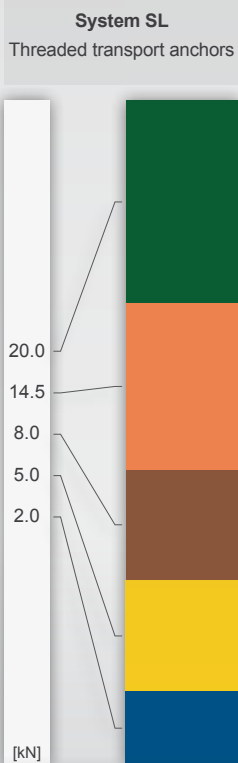
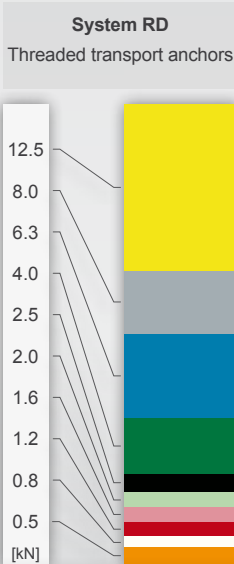
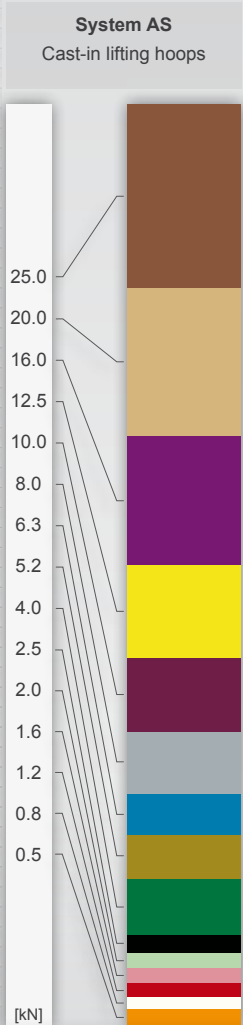
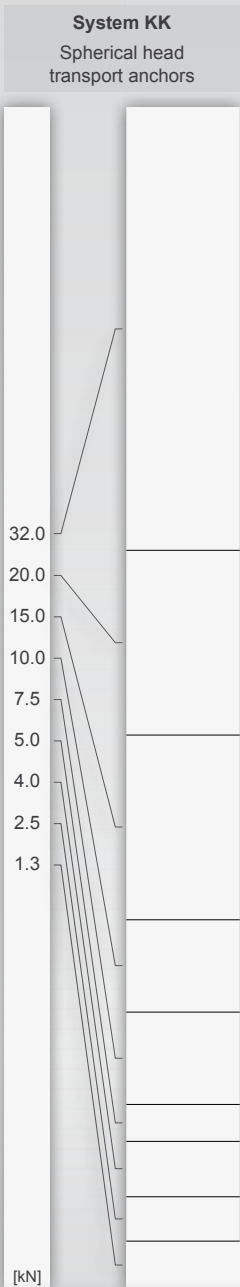


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Transport anchor systems / load classes



General notes

Design assistance

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



Information about further bearing capacities as a function of the concrete strength and the element thickness are given in the Installation 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, transportation and placing 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 hoisting class H1)

Hoisting conditions	Dynamic factor ψ_{dyn}
Stationary crane Hoisting speed > 90 m/min	1.3
Lifting and transport (e.g. with excavator) on flat terrain	2.5
Lifting and transport (e.g. with excavator) on rough terrain	≥ 4.0

Mould adhesion

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



The load case mould adhesion is not considered on the following pages.

Table 2: Basic values of the mould adhesion q_{adh}

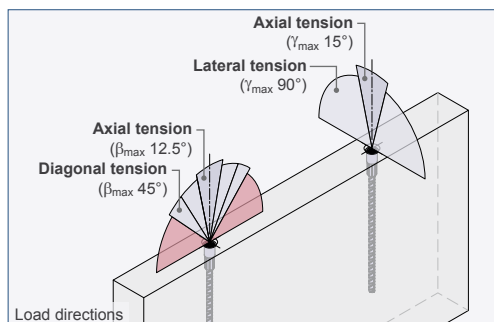
Mould type	q_{adh} [kN/m ²]
Oiled mould	≥ 1.0
Finished timber mould	≥ 2.0
Rough timber mould	≥ 3.0

With highly structured moulds (e.g. π -slabs) the values for mould adhesion can be two times and more. The calculated load increase must be added to the unit weight.

Concrete strength

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

Load directions



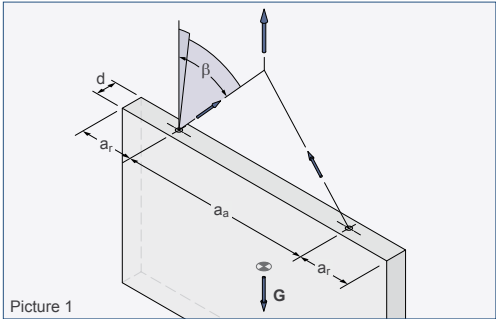
Lifting of a panel

Boundary conditions:

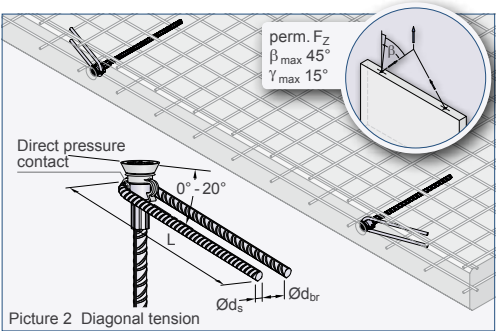
2 anchors symmetrical to the centre of gravity

(Threaded transport anchor - straight tail, - long wavy tail or Compact anchor)

- Dynamic factor: $\psi_{dyn} = 1.3$ (tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)
- Mould adhesion: **not included**
- Load per anchor: **diagonal tension** $\beta_{max} 45^\circ$ / $\gamma_{max} 15^\circ$
- Additional reinforcement: **reinforcement for diagonal tension** if $\beta > 12.5^\circ$
- Minimum concrete strength: **15 N/mm²**



Picture 1



Picture 2 Diagonal tension

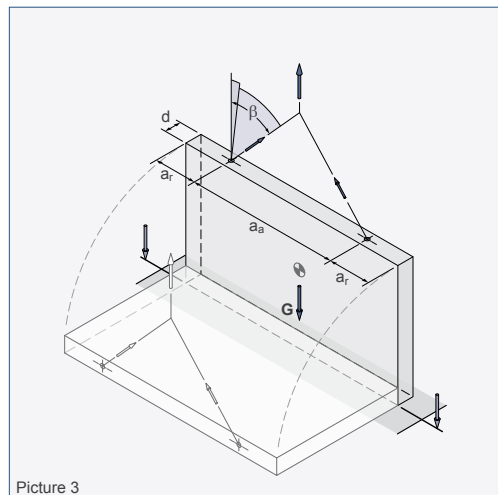
Table 3: Lifting of a panel

Type	Max. element weight G if $f_{cc} 15 \text{ N/mm}^2$			Minimum dimensions			Surface reinforce- ment	Reinforcement for diagonal tension					
	$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 30^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 45^\circ$ $\gamma_{max} 15^\circ$ [t]					if $\beta_{max} 30^\circ$			if $\beta_{max} 45^\circ$		
RD				d [mm]	a _r [mm]	a _a [mm]	a _{sx} = a _{sy} [mm ² /m]	$\varnothing d_s$ [mm]	L [mm]	$\varnothing d_{br}$ [mm]	$\varnothing d_s$ [mm]	L [mm]	$\varnothing d_{br}$ [mm]
12	0.75	0.66	0.54	60	150	300	131	6	150	24	6	150	24
14	1.20	1.06	0.87	60	200	400	131	6	200	24	6	200	24
16	1.80	1.59	1.30	80	200	400	131	6	250	24	8	200	32
18	2.40	2.13	1.74	100	250	500	188	8	200	32	8	250	32
20	3.00	2.66	2.17	100	275	550	188	8	250	32	8	300	32
24	3.75	3.33	2.71	120	300	600	188	8	300	32	10	300	40
30	6.00	5.32	4.35	140	350	650	188	10	350	40	12	400	48
36	9.46	8.39	6.85	200	400	800	188	12	450	48	14	550	56
42	12.02	10.65	8.70	240	500	1000	188	14	600	56	16	600	64
52	18.77	16.65	13.59	275	600	1200	188	16	700	67	20	750	140

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

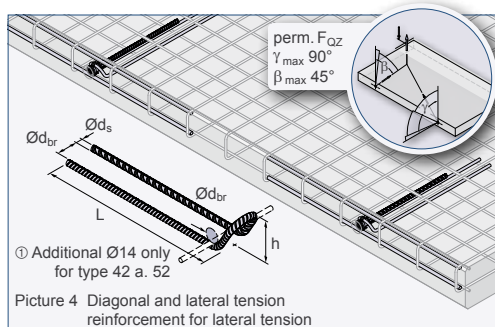
Boundary conditions:

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



Picture 3

- Dynamic factor: $\psi_{dyn} = 1.3$
(tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90 \text{ m/min}$)
- Mould adhesion: **not included**
- Load of anchor during tilt-up: **combined diagonal and lateral tension** $\gamma_{max} 90^\circ / \beta_{max} 45^\circ$,
Load of anchor during lifting:
diagonal tension $\beta_{max} 45^\circ / \gamma_{max} 15^\circ$
- Additional reinforcement: **anchor stirrup for lateral tension** (covers also diagonal tension)
- Minimum concrete strength: **15 N/mm²**



Picture 4 Diagonal and lateral tension reinforcement for lateral tension

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

Type	Max. element weight G if $f_{cc} 15 \text{ N/mm}^2$			Minimum dimensions			Surface reinforcement ②	Longitudinal reinforcement		Anchor stirrup for lateral tension			
RD	$\gamma_{max} 90^\circ$ $\beta_{max} 12.5^\circ$ [t]	$\gamma_{max} 90^\circ$ $\beta_{max} 30^\circ$ [t]	$\gamma_{max} 90^\circ$ $\beta_{max} 45^\circ$ [t]	d [mm]	a_r [mm]	a_a [mm]	$a_{sx} = a_{sy}$ [mm ² /m]	$\emptyset$ [mm]	Length [mm]	$\emptyset d_s$ [mm]	L [mm]	h [mm]	$\emptyset d_{br}$ [mm]
12	0.75	0.66	0.54	80	150	300	131	10	850	6	270	35	24
14	1.20	1.06	0.87	80	200	400	131	10	850	6	350	42	24
16	1.80	1.59	1.30	80	200	400	131	10	850	8	420	49	32
18	2.40	2.13	1.74	100	250	500	188	12	850	8	460	55	32
20	3.00	2.66	2.17	100	275	550	188	12	850	10	490	64	40
24	3.75	3.33	2.71	120	300	600	188	12	850	12	520	75	48
30	6.00	5.32	4.35	140	350	650	188	16	1000	12	570	92	48
36	9.46	8.39	6.85	200	400	800	188	16	1000	14	690	118	56
42 ^①	12.02	10.65	8.70	240	500	1000	188	16	1000	16	830	143	64
52 ^①	18.77	16.65	13.59	275	600	1200	188	20	1200	20	930	174	140

① Additional $\emptyset d_s = 14 \text{ mm}$, $L = 600 \text{ mm}$ (see Picture 4)

② To be installed as mesh cap (see Picture 4)



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 wall-like elements

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: $\psi_{dyn} = 1.3$ (Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)

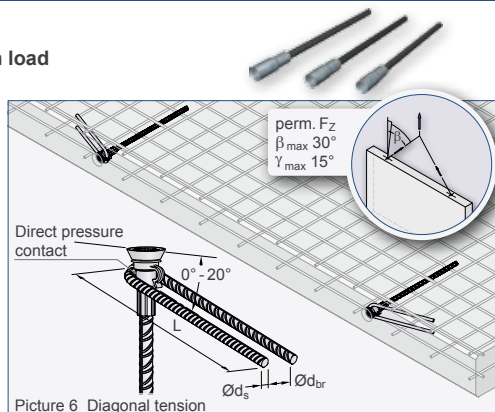
■ Mould adhesion: **not included**

■ Load per anchor: **diagonal tension** $\beta_{max} 30^\circ / \gamma_{max} 15^\circ$

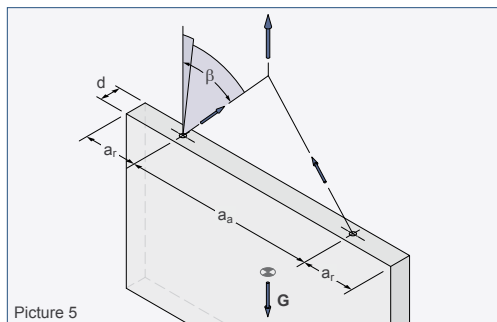
■ Additional reinforcement: **reinforcement for diagonal tension** if $\beta > 12.5^\circ$

■ Minimum concrete strength **15 N/mm²**

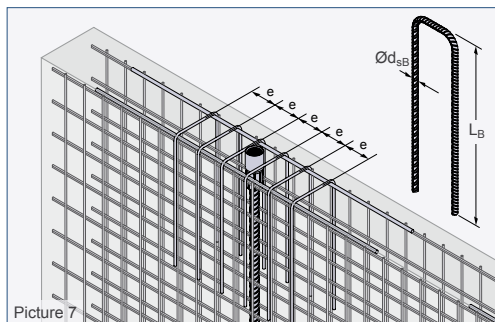
■ Lateral tension not allowed, panel must be tilted-up with a tilting table



Picture 6 Diagonal tension



Picture 5



Picture 7

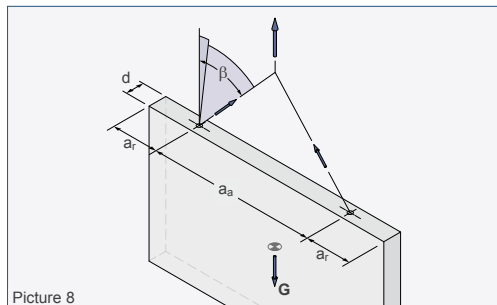
Table 5: Lifting of a panel with small element thickness or high load

Type	Max. element weight G		Minimum dimensions			Surface reinforcement	Longitudinal reinforcement		U-bar			Reinforcement for diagonal tension if $\beta_{max} 30^\circ$		
RD	$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 30^\circ$ $\gamma_{max} 15^\circ$ [t]	d [mm]	ar [mm]	aa [mm]	$a_{sx} = a_{sy}$ [mm ² /m]	Ø [mm]	Length [mm]	qty / Ødsb [mm]	LB [mm]	e [mm]	Øds [mm]	L [mm]	Ødbr [mm]
Minimum concrete strength f_{cc} : 15 N/mm²														
12	0.75	0.66	60	150	300	131	-	-	-	-	-	6	150	24
14	1.20	1.06	60	200	400	131	-	-	-	-	-	6	200	24
16	1.80	1.59	65	200	400	131	-	-	-	-	-	6	250	24
18	2.40	2.13	80	250	500	188	-	-	-	-	-	8	200	32
20	3.00	2.66	90	275	550	188	-	-	-	-	-	8	250	32
24	3.75	3.33	100	300	600	188	-	-	-	-	-	8	300	32
30	6.00	5.32	120	350	650	188	-	-	-	-	-	10	350	40
36	9.46	8.39	150	400	800	188	-	-	-	-	-	12	450	48
42	12.02	-	120	500	1000	257	10	1400	6 Ø6	400	150	-	-	-
	12.02	10.65	160	500	1000	188	-	-	-	-	-	14	600	56
52	18.77	16.65	180	600	1200	188	-	-	-	-	-	16	700	67
56	22.52	19.98	280	1200	2000	375	14	1500	6 Ø10	600	125	25	750	175
60	30.03	26.64	280	1200	2000	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	188	-	-	-	-	-	12	450	48
42	12.02	10.65	120	500	1000	275	10	1400	6 Ø6	400	150	12	450	48
	12.02	10.65	140	500	1000	188	-	-	-	-	-	16	600	56
52	18.77	16.65	150	600	1200	188	-	-	-	-	-	16	700	67

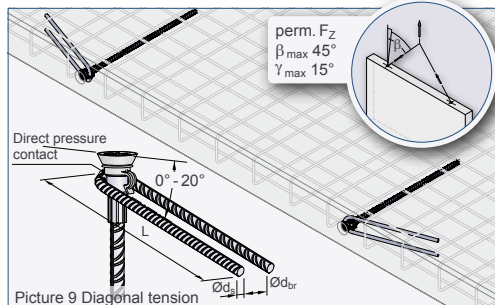
Lifting of a panel (Power System SL)

Boundary conditions:

- 2 anchors symmetrical to the centre of gravity (**Threaded transport anchor SL - straight tail**)
- Dynamic factor: $\Psi_{dyn} = 1.3$ (Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)
- Mould adhesion: **not included**
- Load per anchor: **diagonal tension $\beta_{max} 45^\circ / \gamma_{max} 15^\circ$**
- Additional reinforcement: **reinforcement for diagonal tension if $\beta > 12.5^\circ$**
- Minimum concrete strength: **15 N/mm²**
- Lateral tension not allowed, panel must be tilted-up with a tilting table



Picture 8



Picture 9 Diagonal tension

Table 6: Lifting of a panel with Threaded transport anchor SL - straight tail

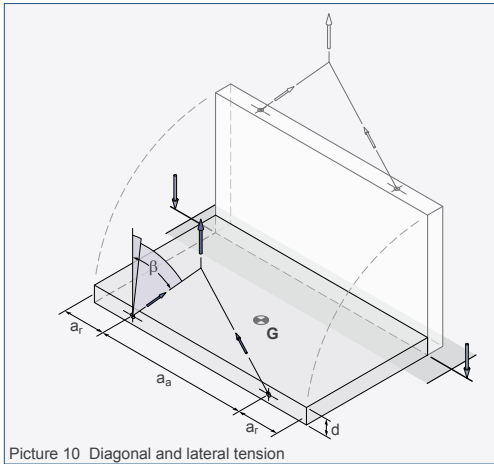
Type	SL	Max. element weight G						Minimum dimensions			Surface reinforcement (mesh cap)	Additional reinforcement for diagonal tension if $\beta_{max} 45^\circ$		
		if 15 N/mm ²			if 25 N/mm ²			d	a _r	a _a		$\varnothing d_s$	L	$\varnothing d_{br}$
		$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 30^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 45^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 30^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 45^\circ$ $\gamma_{max} 15^\circ$ [t]	[mm]	[mm]	[mm]	[mm ² /m]	[mm]	[mm]	[mm]
16		3.00	2.15	1.76	3.00	2.55	2.08	80						
		3.00	2.17	1.77	3.00	2.55	2.08	100	465	930	188 ①	10	300	24
		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						
		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	590	1180	188	12	550	34
		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						
		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	760	1520	188	16	700	41
		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						
		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	1115	2230	188	20	1000	64
		21.77	15.45	12.61	21.77	15.45	12.61	220						
52		27.29	19.77	11.41	30.03	25.52	14.74	200	1215	2430	257	20	1000	140

① With an element thickness of 80 mm only a single mesh reinforcement Q188A is required in the centre.

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

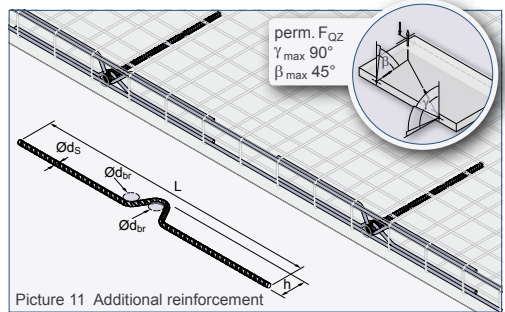
Boundary conditions:

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



Picture 10 Diagonal and lateral tension

- Dynamic factor: $\Psi_{dyn} = 1.3$
(Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90\text{m/min}$)
- Mould adhesion: **not included**
- Load per anchor: **combined diagonal and lateral tension $\beta_{max} 45^\circ / \gamma_{max} 90^\circ$**
- Additional reinforcement: **double reinforcement bar**
- Minimum concrete strength: **15 N/mm²**



Picture 11 Additional reinforcement

Table 7: Tilt-up of a panel with contact to the ground using Threaded transport anchor SL - straight tail

Type	Max. element weight G						Minimum dimensions			Surface reinforcement	Additional reinforcement for lateral tension				2× Longitudinal reinforcement		
	if f _{cc} 15 N/mm ²			if f _{cc} 25 N/mm ²													
	SL	γ _{max} 90° β _{max} 12.5° [t]	γ _{max} 90° β _{max} 30° [t]	γ _{max} 90° β _{max} 45° [t]	γ _{max} 90° β _{max} 12.5° [t]	γ _{max} 90° β _{max} 30° [t]	γ _{max} 90° β _{max} 45° [t]	d	a _r [mm]	a _b [mm]	② a _{sx} = a _{sy} [mm ² /m]	Ød _s [mm]	Ød _{br} [mm]	h [mm]	L [mm]	Ø	Length [mm]
 12		1.62	1.43	1.17	2.10	1.86	1.52	80						40		-	-
		2.31	2.05	1.67	3.00	2.55	2.08	100	465	930	188 ①	10	32	50	800	2Ø10	930
		3.00	2.19	1.79	3.00	2.55	2.08	120						60			
		3.18	2.82	2.30	4.11	3.65	2.98	100						57			
 24		4.14	3.67	3.00	5.34	4.74	3.87	120	590	1180	188	12	48	67	1000	2Ø12	1180
		5.25	4.66	3.80	6.78	5.66	4.62	140						77			
		6.48	5.66	4.62	7.50	5.66	4.62	160						87			
 30		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			
		7.54	6.68	5.46	9.73	8.63	7.04	160	760	1520	188	16	48	96	1200	2Ø14	1520
		9.10	8.07	6.59	11.77	8.84	7.22	180						106			
		8.23	7.30	5.96	10.60	9.40	7.68	160						107			
 42		9.94	8.82	7.20	12.82	11.37	9.29	180						117			
		11.89	10.55	8.61	15.35	13.61	11.11	200	1115	2230	188	20	64	127	1800	2Ø14	2230
		13.90	12.33	10.07	17.96	15.45	12.61	220						137			
		16.16	14.33	11.70	20.84	15.45	12.61	240						147			
		8.86	7.86	6.41	13.72	12.17	9.94	200	1215	2430	257	20	140	120	1800	2Ø14	2800

① With an element thickness of 80 mm only a single mesh reinforcement Q188A is required in the centre.

② To be installed as mesh cap

Lifting of a panel

Boundary conditions:

2 anchors symmetrical to the centre of gravity
(**Spherical head transport anchor**).

- Dynamic factor: $\psi_{dyn} = 1.3$
(Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90\text{m/min}$)
- Mould adhesion: **not included**
- Load per anchor: **diagonal tension** $\beta_{max} 45^\circ / \gamma_{max} 15^\circ$
- Additional reinforcement: **reinforcement for diagonal tension** if $\beta > 12.5^\circ$
- Minimum concrete strength: **15 N/mm²**

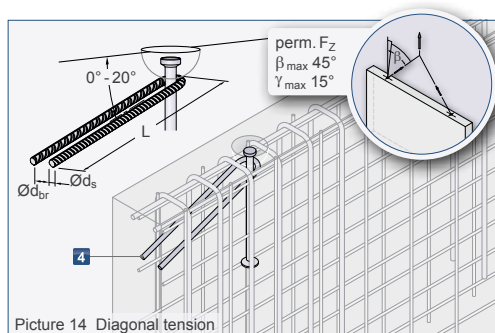
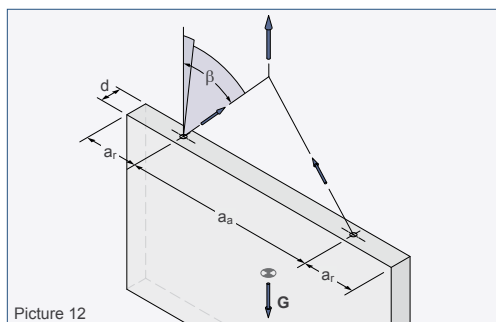
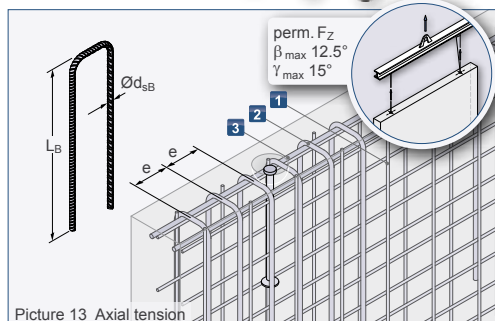


Table 8: Lifting of a panel

Type	Max. element weight G			Minimum dimensions			Surface reinforcement 1	U-bar ① 2		Longitudinal reinforcement 3	Additional reinforcement for diagonal tension if $\beta_{max} 30^\circ$ 4			
KK	$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 30^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 45^\circ$ $\gamma_{max} 15^\circ$ [t]	d [mm]	a _r [mm]	a _a [mm]	a _{sx} = a _{sy} [mm ² /m]	qty / Ød _{sB} / e	L _B [mm]	qty / Ø	[pcs.]	Ød _s [mm]	L [mm]	d _{br} [mm]
Minimum concrete strength f _{cc} : 15 N/mm²														
1.3	1.95	1.73	1.41	100	195	390	131	6Ø8/100	600	2Ø10	1 ②	8	200	32
2.5	3.75	3.33	2.71	120	275	550	131	6Ø8/100	600	2Ø10	1 ②	10	320	40
4.0	6.00	5.32	4.35	160	340	680	131	6Ø8/100	600	2Ø10	1 ②	14	350	56
5.0	7.50	6.66	5.43	180	385	770	131	6Ø8/125	600	2Ø10	1 ②	16	400	64
7.5	11.26	9.99	8.15	240	475	950	221	6Ø8/125	600	2Ø10	1 ②	20	500	140
10.0	15.01	13.32	10.87	260	535	1070	257	6Ø10/125	1000	2Ø14	1 ②	20	650	140
15.0	22.52	19.98	16.31	280	625	1250	378	6Ø10/125	1000	2Ø14	1 ②	25	750	175
20.0	30.03	26.64	21.75	280	775	1550	513	6Ø10/125	1000	2Ø14	1 ②	25	950	175
Minimum concrete strength f _{cc} : 25 N/mm²														
32.0	48.06	42.63	34.81	340	1085	2170	524	10Ø12/125	1400	2Ø16	2	25	1200	160
Minimum concrete strength f _{cc} : 35 N/mm²														
32.0	48.06	42.63	34.81	300	1085	2170	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 A reinforcement for diagonal tension is not necessary, if the concrete strength at the first lift is at least f_{cc} 30 N/mm² and the minimum thicknesses and edge distances given in the table are met.

Lifting of slabs with a 4-leg compensation rig (balancer or similar)



Boundary conditions:

4 anchors symmetrical to the centre of gravity, **4 load bearing anchors** (Capped end anchor (FL), Threaded transport anchor - short wavy tail (KW) or Screw anchor (SA))

■ Dynamic factor: $\Psi_{dyn} = 1.3$

(Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)

■ Mould adhesion: **not included**

■ Load per anchor: **diagonal tension $\beta_{max} 45^\circ$**

■ Additional reinforcement: **reinforcement for diagonal tension if $\beta > 12.5^\circ$**

■ Minimum concrete strength: **15 N/mm²**

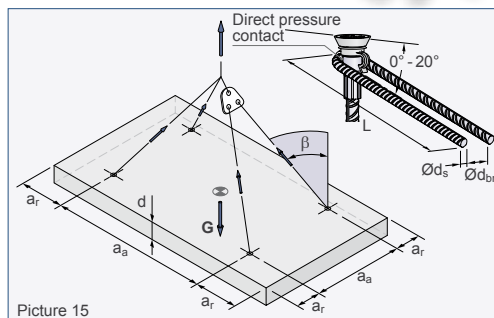


Table 9: Lifting of slabs with a 4-leg compensation rig (balancer or similar)

Type	Anchor	Max. element weight G $f_{cc} 15 \text{ N/mm}^2$			Minimum dimensions			Surface reinforcement $a_{sx} = a_{sy}$ [mm ² /m]	Reinforcement for diagonal tension					
		$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 30^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 45^\circ$ $\gamma_{max} 15^\circ$ [t]	d [mm]	a_r [mm]	a_a [mm]		if $\beta_{max} 30^\circ$		if $\beta_{max} 45^\circ$			
RD									ϕ_{ds} [mm]	L [mm]	ϕ_{db} [mm]	ϕ_{ds} [mm]	L [mm]	ϕ_{db} [mm]
12	FL ①	1.50	1.33	1.08	70	180	350	131	6	150	24	6	150	24
	KW				140	95	200	131						
	SA				80	180	360	-						
14	FL ①	2.40	2.13	1.74	80	180	350	131	6	200	24	6	200	24
	KW				160	115	200	131						
	SA				90	210	420	-						
16	FL ①	3.60	3.19	2.61	85	250	500	131	6	250	24	8	200	32
	KW				195	135	260	131						
	SA ②				100	240	480	-						
18	FL ①	4.80	4.26	3.48	95	300	600	188	8	200	32	8	250	32
	KW				202	155	300	188						
	SA ②				110	270	540	-						
20	FL ①	6.00	5.32	4.35	100	300	600	188	8	250	32	8	300	32
	KW				215	170	350	188						
	SA ②				120	300	600	-						
24	FL ①	7.50	6.66	5.43	115	400	800	188	8	300	32	10	300	40
	KW				270	220	440	188						
	SA ③				135	345	690	-						
30	FL ①	12.01	10.65	8.70	140	500	1000	221	10	350	40	12	400	48
	KW				390	275	550	188						
	SA ③				170	450	900	-						
36	FL ①	18.92	16.78	13.70	160	650	1300	221	12	450	48	14	550	56
	KW				410	300	600	188						
42	FL ①	24.03	21.31	17.40	175	650	1300	513	14	600	56	16	600	64
	KW				480	400	800	188						
52	FL ①	37.54	33.30	27.19	215	750	1300	513	16	700	67	20	750	140

① With Capped end anchors additional anchor stirrups are required (pls. refer to the Installation and Application Instruction).

② In case of diagonal tension $\beta \leq 30^\circ$ the reinforcement for diagonal tension is not necessary if:

- there is a single mesh reinforcement Q188A
- the Screw anchor is installed recessed by a Nailing plate (Ref.-No. 72KHN___, 72KHN__STK, 72MAXKHN___)

③ In case of diagonal tension $\beta \leq 30^\circ$ the reinforcement for diagonal tension is not necessary if:

- there is a double mesh reinforcement Q188A
- the Screw anchor is installed recessed by a Nailing plate (Ref.-No. 72KHN___, 72KHN__STK, 72MAXKHN___)

Lifting of slabs without a 4-leg compensation rig

Boundary conditions:

4 anchors symmetrical to the centre of gravity, **2 load bearing anchors** (Capped end anchor (FL), Threaded transport anchor-short wavy tail (KW) or Screw anchors (SA))

■ Dynamic factor: $\psi_{dyn} = 1.3$

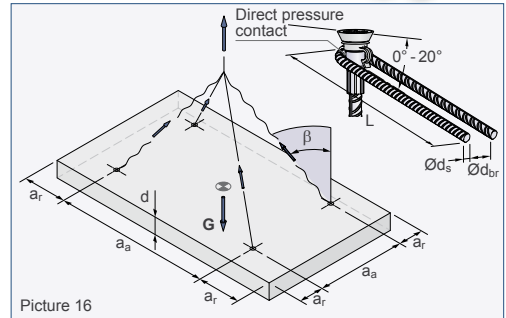
(Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)

■ Mould adhesion: **not included**

■ Load per anchor: **diagonal tension $\beta_{max} 45^\circ$**

■ Additional reinforcement: **reinforcement for diagonal tension if $\beta > 12.5^\circ$**

■ Minimum concrete strength: **15 N/mm²**



Picture 16

Table 10: Lifting of slabs without a 4-leg compensation rig

Type	Anchor	Max. element weight G $f_{cc} 15 \text{ N/mm}^2$			Minimum dimensions			Surface reinforcement $a_{sx} = a_{sy}$ [mm ² /m]	Reinforcement for diagonal tension					
		$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 30^\circ$ $\gamma_{max} 15^\circ$ [t]	$\beta_{max} 45^\circ$ $\gamma_{max} 15^\circ$ [t]	d [mm]	a_r [mm]	a_a [mm]		if $\beta_{max} 30^\circ$			if $\beta_{max} 45^\circ$		
RD									$\varnothing d_s$ [mm]	L [mm]	$\varnothing d_{br}$ [mm]	$\varnothing d_s$ [mm]	L [mm]	$\varnothing d_{br}$ [mm]
12	FL ①	0.75	0.66	0.54	70	180	350	131	6	150	24	6	150	24
	KW				140	95	200	131						
	SA				80	180	360	-						
14	FL ①	1.20	1.06	0.87	80	180	350	131	6	200	24	6	200	24
	KW				160	115	200	131						
	SA				90	210	420	-						
16	FL ①	1.80	1.59	1.30	85	250	500	131	6	250	24	8	200	32
	KW				195	135	260	131						
	SA ②				100	240	480	-						
18	FL ①	2.40	2.13	1.74	95	300	600	188	8	200	32	8	250	32
	KW				202	155	300	188						
	SA ②				110	270	540	-						
20	FL ①	3.00	2.66	2.17	100	300	600	188	8	250	32	8	300	32
	KW				215	170	350	188						
	SA ②				120	300	600	-						
24	FL ①	3.75	3.33	2.71	115	400	800	188	8	300	32	10	300	40
	KW				270	220	440	188						
	SA ③				135	345	690	-						
30	FL ①	6.00	5.32	4.35	140	500	1000	221	10	350	40	12	400	48
	KW				390	275	550	188						
	SA ③				170	450	900	-						
36	FL ①	9.46	8.39	6.85	160	650	1300	221	12	450	48	14	550	56
	KW				410	300	600	188						
42	FL ①	12.02	10.65	8.70	175	650	1300	513	14	600	56	16	600	64
	KW				480	400	800	188						
52	FL ①	18.77	16.65	13.59	215	750	1500	513	16	700	67	20	750	140

① With Capped end anchors additional anchor stirrups are required (pls. refer to the Installation and Application Instruction).

② In case of diagonal tension $\beta \leq 30^\circ$ the reinforcement for diagonal tension is not necessary if:

- there is a single mesh reinforcement Q188A
- the Screw anchor is installed recessed by a Nailing plate (Ref.-No. 72KHN___, 72KHN__STK, 72MAXKHN___)

③ In case of diagonal tension $\beta \leq 30^\circ$ the reinforcement for diagonal tension is not necessary if:

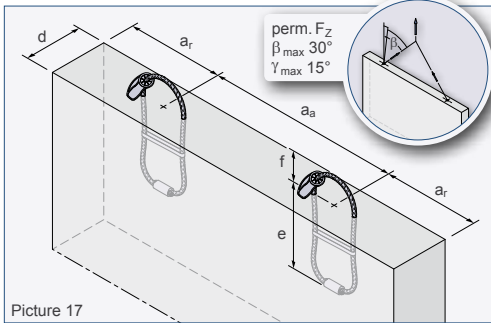
- there is a double mesh reinforcement Q188A
- the Screw anchor is recessed installed by a Nailing plate (Ref.-No. 72KHN___, 72KHN__STK, 72MAXKHN___)

Lifting of beams

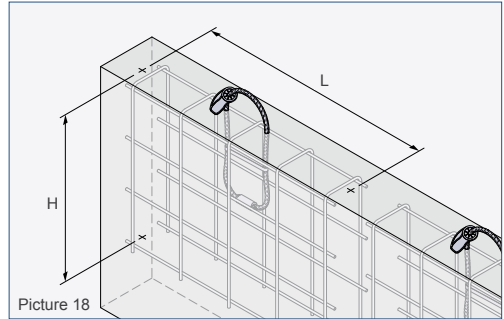
Boundary conditions:

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

- Dynamic factor: $\Psi_{\text{dyn}} = 1.3$ (Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)
- Mould adhesion: **not included**
- Load per anchor: **diagonal tension** $\beta_{\text{max}} 30^\circ / \gamma_{\text{max}} 15^\circ$
- Minimum concrete strength: **15 N/mm²**



Picture 17



Picture 18

Table 11: Lifting of beams (element thicknesses d for concrete strengths f_{cc} 15/20/25 N/mm²)

Type	Max. element weight G						Minimum dimensions					Surface rein- forcement (square)	L	H ③
	f _{cc} 15 N/mm²		f _{cc} 20 N/mm²		f _{cc} 25 N/mm²		d	a _r	a _a	e	f			
AS	β _{max} 12.5° γ _{max} 15°	β _{max} 30° γ _{max} 15°	β _{max} 12.5° γ _{max} 15°	β _{max} 30° γ _{max} 15°	β _{max} 12.5° γ _{max} 15°	β _{max} 30° γ _{max} 15°						[mm]	[mm]	[mm]
 0.8	1.20	1.06	1.20	1.06	1.20	1.06	80	600	300	150	85	1 × 188 ①	600	710
 1.2	1.80	1.57	1.80	1.59	1.80	1.59	90	640	320	160	75	1 × 188 ①	640	720
 1.6	1.98	1.57	2.29	1.65	2.40	1.83	100	660	330	165	70	2 × 188	660	725
 2.0	2.38	1.71	2.76	1.98	3.00	2.21	110	800	400	200	70	2 × 188	800	760
 2.5	3.18	2.47	3.66	2.86	3.75	3.21	120	920	460	230	80	2 × 188	920	790
 4.0	4.94	3.54	5.70	4.10	6.00	4.58	200	960	480	240	100	2 × 188 ②	960	800
 5.2	6.53	4.68	7.54	5.42	7.81	6.06	250	1040	520	260	105	2 × 188 ②	1040	820
 6.3	9.31	6.79	9.46	7.84	9.46	8.39	300	1120	560	280	100	2 × 188 ②	1120	840
 8.0	11.32	8.14	12.01	9.40	12.01	10.51	380	1280	640	320	120	2 × 188 ②	1280	880
 10.0	15.01	10.87	15.01	12.55	15.01	13.32	460	1560	780	390	125	2 × 188 ②	1560	950
 12.5	18.77	16.65	18.77	16.65	18.77	16.65	560	1680	840	420	150	2 × 257 ②	1680	1080
 16.0	22.43	16.65	24.03	18.61	24.03	20.81	620	1800	900	450	155	2 × 524 ②	1800	1390
 20.0	26.73	19.21	30.03	22.18	30.03	24.80	680	2200	1100	550	180	2 × 524 ②	2200	1490
 25.0	33.61	30.39	37.54	33.30	37.54	33.30	750	2320	1160	580	200	2 × 524 ②	2320	1520

① Centrally arranged reinforcement

② Mesh reinforcement shall be done as a mesh cap!

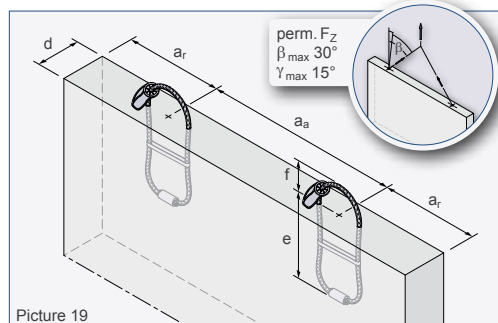
③ Required H if f_{cc} 15 N/mm². H can be reduced, if the required anchorage length of the reinforcement acc. to EC 2 is extended beyond the embedment depth e.

Lifting of beams and wall-like elements (reduced element thicknesses)

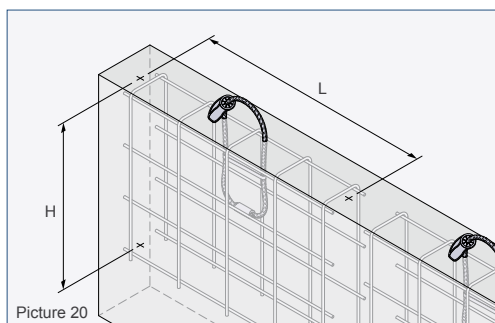
Boundary conditions:

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

- Dynamic factor: $\Psi_{dyn} = 1.3$ (Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)
- Mould adhesion: **not included**
- Load per anchor: **diagonal tension** $\beta_{max} 30^\circ / \gamma_{max} 15^\circ$
- Minimum concrete strength: **30 N/mm²**



Picture 19



Picture 20

Table 12: Lifting of beams and wall-like elements (element thicknesses d for concrete strengths f_{cc} 30/35/45 N/mm²)

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

① Centrally arranged reinforcement

② Mesh reinforcement shall be done as a mesh cap!

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.



Lifting of narrow beams

Boundary conditions:

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

- Dynamic factor: $\psi_{dyn} = 1.3$
(Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)
- Mould adhesion: **not included**
- Load per anchor: **diagonal tension** $\beta_{max} 30^\circ / \gamma_{max} 10^\circ$
- Minimum concrete strength: **15 N/mm²**

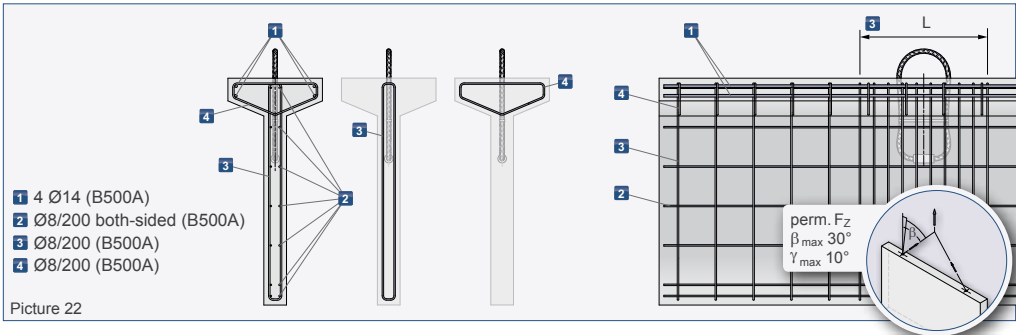
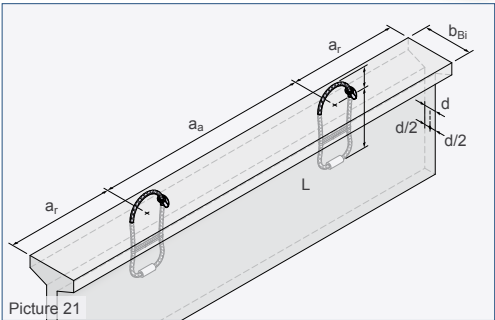


Table 13: Lifting of narrow beams										
Type	Max. element weight G				Minimum dimensions					
AS	$f_{cc} 25 \text{ N/mm}^2$		$f_{cc} 30 \text{ N/mm}^2$		d [mm]	b_{Bi} [mm]	a_r [mm]	a_a [mm]	e [mm]	f [mm]
	$\beta_{max} 12.5^\circ$ $\gamma_{max} 10^\circ$ [t]	$\beta_{max} 30^\circ$ $\gamma_{max} 10^\circ$ [t]	$\beta_{max} 12.5^\circ$ $\gamma_{max} 10^\circ$ [t]	$\beta_{max} 30^\circ$ $\gamma_{max} 10^\circ$ [t]						
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	33.30	37.54	33.30	120	≥ 400	1400	2000	600	200

Lifting of narrow beams

Boundary conditions:

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

■ Dynamic factor: $\psi_{dyn} = 1.3$

(Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)

■ Mould adhesion: **not included**

■ Load per anchor: axial tension $\beta_{max} 12.5^\circ / \gamma_{max} 10^\circ$,
diagonal tension $\beta_{max} 45^\circ / \gamma_{max} 10^\circ$

■ Minimum concrete strength: **25 N/mm²** ①

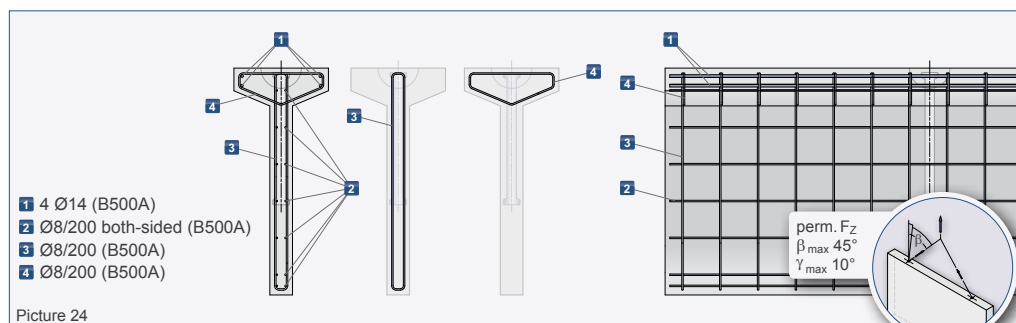
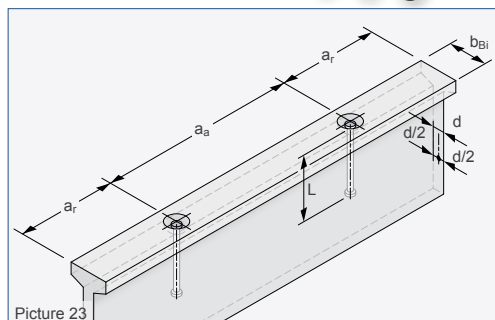


Table 14: Lifting of narrow beams

Type	Anchor length	Max. element weight G						Minimum dimensions			
		$f_{cc} 25 \text{ N/mm}^2$ ①		$f_{cc} 35 \text{ N/mm}^2$ ①		$f_{cc} 45 \text{ N/mm}^2$ ①					
		$\beta_{max} 12.5^\circ$ $\gamma_{max} 10^\circ$	$\beta_{max} 45^\circ$ $\gamma_{max} 10^\circ$	$\beta_{max} 12.5^\circ$ $\gamma_{max} 10^\circ$	$\beta_{max} 45^\circ$ $\gamma_{max} 10^\circ$	$\beta_{max} 12.5^\circ$ $\gamma_{max} 10^\circ$	$\beta_{max} 45^\circ$ $\gamma_{max} 10^\circ$	d	a_r	a_a	b_{BI}
20.0	500	L	[mm]	[t]	[t]	[t]	[t]	[mm]	[mm]	[mm]	[mm]
		20.20	13.17	23.91	15.58	27.11	17.66	120			
		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	1400	2000	≥ 400
		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			
		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	1400	2000	≥ 500
		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

Lifting of concrete tubes and shafts / manholes



Boundary conditions:

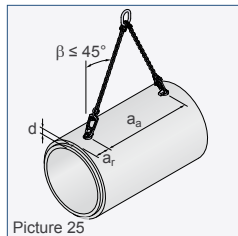
2 anchors symmetrical to the centre of gravity (Spherical head transport anchor)

■ Dynamic factor: $\Psi_{dyn} = 1.3$ (Tower cranes, portal cranes and mobile cranes with hoisting speed $v_H \leq 90$ m/min)

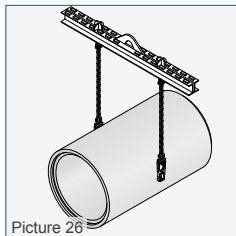
■ **Mould adhesion: not included**

■ Load per anchor: axial tension $\beta_{max} 12.5^\circ / \gamma_{max} 15^\circ$, diagonal tension $\beta_{max} 45^\circ / \gamma_{max} 15^\circ$, lateral tension $\gamma_{max} 90^\circ$

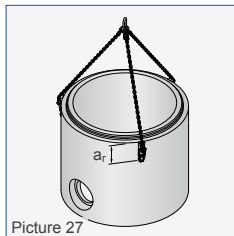
■ Minimum concrete strength: **35 N/mm²**



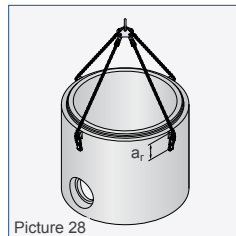
Picture 25



Picture 26



Picture 27



Picture 28

For applications acc. to Picture 27: max. element weight: values for lateral tension $\times 1.5$

For applications acc. to Picture 28: max. element weight: values for lateral tension $\times 2.0$ (compensation rig mandatory!)

Table 15: Lifting of concrete tubes and shafts / manholes

Load class	Anchor length [mm]	$f_{cc} 35 \text{ N/mm}^2$			Max. element weight G			$f_{cc} 55 \text{ N/mm}^2$			Minimum dimensions			
		$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$	$\beta_{max} 45^\circ$ $\gamma_{max} 15^\circ$	$\gamma_{max} 90^\circ$	$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$	$\beta_{max} 45^\circ$ $\gamma_{max} 15^\circ$	$\gamma_{max} 90^\circ$	$\beta_{max} 12.5^\circ$ $\gamma_{max} 15^\circ$	$\beta_{max} 45^\circ$ $\gamma_{max} 15^\circ$	$\gamma_{max} 90^\circ$	d	a _r	a _a	DN
		[t]	[t]	[t]	[t]	[t]	[t]	[t]	[t]	[t]	[mm]	[mm]	[mm]	[mm]
5.0	75	4.02	2.32	6.23	4.56	2.64	7.06	5.04	2.92	7.69	115	270	540	≥ 500
5.0	85	4.73	2.74	7.33	5.37	3.11	7.69	5.93	3.43	7.69	125	300	600	
5.0	95	5.48	3.17	7.69	6.21	3.60	7.69	6.87	3.98	7.69	135	330	660	
5.0	110	6.68	3.87	7.69	7.50	4.39	7.69	7.50	4.43	7.69	150	375	750	
5.0	120	7.50	4.36	7.69	7.50	4.43	7.69	7.50	4.43	7.69	160	405	810	
7.5	85	4.70	2.71	7.27	5.33	3.08	8.24	5.88	3.41	9.12	125	300	600	≥ 1200
7.5	95	5.45	3.15	8.43	6.17	3.57	9.56	6.83	3.95	10.56	135	330	660	
7.5	100	5.84	3.38	9.03	6.62	3.84	10.24	7.31	4.24	11.32	140	345	690	
7.5	120	7.47	4.32	11.53	8.47	4.91	11.53	9.37	5.42	11.53	160	405	810	
7.5	140	9.25	5.35	11.53	10.48	6.07	11.53	11.26	6.44	11.53	180	465	930	
7.5	165	11.26	6.44	11.53	11.26	6.44	11.53	11.26	6.44	11.53	205	540	1080	≥ 1400
10.0	115	7.01	4.06	10.86	7.94	4.61	12.30	8.78	5.09	13.60	155	390	780	
10.0	120	7.43	4.30	11.50	8.42	4.88	13.04	9.31	5.39	14.43	160	405	810	
10.0	135	8.74	5.06	13.53	9.91	5.74	15.35	10.96	6.35	15.38	175	450	900	
10.0	150	10.12	5.87	15.38	11.49	6.65	15.38	12.69	7.35	15.38	190	495	990	
10.0	170	12.07	6.99	15.38	13.69	7.75	15.38	15.01	7.75	15.38	210	555	1110	≥ 1400
10.0	200	15.01	7.75	15.38	15.01	7.75	15.38	15.01	7.75	15.38	240	645	1290	
10.0	250	15.01	7.75	15.38	15.01	7.75	15.38	15.01	7.75	15.38	290	795	1590	
15.0	140	9.14	5.30	14.16	10.37	6.01	16.06	11.47	6.64	17.76	180	465	930	
15.0	165	11.53	6.67	17.84	13.06	7.57	20.23	14.44	8.37	22.36	205	540	1080	
15.0	200	15.14	8.77	23.07	17.16	9.95	23.07	18.98	10.99	23.07	240	645	1290	≥ 1400
15.0	300	22.52	13.32	23.07	22.52	13.32	23.07	22.52	13.32	23.07	340	945	1890	
20.0	165	11.47	6.64	17.76	13.02	7.53	20.13	14.38	8.33	22.27	205	540	1080	
20.0	200	15.09	8.74	23.35	17.10	9.91	26.47	18.91	10.95	29.27	240	645	1290	
20.0	250	20.78	12.04	30.76	23.56	13.65	30.76	26.05	15.09	30.76	290	795	1590	
20.0	340	30.03	15.22	30.76	30.03	15.22	30.76	30.03	15.22	30.76	380	1065	2130	

Notes:

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