RTA, RWTL and RWTS Lifting anchors

Design According to Eurocodes, EU Machinery directive 2006/42/EC and VDI/BV-BS 6205
CE Approved

Technical Manual

Technical changes and errors reserved

Version 15.06.2023

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1 DESCRIPTION OF THE SYSTEM

RTA, RWTL and RWTS lifting anchors manufactured by R-Group are lifting anchors designed for lifting of concrete elements. They are inner thread sockets equipped with ribbed steel bars for anchoring. A separate lifting device is used for lifting. This lifting device can be reused.

RTA, RWTL and RWTS lifting anchors are designed and manufactured in accordance with EU Machinery Directive 2006/42/EC and VDI/BV-BS 6205. Lifting anchors meet the requirements for safe lifting and handling of concrete elements.

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2. RTA LIFTING ANCHOR DIMENSIONS

2.1 RTA lifting anchor dimensions and tolerancesnts.

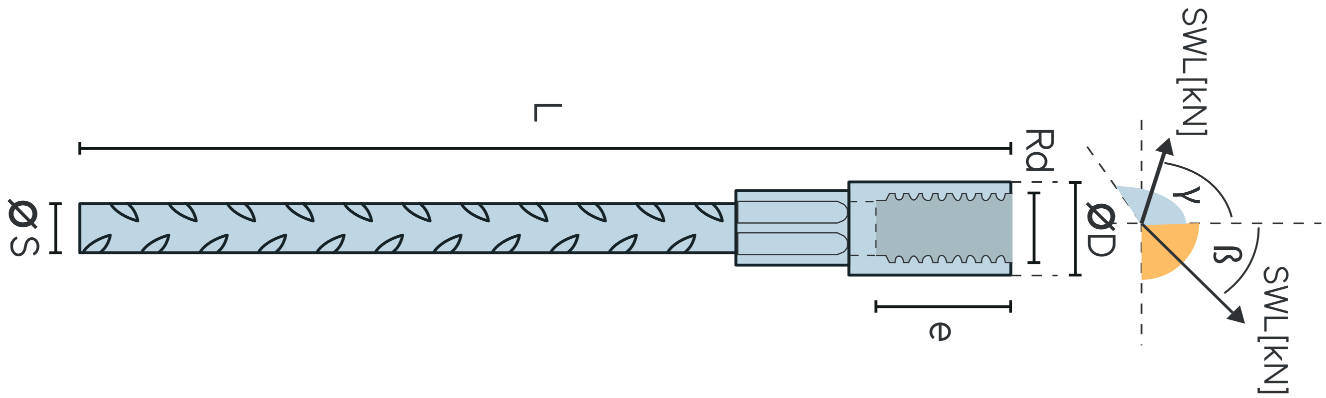

Figure 1. RTA lifting anchor dimensions

Table 1. RTA lifting anchor dimensions and tolerances

Lifting anchor	Rd (thread size) * [mm]	L (total height of anchor) ± 5,0 [mm]	ØD (outer diameter) ± 0,1 [mm]	e (thread length) ± 1,0 [mm]	Øs (ribbed steel bar diameter) ± 0,1 [mm]
RTA 12x195	12	195	15,5	22	8
RTA 14x235	14	235	18	25	10
RTA 16x275	16	275	21,4	27	12
RTA 16x400	16	400	21,4	27	12
RTA 18x305	18	305	22,3	34	14
RTA 20x360	20	360	27	35	14
RTA 24x400	24	400	31	43	16
RTA 30x505	30	505	40	56	20
RTA 36x690	36	690	47	68	25
RTA 42x840	42	840	54	80	28
RTA 52x950	52	950	67	97	32

* Rd thread tolerance 6H

2.2 Long RTA lifting anchor dimensions and tolerances

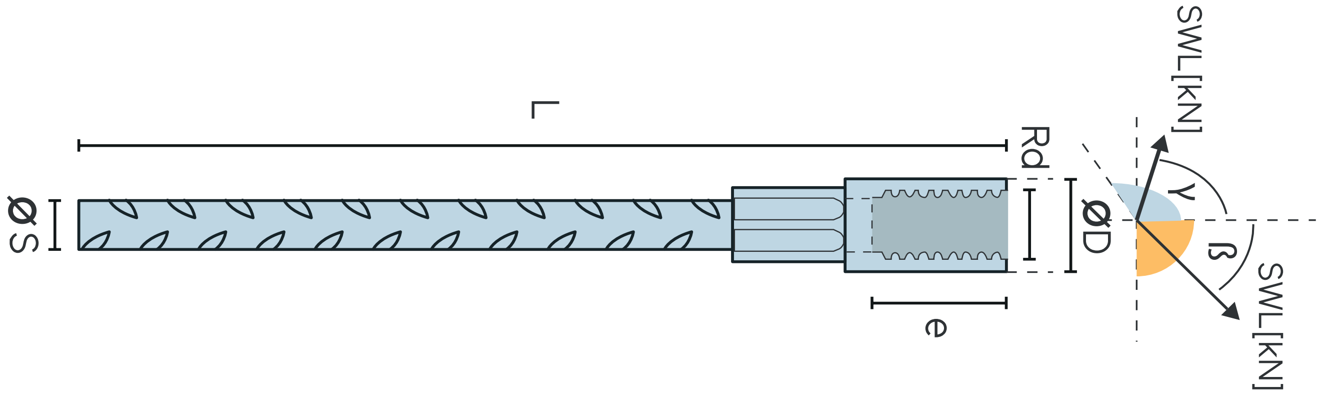

Figure 2. Long RTA lifting anchor dimensions

Table 2. Long RTA lifting anchor dimensions and tolerances

Lifting anchor	Rd (thread size) * [mm]	L (total height of anchor) ± 5,0 [mm]	ØD (outer diameter) ± 0,1 [mm]	e (thread length) ± 1,0 [mm]	Øs (ribbed steel bar diameter) ± 0,1 [mm]
RTA 20x1500	20	1500	27	35	14
RTA 24x1600	24	1600	31	43	16
RTA 30x1900	30	1900	40	56	20

* Rd thread tolerance 6H

3. RWTL LIFTING ANCHOR DIMENSIONS

3.1 RWTL lifting anchor dimensions and tolerances

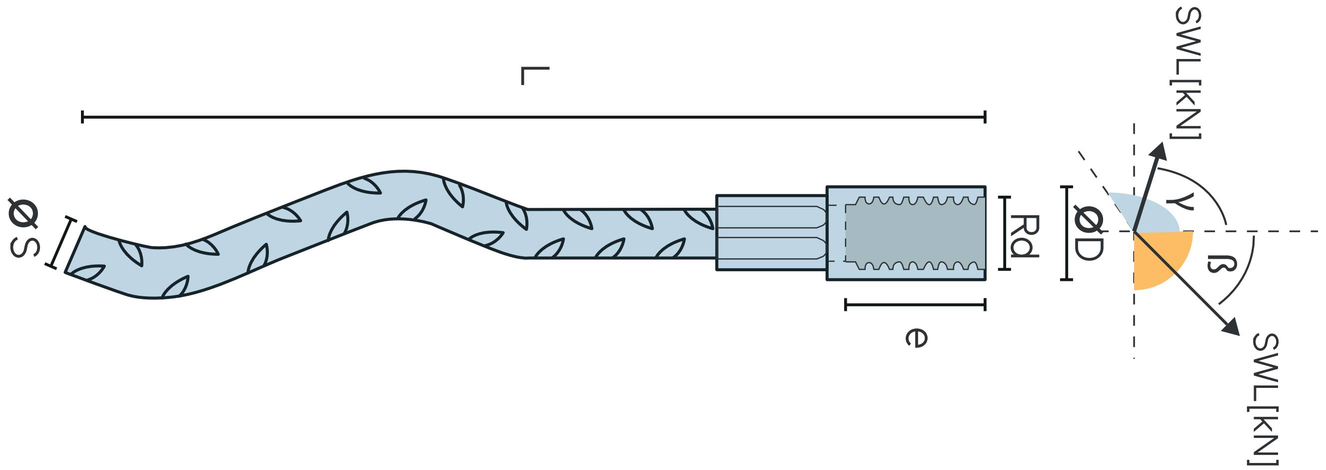

Figure 3. RWTL lifting anchor dimensions

Table 3. RWTL lifting anchor dimensions and tolerances

Lifting anchor	Rd (thread size) * [mm]	L (total height of anchor) ± 5,0 ** [mm]	ØD (outer diameter) ± 0,1 [mm]	e (thread length) ± 1,0 [mm]	Øs (ribbed steel bar diameter) ± 0,1 [mm]
RWTL 12x137	12	137	15,5	22	8
RWTL 14x170	14	170	18	25	10
RWTL 16x216	16	216	21,4	27	12
RWTL 18x235	18	235	22,3	34	14
RWTL 20x257	20	257	27	35	14
RWTL 24x360	24	360	31	43	16
RWTL 30x450	30	450	40	56	20
RWTL 36x570	36	570	47	68	25
RWTL 42x620	42	620	54	80	28
RWTL 52x880	52	880	67	97	32

* Rd thread tolerance 6H

** L (total height of anchor) tolerance for RWTL 36x570, RWTL 42x620 and RWTL 52x880 is ± 20

4. RWTS LIFTING ANCHOR DIMENSIONS

4.1 RWTS lifting anchor dimensions and tolerances

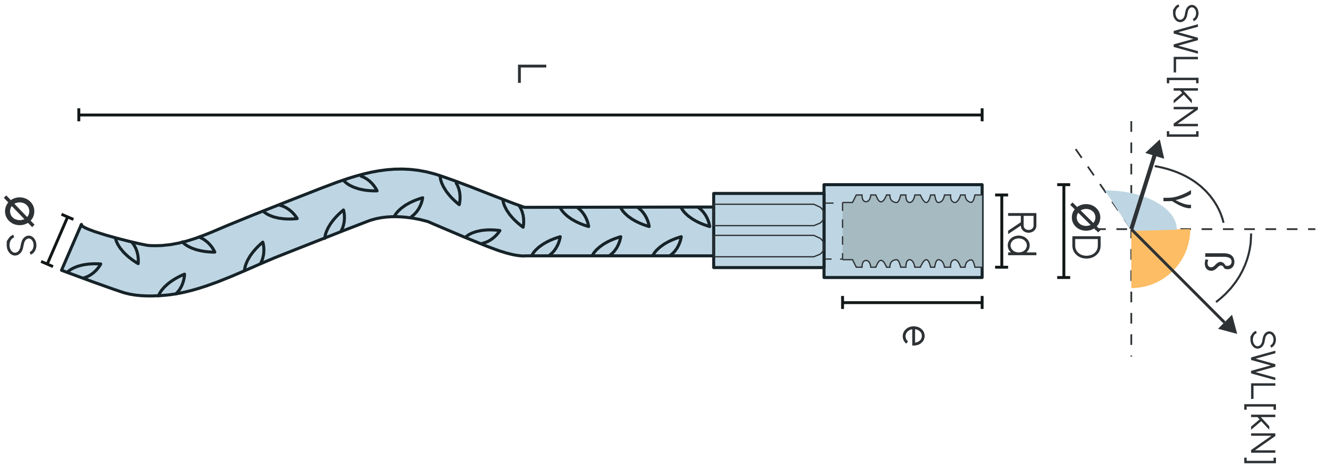

Figure 4. RWTS lifting anchor dimensions

Table 4. RWTS lifting anchor dimensions and tolerances

Lifting anchor	Rd (thread size) * [mm]	L (total height of anchor) ± 5,0 ** [mm]	ØD (outer diameter) ± 0,1 [mm]	e (thread length) ± 1,0 [mm]	Øs (ribbed steel bar diameter) ± 0,1 [mm]
RWTS 12x108	12	108	15,5	22	8
RWTS 14x130	14	130	18	25	10
RWTS 16x167	16	167	21,4	27	12
RWTS 18x175	18	175	22,3	34	14
RWTS 20x187	20	187	27	35	14
RWTS 24x240	24	240	31	43	16
RWTS 30x300	30	300	40	56	20
RWTS 36x380	36	380	47	68	25
RWTS 42x450	42	450	54	80	28

* Rd thread tolerance 6H

** L (total height of anchor) tolerance for RWTS 36x380 and RWTS 42x450 is ± 20

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4.2 RTA, RWTL and RWTS lifting anchors materials and standards

Table 5. RTA, RWTL and RWTS lifting anchors materials and standards

Part	Lifting anchor type	Material	Standard
Ribbed steel bar	RTA, RTAr, RTAhh RWTL, RWTLr, RWTLhh RWTS, RWTSr, RWTShh	B500B K500C-T 1.4362	EN 10080 SS 212540:2014 BS 6744
Inner thread socket	RTA RWTL RWTS	S235J2+N	EN 10025
Inner thread socket	RTAr RWTLr RWTLr	1.4301	EN 10088
Inner thread socket	RTAhh RWTLhh RWTShh	1.4401	EN 10088

4.3 RTA, RWTL and RWTS lifting anchors ordering codes

Ordering codes of RTA, RWTL and RWTS lifting anchors consist of lifting anchor model, size and type.

Table 6. RTA, RWTL and RWTS lifting anchors ordering codes according to type

Lifting anchor ordering code	Lifting anchor inner thread socket type
RTA RWTL RWTS	Electro zinced and yellow passivated
RTAr RWTLr RWTLr	Stainless
RTAhh RWTLhh RWTShh	Acid resistant

In all types ribbed steel bar material B500B or K500C-T or 1.4362.

Eg. Stainless RTA lifting anchor, size Rd30x505. Ordering code is RTAr

30x505.

5. MANUFACTURING

5.1 Manufacturing method

Inner thread socket is cut from a round steel bar to correct length. RD inner thread is whirled to the socket. Ribbed steel bar is cut to correct length and for RWTL and RWTS lifting anchors it is bent to shape. Parts are attached with a compression joint.

5.2 Manufacturing markings

Products are marked with RSteel logo, Rd (size), load class and CE-marking.

Products are delivered [in cardboard boxes] on a truck palette. Product package is equipped with an RSteel Pallet Label, which contains the following information: product type, product name, quantity, ISO9001 and ISO14001 quality and environment system markings, and CE, FI and BY (Concrete Association of Finland) logo.

5.3 Quality control

Quality control of the lifting anchors is done according to the requirements of EN 1090-2 and the instructions according to quality and environment system of the R-Group Baltic OÜ (ISO9001 and ISO14001). R-Group Baltic OÜ has a quality control contract with Kiwa Inspecta OÜ.

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6. SAFE WORKING LOADS

6.1 Design concept

Safe working loads of RTA, RWTL and RWTS lifting anchors are calculated according to following standards and instructions:

EN 1992: Eurocode 2
EN 1993: Eurocode 3
Machinery directive 2006/42/EC
VDI/BV-BS 6205

Global safety factors used in calculation of safe working loads are

Steel failure	γ = 3,0
Concrete failure	γ = 2,5

Safe working loads are based on concrete dimensions, anchor steel bars and lifting insert edge distances given in the following sections. Minimum concrete compressive strength at the moment of load application $f_{ck.cube.min}$ = 15 MPa.

Safety concept

E ≤ SWL

Where E = action placed on lifting insert
SWL = safe working load of lifting insert

Actions placed on lifting inserts must take into account all loads and load distribution to lifting inserts according to following sections.

6.2 RTA lifting anchors safe working loads

6.2.1 RTA lifting anchors safe working loads

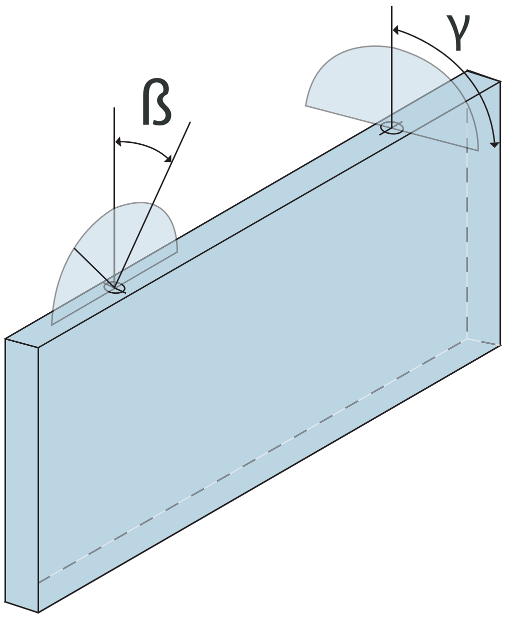

Figure 5. Lifting angles β (straight and angled pull) and γ (side lifting)

Table 7. RTA lifting anchors safe working loads in good bond conditions

Lifting anchor	β = 0° - 45°	γ = 0° - 15°	γ = 15° - 90°
	≥ C12/15	≥ C12/15	≥ C12/15
	SWL [kN]	SWL [kN]	SWL [kN]
RTA 12x195	5.0	5.0	2.5
RTA 14x235	8.0	8.0	4.0
RTA 16x275	12.0	12.0	6.0
RTA 16x400	12.0	12.0	6.0
RTA 18x305	16.0	16.0	8.0
RTA 20x360	20.0	20.0	10.0
RTA 24x400	25.0	25.0	12.5
RTA 30x505	40.0	40.0	20.0
RTA 36x690	63.0	63.0	31.5
RTA 42x840	80.0	80.0	40.0
RTA 52x950	125.0	125.0	62.5

Safe working loads in table apply for all RTA types (RTA, RTAr, RTAh).

Bond condition coefficient for safe working loads in Table 7 is $\eta_1 = 1,0$ (good conditions). In other bond conditions safe working loads must be multiplied by 0,7.

6.2.2 Long RTA lifting anchors safe working loads

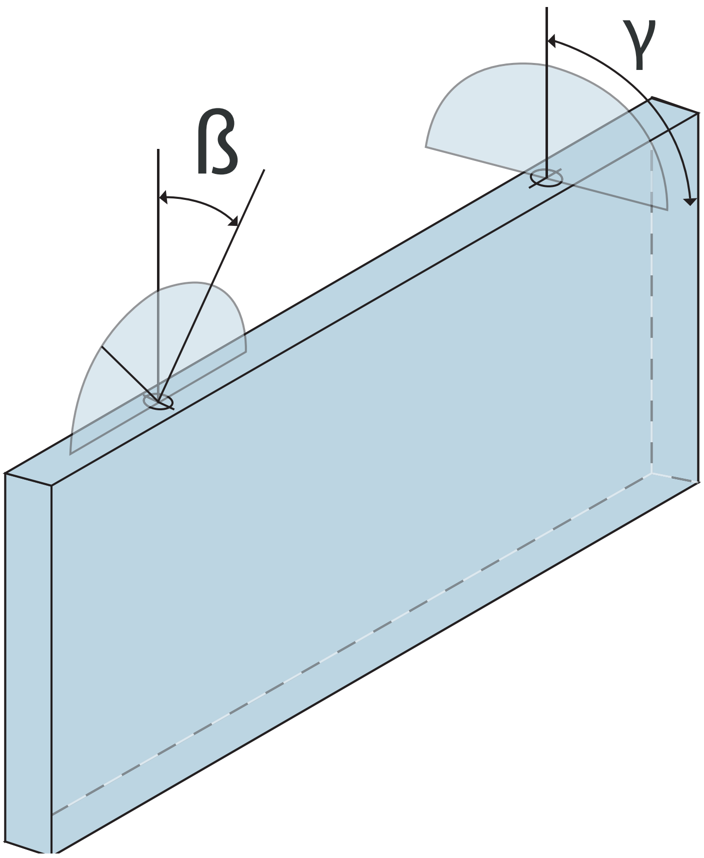

Figure 6. Lifting angles β (straight and angled pull) and γ (Side Lifting)

Table 8. Long RTA lifting anchors safe working loads in good bond conditions

Lifting anchor	β = 0° - 45°	γ = 0° - 15°	γ = 15° - 90°
	≥ C12/15	≥ C12/15	≥ C12/15
	SWL [kN]	SWL [kN]	SWL [kN]
RTA 20x1500	20.0	20.0	10.0
RTA 24x1600	25.0	25.0	12.5
RTA 30x1900	40.0	40.0	20.0

Safe working loads in table apply for all RTA types (RTA, RTAr, RTAh).

Bond condition coefficient for safe working loads in Table 8 is η_1 = 1,0 (good conditions). In other bond conditions safe working loads must be multiplied by 0,7.

6.3 RWTL lifting anchors safe working loads

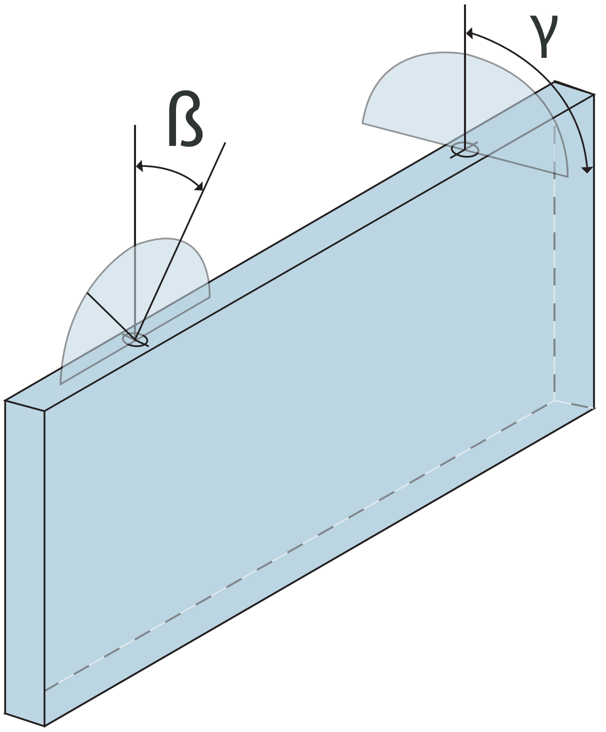

Figure 7. Lifting angles β (straight and angled pull) and γ (side lifting)

Table 9. RWTL lifting anchors safe working loads in good bond conditions

Lifting anchor	β = 0° - 45°	γ = 0° - 15°	γ = 15° - 90°
	≥ C12/15	≥ C12/15	≥ C12/15
	SWL [kN]	SWL [kN]	SWL [kN]
RWTL 12x137	5.0	5.0	2.5
RWTL 14x170	8.0	8.0	4.0
RWTL 16x216	12.0	12.0	6.0
RWTL 18x235	16.0	16.0	8.0
RWTL 20x257	20.0	20.0	10.0
RWTL 24x360	25.0	25.0	12.5
RWTL 30x450	40.0	40.0	20.0
RWTL 36x570	63.0	63.0	31.5
RWTL 42x620	80.0	80.0	40.0
RWTL 52x880	125.0	125.0	62.5

Resistances in table apply for all RWTL types (RWTL, RWTLr, RWTLh).

Bond condition coefficient for safe working loads in Table 9 is $\eta_1 = 1,0$ (good conditions). In other bond conditions safe working loads must be multiplied by 0,7.

6.4 RWTS lifting anchors safe working loads

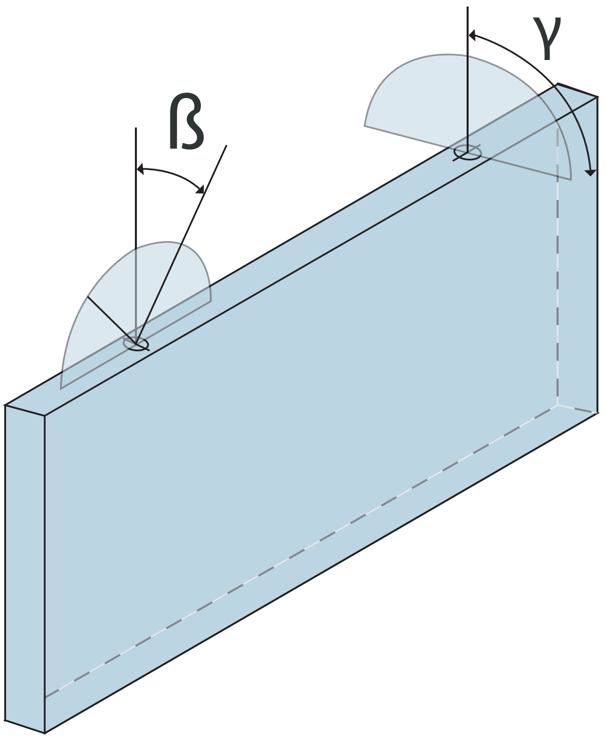

Figure 8. Lifting angles β (straight and angled pull) and γ (side lifting)

Table 10. RWTS lifting anchors safe working loads in good bond conditions

Lifting anchor	β = 0° - 45°	γ = 0°-90°
	≥ C12/15	≥ C12/15
	SWL [kN]	SWL [kN]
RWTS 12x108	2.6	1.3
RWTS 14x130	3.9	1.9
RWTS 16x167	6.3	3.1
RWTS 18x175	7.3	3.6
RWTS 20x187	7.8	3.9
RWTS 24x240	12.3	6.2
RWTS 30x300	17.0	8.5
RWTS 36x380	28.9	14.4
RWTS 42x450	37.2	18.6

Resistances in table apply for all RWTS types (RWTS, RWTSr, RWTSh).

Bond condition coefficient for safe working loads in Table 10 is η1 = 1,0 (good conditions). In other bond conditions safe working loads must be multiplied by 0,7.

6.5 Concrete thickness and anchor spacing

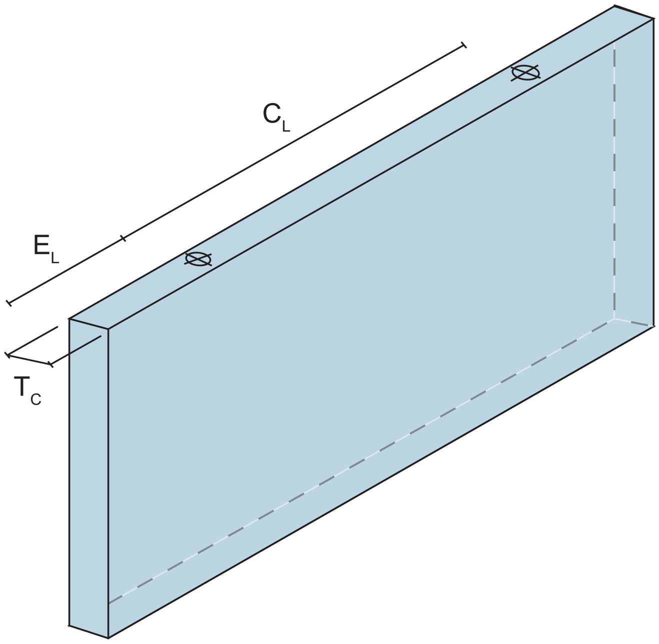

Figure 9. Element thickness and lifting anchor spacing

Safe working loads are valid only with minimum concrete thickness and minimum lifting insert spacing given in Figure 9 and Tables 11 and 12.

Table 11. Minimum element thickness and minimum lifting insert spacing, RTA, RWTL and RWTS anchors

Lifting anchor size	Minimum Concrete thickness T_c [mm]			Minimum Lifting anchor edge spacing E_L [mm]	Minimum Lifting anchor centre spacing C_L [mm]
	Straight and angled pull (β = 0°-45°)	Straight and angled pull (γ = 0°-15°)	Side lifting (γ = 15°-90°)		
Rd 12	60	60	60	140	280
Rd 14	70	70	70	180	360
Rd 16	80	80	80	180	360
Rd 18	95	95	95	220	440
Rd 20	110	110	110	220	440
Rd 24	120	120	120	250	500
Rd 30	140	140	140	300	600
Rd 36	150	150	200	400	800
Rd 42	160	160	210	450	900
Rd 52	230	230	280	500	1000

Table 12. Minimum element thickness and minimum lifting insert spacing, RTA Long anchors

Lifting anchor size	Minimum Concrete thickness T_c [mm]			Minimum Lifting anchor edge spacing E_L [mm]	Minimum Lifting anchor centre spacing C_L [mm]
	Straight and angled pull (β = 0°-45°)	Straight and angled pull (γ = 0°-15°)	Side lifting (γ = 15°-90°)		
RTA 20x1500	90	90	110	220	440
RTA 24x1600	100	100	120	250	500
RTA 30x1900	120	120	140	300	600

6.6 Reinforcement of the concrete

6.6.1 Reinforcement of the pre-cast element

The concrete element must have at least minimum reinforcement according to EN 1992-1-1. Concrete element must be reinforced to withstand all actions from lifting, tilting and transport including dynamic actions. This reinforcement must be designed by the structural designer.

6.6.2 Additional reinforcement when the lifting angle is > 15°

If the lifting angle β is >15°, additional reinforcement must be situated next to the lifting anchor according to table 13 and figure 10. Steel material f_{yk} ≥ 500MPa. Additional reinforcement must be placed in direct contact with the lifting anchor. Bending diameter D should be same as the diameter of the lifting anchor head former for tight fit.

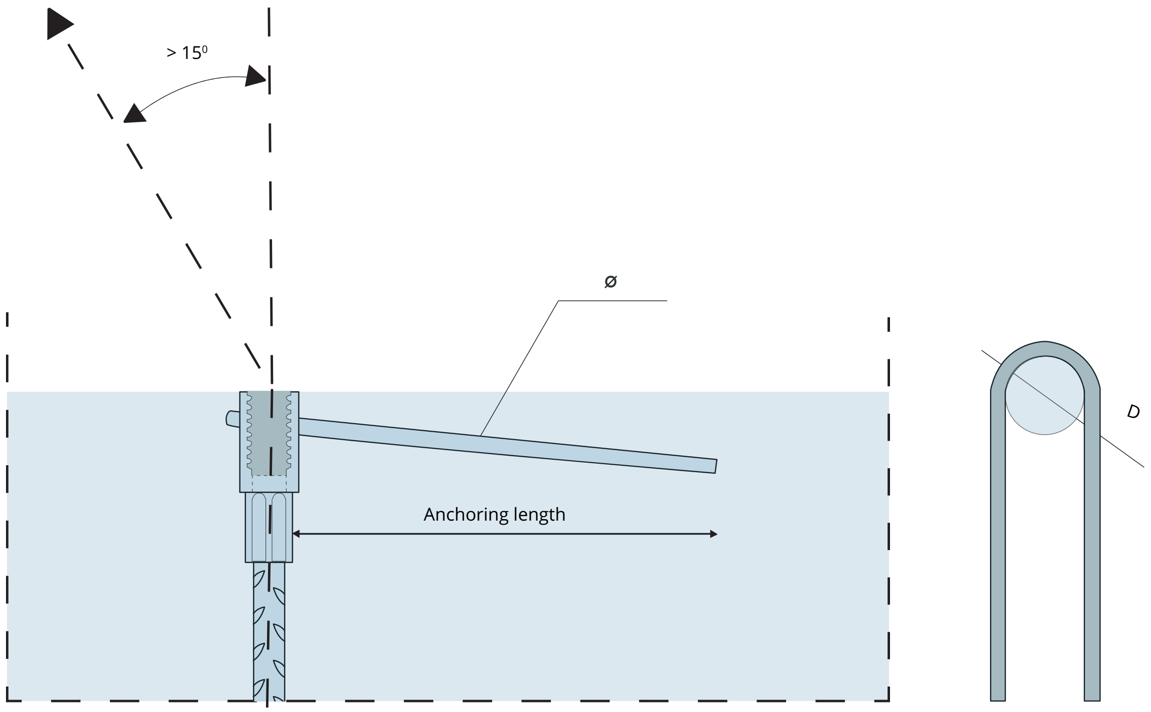

Figure 10. Additional reinforcement when the lifting angle is > 15°

Table 13. Additional reinforcement when the lifting angle is > 15°

Lifting anchor			Reinforcement [Ø]	Anchoring Length [mm]
RTA 12x195	RWTL 12x137	RWTS 12x108	6	150
RTA 14x235	RWTL 14x170	RWTS 14x130	6	250
RTA 16x275 RTA 16x400	RWTL 16x216	RWTS 16x167	8	300
RTA 18x305	RWTL 18x235	RWTS 18x175	8	350
RTA 20x360 RTA 20x1500	RWTL 20x257	RWTS 20x187	8	400
RTA 24x400 RTA 24x1600	RWTL 24x360	RWTS 24x240	10	450
RTA 30x505 RTA 30x1900	RWTL 30x450	RWTS 30x300	12	550
RTA 36x690	RWTL 36x570	RWTS 36x380	14	700
RTA 42x840	RWTL 42x620	RWTS 42x450	16	750
RTA 52x950	RWTL 52x880	-	20	900

6.6.3 Reinforcement in lateral pull

When the element is lifted from the side or is tilted resulting in lateral pull (γ ≥ 15°), additional reinforcement according to figure 12 and table 14 must be installed. Steel material f_{yk} ≥ 500 MPa. Additional reinforcement must be placed in direct contact with the lifting anchor. Bending diameter should be same as the diameter of the lifting anchor head former for tight fit.

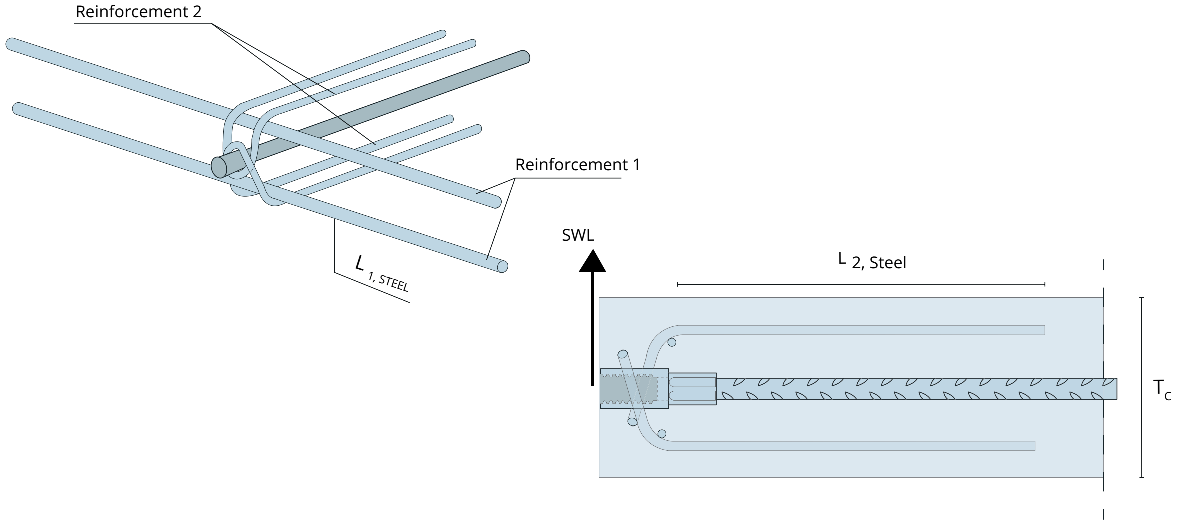

Figure 11. Additional reinforcement in side lifting

Table 14. Additional reinforcement in side lifiting

Lifting anchor	Reinforcement 1 [Ø]	$L_{1,steel}$ [mm]	Reinforcement 2 [Ø]	$L_{2,steel}$ [mm]
RTA 12x195 RWTL 12x137 RWTS 12x108	8	400	6	300
RTA 14x235 RWTL 14x170 RWTS 14x130	8	400	6	350
RTA 16x275 RTA 16x400 RWTL 16x216 RWTS 16x167	10	500	8	425
RTA 18x305 RWTL 18x235 RWTS 18x175	10	550	8	475
RTA 20x360 RTA 20x1500 RWTL 20x257 RWTS 20x187	12	600	10	500
RTA 24x400 RTA 24x1600 RWTL 24x360 RWTS 24x240	12	600	10	600
RTA 30x505 RTA 30x1900 RWTL 30x450 RWTS 30x300	16	700	16	750
RTA 36x690 RWTL 36x570 RWTS 36x380	20	800	16	850
RTA 42x840 RWTL 42x620 RWTS 42x450	20	850	20	950
RTA 52x950 RWTL 52x880 -	20	1000	25	1000

$L_{1,steel}$ = cut length of reinforcement 1

$L_{2,steel}$ = anchoring length of reinforcement 2

6.7 Actions on lifting inserts

6.7.1 General

The loads acting on a lifting anchor shall be determined considering the following factors:

- statical system
- element self-weight
- adhesion and form friction
- dynamic effects
- position and number of lifting anchors
- type of lifting equipment and different load scenarios (tension, combined tension and shear, shear loading).

6.7.2 Number and actions of lifting anchors

The number of load bearing lifting anchors and the load acting on the lifting anchors shall be determined corresponding with the individual lifting situations.

Statical system of lifting anchors must be accounted for in these calculations. Actions from all individual lifting situations must be calculated according to sections 6.7.3 to 6.7.11.

After actions placed on lifting anchors are determined, the safe working load (SWL) shall then be compared with the actions. The safety concept requires that the action E does not exceed the safe working load SWL. The following formula must be satisfied for all actions on lifting anchors

$E \leq SWL$

where

E	action on lifting anchor, see sections 6.7.3 to 6.7.11, in kN
SWL	safe working load of lifting anchor, in kN

The most unfavorable relation from action to resistance resulting governs the design.

6.7.3 Statical system

Lifting equipment used in lifting of pre-cast elements shall allow determinate load distribution to all present lifting anchors. Figure 12 gives examples of statically indeterminate systems where only two lifting anchors carry the load. The load distribution is not clearly defined in these applications. Therefore these statically indeterminate systems shall be avoided.

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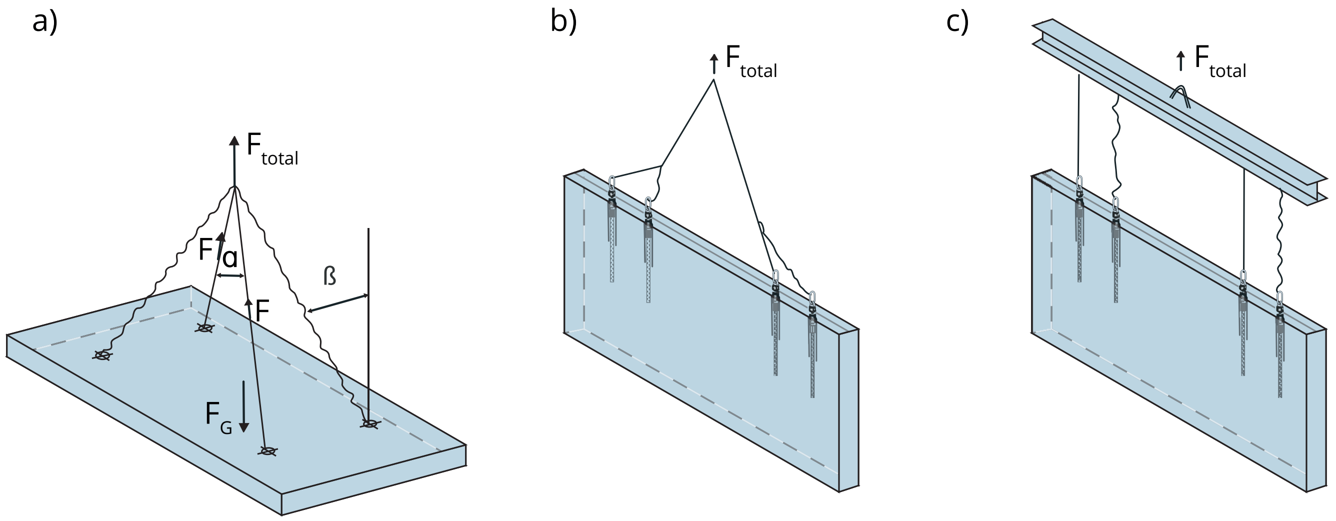

Figure 12. Examples of statically indeterminate lifting systems which should not be used

- a) **statically indeterminate system. Load bearing anchors n = 2.**
- b) **statical system without clearly defined load-bearing mechanism. Load bearing anchors n = 2.**
- c) **statically indeterminate load distribution to the lifting anchors of a wall element. Load bearing anchors n = 2.**

To ensure a statically determinate system and that all lifting anchors carry their required part of the load in case of applications with more than two lifting anchors transport aids such as sliding or rolling couplings or balancing beams shall be used.

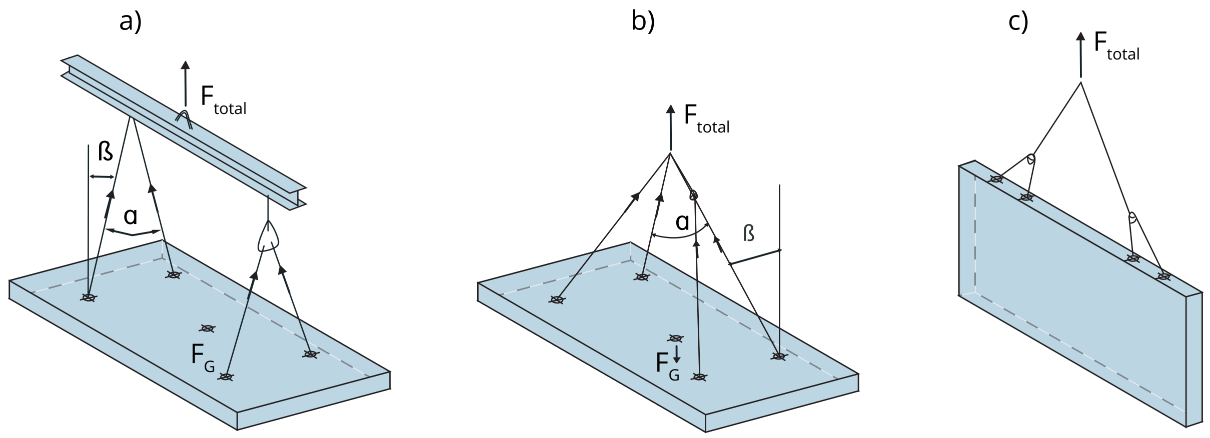

Figure 13. Transportation aids for the statically determinate lifting of slabs and wall elements

- a) **balancing beam and rolling coupling. Load bearing anchors n = 4.**
- b) **sliding coupling. Load bearing anchors n = 4.**
- c) **rolling coupling. Load bearing anchors n = 4.**

In case of inclined lifting slings the lifting anchors are loaded by combined tension and shear loads. The inclination β according to Figure 13 governs the level of combined tension and shear loads to be taken into account in the design.

If three lifting anchors are located in slab and situated in star pattern with same distance to the centre of gravity with equal inclinations of 120° (Figure 14) it is ensured that all three lifting anchors experience the same load.

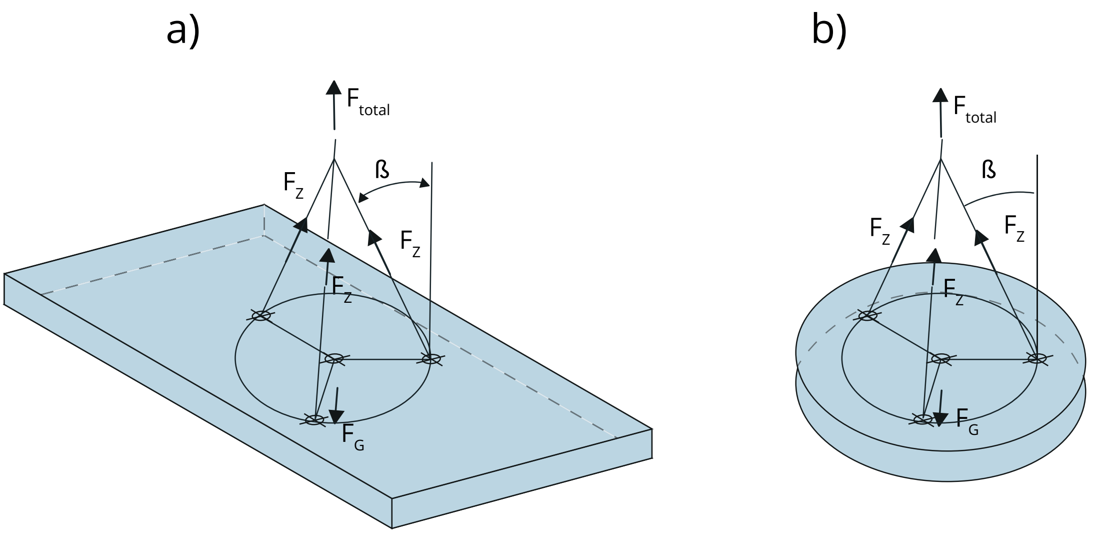

Figure 14. Statically determinate load distribution by means of lifting anchors in star pattern

a) slab. Load bearing anchors n = 3.

b) cover plate. Load bearing anchors n = 3.

6.7.4 Load distribution for non-symmetrical anchor layout

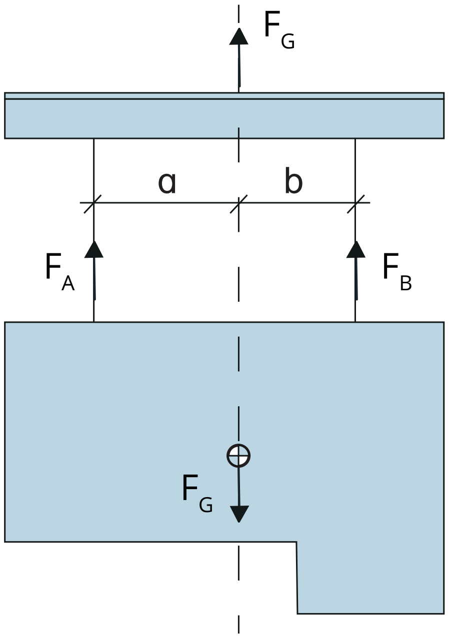

Figure 15. Load distribution for non-symmetrical anchor layout using spreader beam

If the anchors are not installed symmetrically to the load's centre of gravity, the load distribution to different anchors is

$F_A = F_G \cdot b/(a+b)$

$F_B = F_G \cdot a/(a+b)$

where

F_G weight of the pre-cast element, in kN

a distance from anchor to centre of gravity, in m

b distance from anchor to centre of gravity, in m

If elements are lifted without spreader beam, the lifting anchors must be installed symmetrically with respect to the elements centre of gravity.

6.7.5 Spread angle

Influence of spread angle on the actions for lifting anchors must be taken into account.

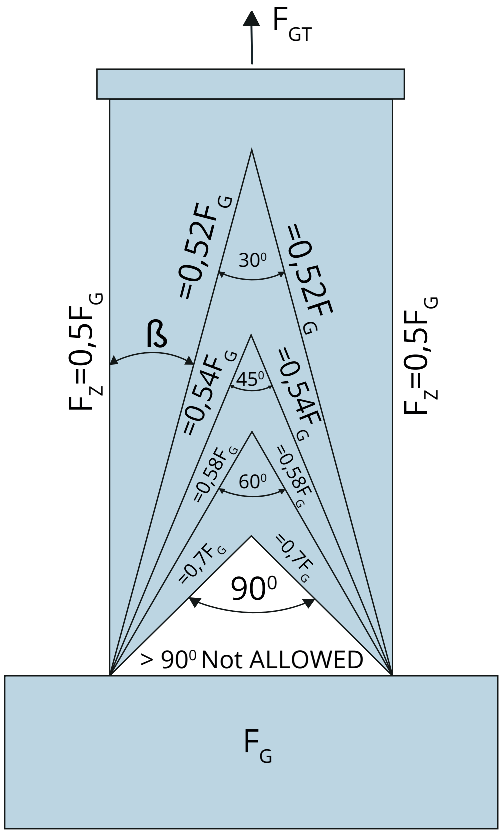

Figure 16. Spread angle factors

Table 15. Spread angle factors

Cable angle β	Spread angle α	Load factor z
0°	-	1,00
7,5°	15°	1,01
15°	30°	1,04
22,5°	45°	1,08
30°	60°	1,15
37,5°	75°	1,26
45°	90°	1,41

6.7.6 Self-weight

The self-weight F_G of pre-cast elements shall be determined as

$$F_G = V \cdot \rho_G$$

where

V volume of the pre-cast element, in m^3

ρ_G density of the concrete, in kN/m^3

6.7.7 Adhesion and form friction

Adhesion and form friction are assumed to act simultaneously during the lifting of the precast element from the formwork. The actions for demolding situations is

$$F_{adh} = q_{adh} \cdot A_f$$

where

F_{adh} action due to adhesion and form friction, in kN

q_{adh} basic value of combined adhesion and form friction as per Table 16, in kN/m^2

A_f contact area between concrete and formwork, in m^2

Table 16. Minimum values of adhesion and form friction q_{adh}

Formwork and condition[a)]	q_{adh} [b)] [kN/m²]
Oiled steel mold, oiled plastic coated plywood	≥ 1,0
Varnished wooden mold with panel boards	≥ 2,0
Rough wooden mold	≥ 3,0

a) Structured surfaces should be considered separately.

b) The area to be used in the calculations is the total contact area between the concrete and the form.

Note: The minimum values of Table 16 are valid only if suitable measures to reduce adhesion and form friction are taken e. g. casting on tilting or vibrating the formwork during the demolding process.

6.7.8 Dynamic actions

During lifting and handling of the precast elements the lifting devices are subjected to dynamic actions. The magnitude of the dynamic actions depends on the type of lifting machinery. Dynamic effects shall be taken into account by the dynamic factor ψ_{dyn}. For further guidance values of ψ_{dyn} depending on the lifting machinery and characteristics of the terrain are given in Table 17.

Table 17. Dynamic factor ψ_{dyn}

Condition	Dynamic factor ψ_{dyn}
Tower crane, portal crane, mobile crane	1,3
Lifting and moving on flat terrain	2,5
Lifting and moving on rough terrain	≥ 4

Note: Other values of ψ_{dyn} than given in Table 17 based on reproducible tests or verified experience can be used in the design. In case of other lifting and handling conditions than reported in Table 17 the factor ψ_{dyn} shall be determined on the base of tests or engineering judgement.

6.7.9 Load condition "erection in combination with adhesion and form friction"

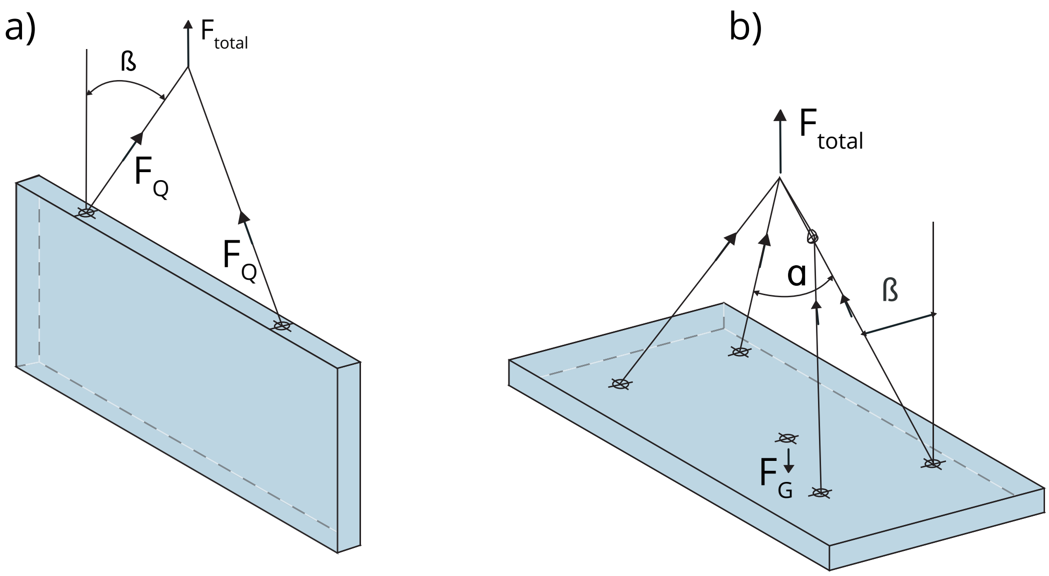

Figure 17. Erection in combination with adhesion and form friction

When pre-cast elements are lift from form according to Figure 17 the action F_Q on lifting anchors is

$F_Q = (F_G + F_{adh}) \cdot z/n$

where

F_Q	load acting on individual lifting anchor, in kN
F_G	self-weight of the pre-cast element, section 6.7.6, in kN
F_{adh}	action due to adhesion and form friction, section 6.7.7, in kN
z	factor for combined tension and shear, $z = 1 / \cos \beta$, angle β in accordance with Figure 17. In case of only tension z = 1.
n	number of lifting anchors carrying the load.

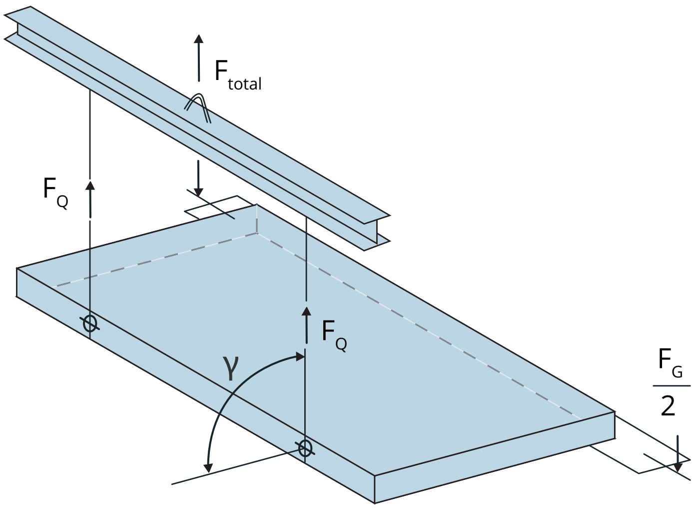

Figure 18. Erection in combination with adhesion and form friction, lifting with balancing beam

When pre-cast elements are lift from form according to Figure 18 the action F_Q on lifting anchors is

$$F_Q = \left(\frac{F_G}{2} + F_{adh}\right) / n$$

where

F_Q	load acting on individual lifting anchor, in kN
F_G	self-weight of the pre-cast element, section 6.7.6, in kN
F_{adh}	action due to adhesion and form friction, section 6.7.7, in kN
n	number of lifting anchors carrying the load.

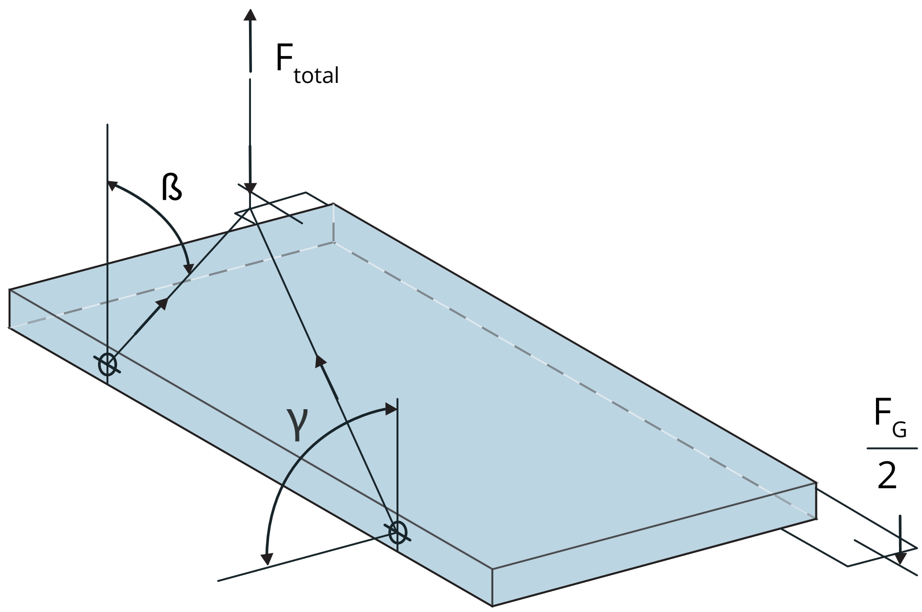

Figure 19. Erection in combination with adhesion and form friction, lifting with chains

When pre-cast elements are lift from form according to Figure 19 the action F_Q on lifting anchors is

$$F_Q = \left(\frac{F_G}{2} + F_{adh}\right) \cdot z/n$$

where

F_Q load acting on individual lifting anchor, in kN

F_G self-weight of the pre-cast element, section 6.7.6, in kN

F_{adh} action due to adhesion and form friction, section 6.7.7, in kN

z factor for combined tension and shear $z = 1 / \cos \beta$, angle β in accordance with Figure 19.

n number of lifting anchors carrying the load.

6.7.10 Load condition “erection”

It is assumed that the pre-cast element rests one-sided in the form or has been tilted up and forces from adhesion and form friction are no longer present.

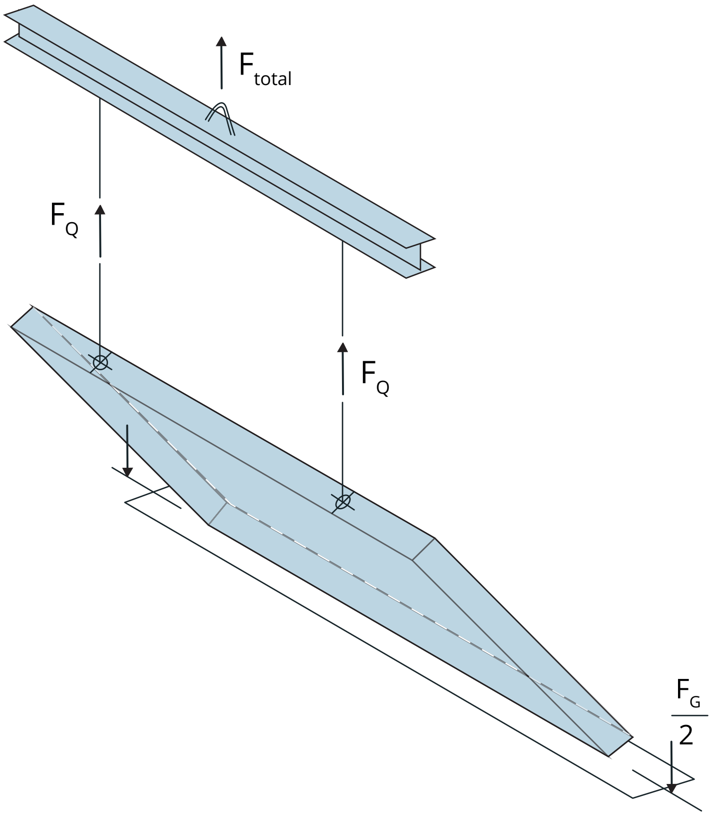

Figure 20. element erection with balancing beam

Erection with balancing beam (Figure 20), action on lifting anchor is

$$F_Q = \left(\frac{F_G}{2}\right) \cdot \psi_{dyn}/n$$

where

F_Q shear load acting on individual lifting anchor, in kN shear directed perpendicular to the longitudinal axis of the concrete component e. g. during lifting from the horizontal position with a beam

F_G self-weight of the pre-cast element, section 6.7.6, in kN

ψ_{dyn} dynamic factor, section 6.7.8

n number of lifting anchors carrying the load.

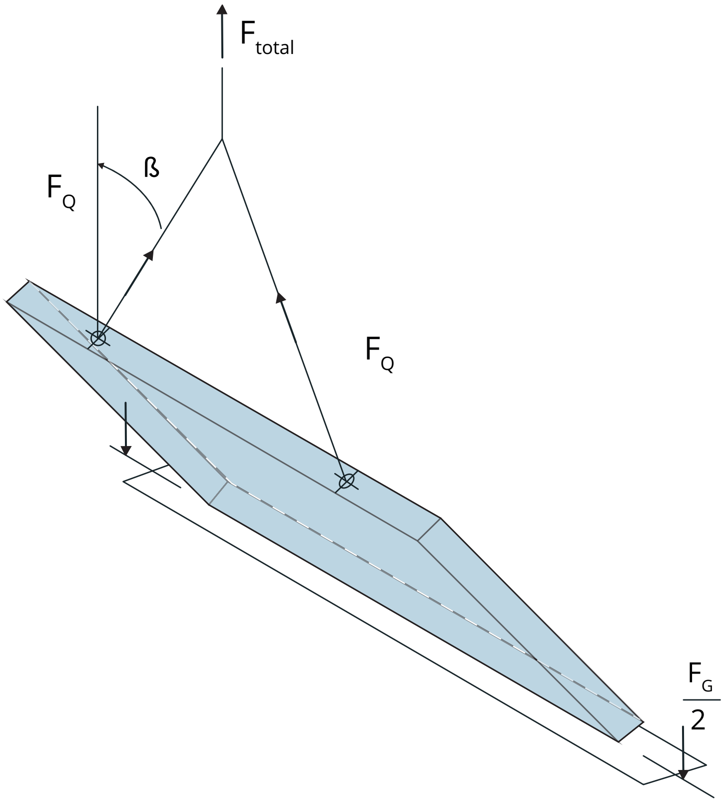

Figure 21. Element erection with chains

For transverse shear (lifting according to Figure 21) action on lifting anchor is

$F_{QZ} = (F_G \,.\, \psi_{dyn} \cdot z/n$

where

F_{QZ}	inclined shear load acting on individual lifting anchor, in kN inclined and perpendicular to the longitudinal axis of the precast element e.g. during lifting from the horizontal position
F_G	self-weight of the pre-cast element, section 6.7.6, in kN
ψ_{dyn}	dynamic factor, section 6.7.8
z	factor for combined tension and shear $z = 1 / \cos \beta$, angle β in accordance with Figure 21.
n	number of lifting anchors carrying the load.

6.7.11 Load condition "lifting and handling under combined tension and shear"

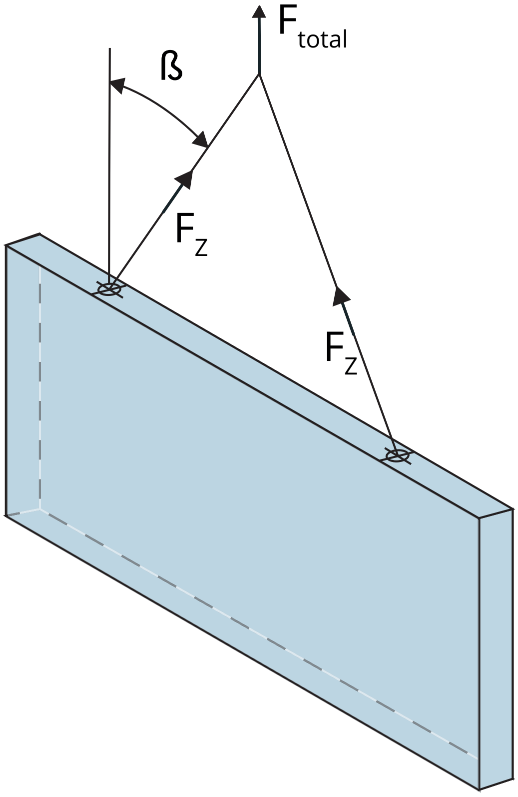

Figure 22. Lifting and handling under combined tension and shear

The load condition "lifting and handling under combined tension and shear" is presented in Figure 22. This is the most common lifting procedure. Action on lifting anchor is

$F_Z = F_G \cdot \psi dyn \cdot z/n$

where

F_Z load acting on the lifting anchor in direction of the sling axis, in kN

F_G self-weight of the pre-cast element, section 6.7.6, in kN

ψ_{dyn} dynamic factor, section 6.7.8

z factor for combined tension and shear $z = 1 / \cos \beta$, angle β in accordance with Figure 22.

n number of lifting anchors carrying the load.

7. INSTALLATION

The lifting anchor must be attached securely so it cannot move during casting. At the lifting anchor the concrete must be compressed carefully. The lifting anchor cannot be vibrated.

When attaching to the side of the formwork, a hole may be drilled through the plywood formwork, through which is then set up a bolt with the same thread as the lifting anchor.

8. SUPERVISION OF ASSEMBLY

Check list before casting:

- lifting anchor is in good condition
- lifting anchor is according to designs and in the right place
- lifting anchor is attached firmly
- the required additional reinforcement is assembled

During the casting:

- lifting anchor stays in the right place
- the concrete is thoroughly vibrated around the lifting anchor

After the casting:

- the situation of the lifting anchor is according to designs.

Notes

CREATE A NOTE

About
R-Group

R-Group is a leading provider of steel connections for precast and cast-in- situ construction around the globe.

With over three decades of our participation in huge projects, we don't compromise on quality or customer satisfaction and we create connections for a lifetime.

Our customer-oriented service, excellent and reliable network of suppliers plus our extensive product portfolio ensure that we are able to offer professional and flexible solutions for any kind of projects.

In our operations we comply with the ISO 9001 and 14001 standards

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