RSTEEL®

RTA, RWTL, RWTS lifting anchors

Technical manual

Version: **11.02.2026**

Machinery Directive 2006/42/EC & VDI/BV-BS 6205

CE

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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. DIMENSIONS AND MATERIALS

2.1. RTA lifting anchor dimensions and tolerances

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 [mm] ±5	ØD outer diameter [mm] ±1	e thread length [mm] ±1	Øs rebar diameter [mm] ±0.1
RTA 12x195	12	195	15.5	22	8
RTA 16x275	16	275	21.4	27	12
RTA 16x400	16	400	21.4	27	12
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

* Tolerances of Rd thread 6H (DIN405).

2.2. RWTL lifting anchor dimensions and tolerances

Figure 2. RWTL lifting anchor dimensions

Table 2. RWTL lifting anchor dimensions and tolerances

Lifting anchor	Rd thread size [mm] *	L total height of anchor [mm] ±5**	ØD outer diameter [mm] ±1	e thread length [mm] ±1	Øs rebar diameter [mm] ±0.1
RWTL 12x137	12	137	15.5	22	8
RWTL 16x216	16	216	21.4	27	12
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

* Tolerances of Rd thread 6H (DIN405).

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

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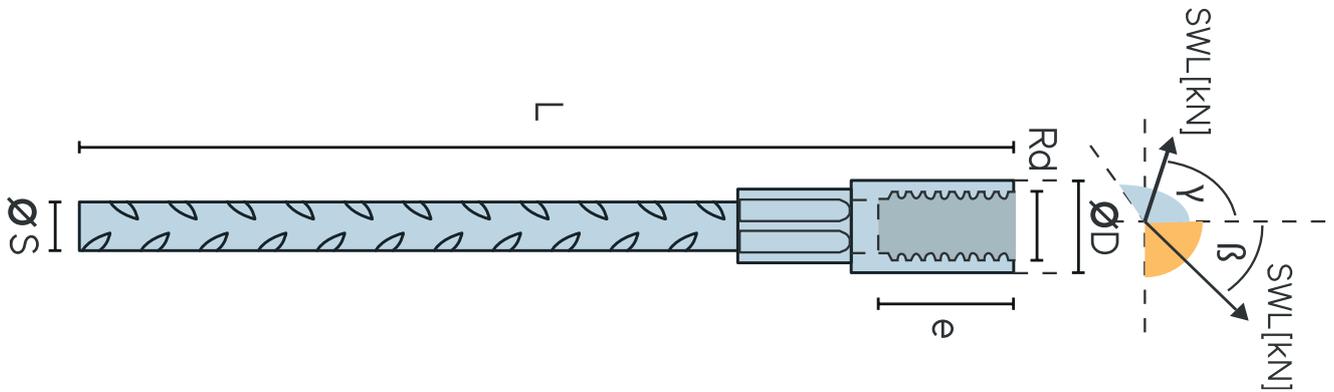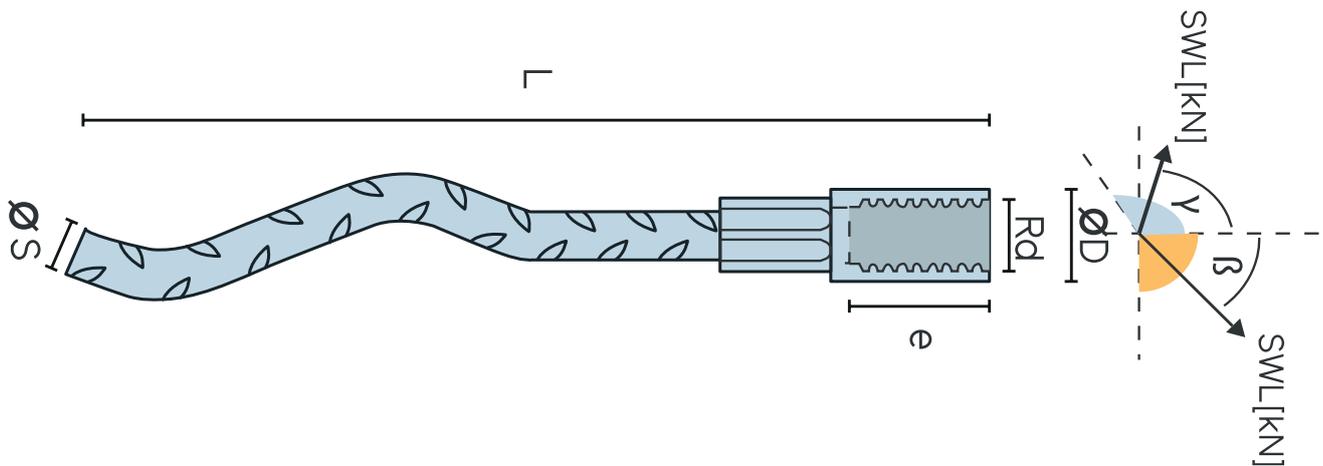## 2.3. RWTS lifting anchor dimensions and tolerances
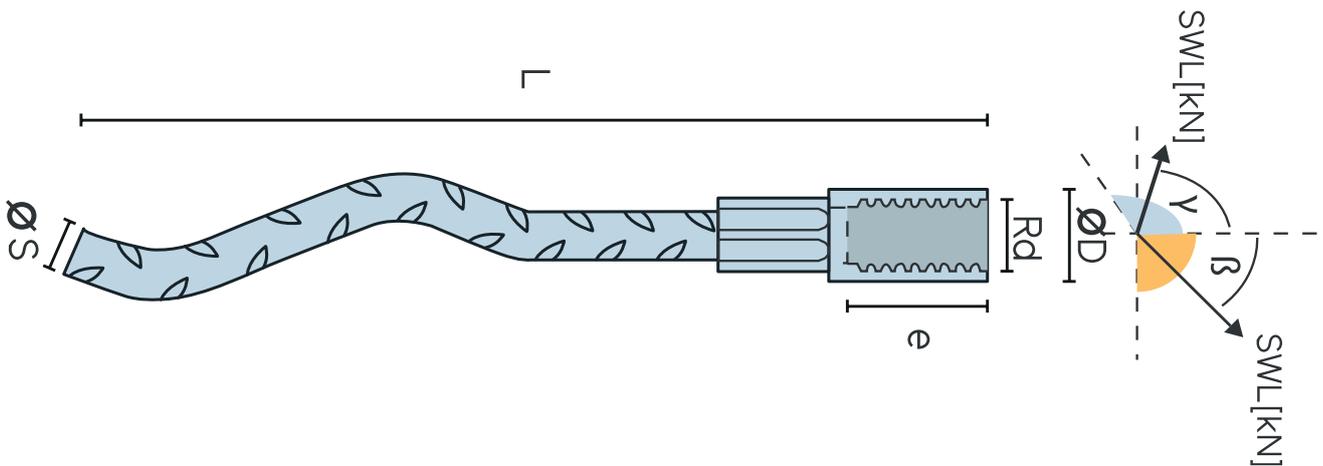
Figure 3. RWTS lifting anchor dimensions

Table 3. RWTS lifting anchor dimensions and tolerances

Lifting anchor	Rd thread size [mm] *	L total height of anchor [mm] ±5	ØD outer diameter [mm] ±1	e thread length [mm] ±1	Øs rebar diameter [mm] ±0.1
RWTS 12x108	12	108	15.5	22	8
RWTS 16x167	16	167	21.4	27	12
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

* Tolerances of Rd thread 6H (DIN405).

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

2.4. Materials and standards

Table 4. Materials and standards

Part	Lifting anchor type	Material	Standard
Rebar	RTA, RTAr, RTAhh RWTL, RWTLr, RWTLhh RWTS, RWTSr, RWTShh	B500B	EN 10080
Inner thread socket	RTA RWTL RWTS	S235J2+N	EN 10025
	RTAr RWTLr RWTLr	1.4301	EN 10088
	RTAhh RWTLhh RWTShh	1.4401	EN 10088

2.5. Ordering codes

Ordering codes of RTA, RWTL and RWTS lifting anchors consist of type, thread diameter and length of the anchor.

Table 5. Ordering codes

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

In all types ribbed steel bar material is B500B.

E.g. for stainless RTA lifting anchor, size Rd30x505 ordering code is RTAr 30x505.

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3. MANUFACTURING

3.1. 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.

3.2. Markings

RTA, RWTL and RWTS lifting anchors are marked with RSTEEL® logo, Rd (size) and CE-marking. Products are delivered in boxes on a truck palette. Product package is equipped with an RSTEEL® pallet label, which contains the following information: product type, product name, quantity, ISO 9001 and ISO 14001 quality and environment system markings and CE-marking.

3.3. Quality control

R-Group Baltic OÜ internal manufacturing and quality control in accordance with EN 1090-2. External quality control provided to R-Group Baltic OÜ by Kiwa Inspecta OÜ.

4. RESISTANCES

4.1. Calculation principles

Capacities of RTA, RWTL and RWTS lifting anchors are calculated for static loads according to the limit state dimensioning method presented in Eurocodes.

The calculations are made according to the following regulations and instructions:

EN 1992: Design of concrete structures

EN 1993: Design of steel structures

Machinery directive 2006/42/EC

VDI/BV-BS 6205

Global safety factors used in calculation of safe working loads are:

Steel failure $\gamma = 3.0$

Concrete failure $\gamma = 2.5$

Safe working loads are based on concrete dimensions, anchor steel bars and lifting anchor 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:

$$E \leq SWL$$

where:

E – action placed on lifting anchor

SWL – safe working load of lifting anchor

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

4.2. Safe working loads

4.2.1. RTA lifting anchors safe working loads

Safe working loads of RTA lifting anchors are given in Table 6. Safe working loads are applicable with concrete thickness and anchor spacing according to Table 9 and lifting anchor reinforcement according to Section 5.2.

Figure 4. RTA lifting anchor load directions

Table 6. RTA lifting anchors safe working loads

Lifting anchor	Safe working loads (SWL) [kN]		
	β = 0° - 45°	γ = 0° - 15°	γ = 15° - 90°
	≥ C12/15	≥ C12/15	≥ C12/15
RTA 12x195	5.0	5.0	2.5
RTA 16x275	12.0	12.0	6.0
RTA 16x400	12.0	12.0	6.0
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

Bond condition coefficient for safe working loads in Table 6 is η_1 = 1.0 (good conditions). In other bond conditions safe working loads must be multiplied by 0.7.

4.2.2. RWTL lifting anchors safe working loads

Safe working loads of RWTL lifting anchors are given in Table 7. Safe working loads are applicable with concrete thickness and anchor spacing according to Table 9 and lifting anchor reinforcement according to Section 5.2.
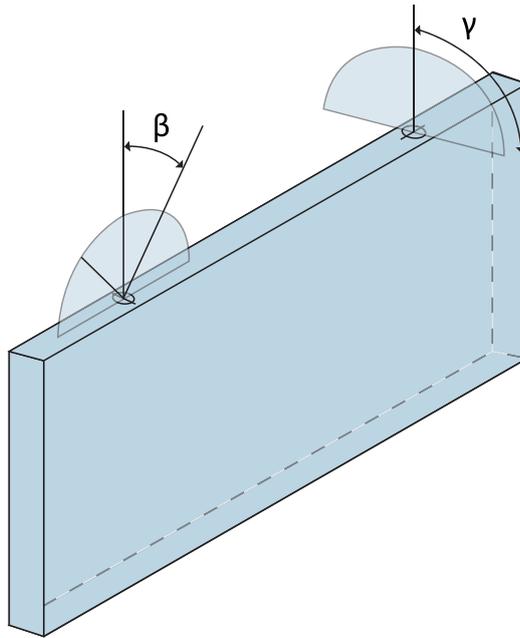

Figure 5. RWTL lifting anchor load directions

Table 7. RWTL lifting anchors safe working loads

Lifting anchor	Safe working loads (SWL) [kN]		
	$\beta = 0° - 45°$	$\gamma = 0° - 15°$	$\gamma = 15° - 90°$
	≥ C12/15	≥ C12/15	≥ C12/15
RWTL 12x137	5.0	5.0	2.5
RWTL 16x216	12.0	12.0	6.0
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

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.

4.2.3.   RWTS lifting anchors safe working loads

Safe working loads of RWTS lifting anchors are given in Table 8. Safe working loads are applicable with concrete thickness and anchor spacing according to Table 9 and lifting anchor reinforcement according to Section 5.2.
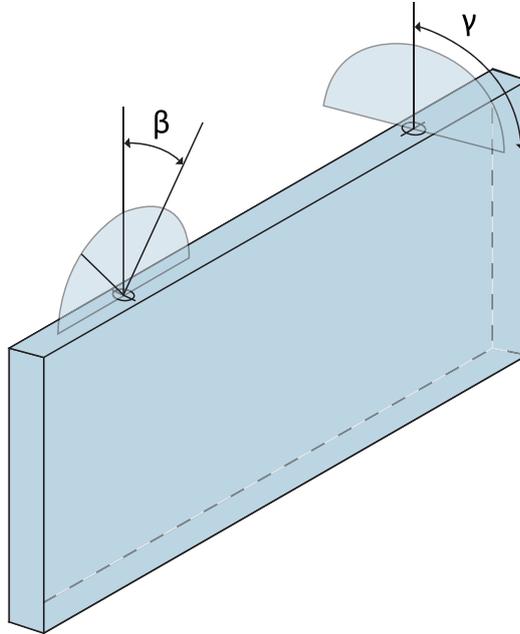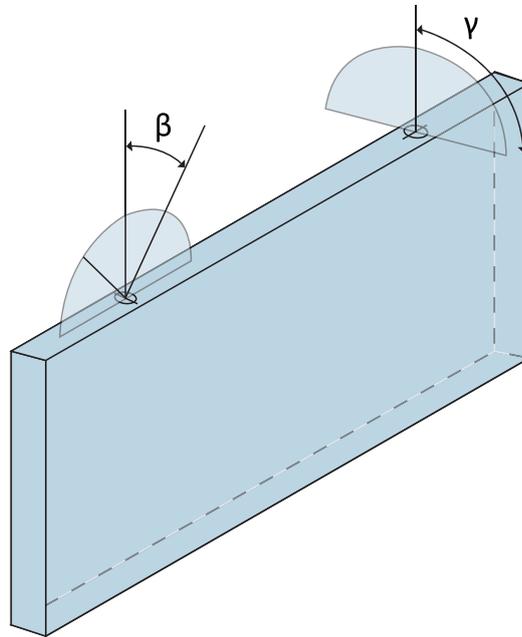

Figure 6. RWTS lifting anchor load directions

Table 8. RWTS lifting anchors safe working loads

Lifting anchor	Safe working loads (SWL) [kN]	
	β = 0° - 45°	γ = 0° - 15°
	≥ C12/15	≥ C12/15
RWTS 12x108	2.6	1.3
RWTS 16x167	6.3	3.1
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

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.

5. APPLICATION

5.1. Minimum edge and center distances

5.1.1. Concrete thickness and anchor spacing

Safe working loads are valid only with minimum concrete thickness and minimum lifting anchor spacing given in Figure 7 and Table 9.
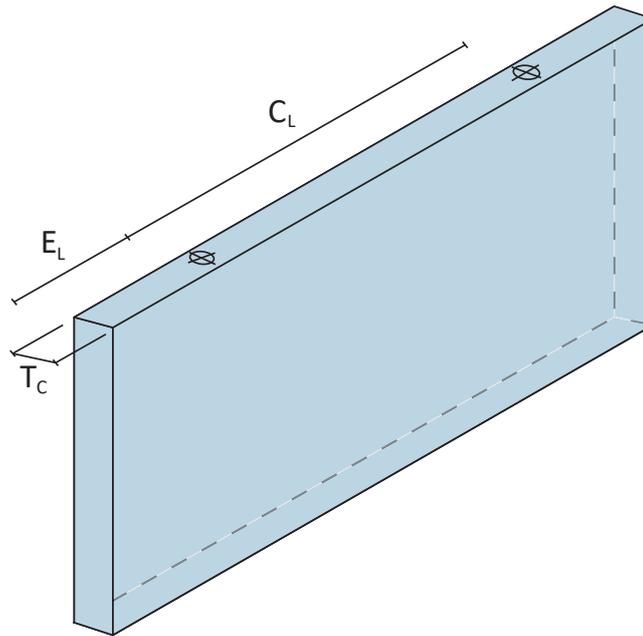

Figure 7. Minimum element thickness and lifting anchor spacing

Table 9. Minimum element thickness and minimum anchors spacing

Lifting anchor size	Minimum concrete thickness T_C [mm]			Minimum edge spacing E_L [mm]	Minimum 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 16	80	80	80	180	360
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

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5.2. Additional reinforcement

Additional reinforcement for lifting anchors, ribbed steel bar according to EN 10080, $f_{yk} \geq 500$ MPa.

5.2.1. 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.

5.2.2. Diagonal pull reinforcement

If the lifting angle β is >15°, additional reinforcement must be situated next to the lifting anchor according to Figure 8 and Table 10. 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.
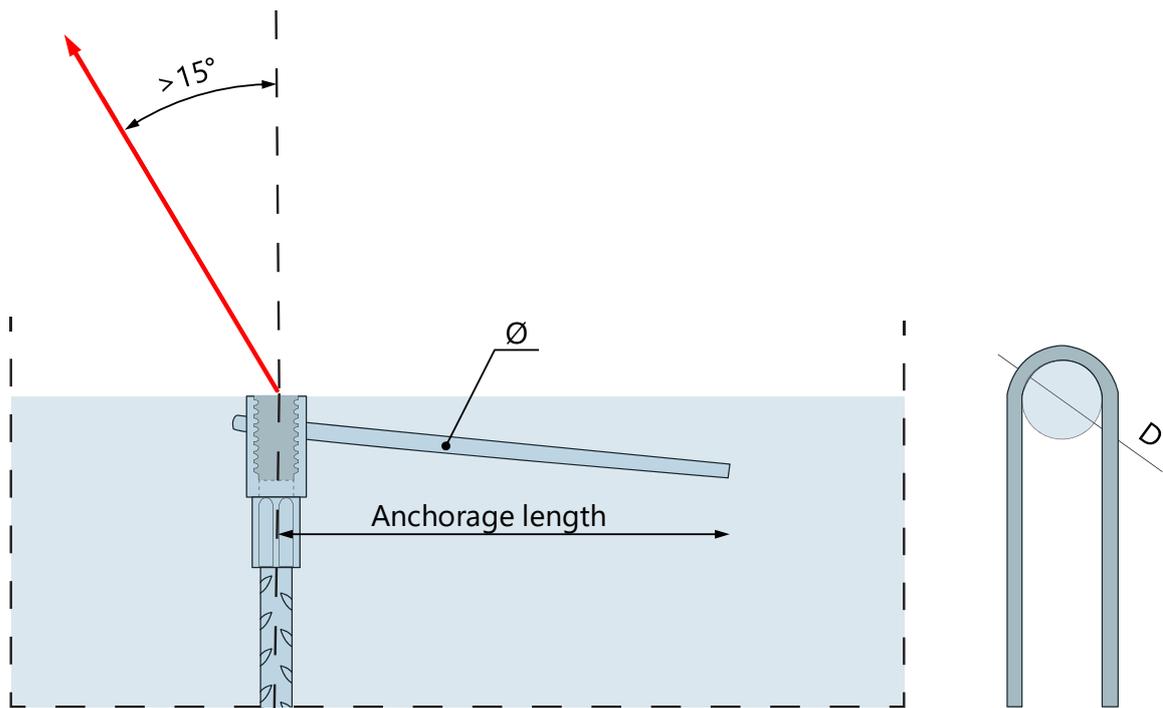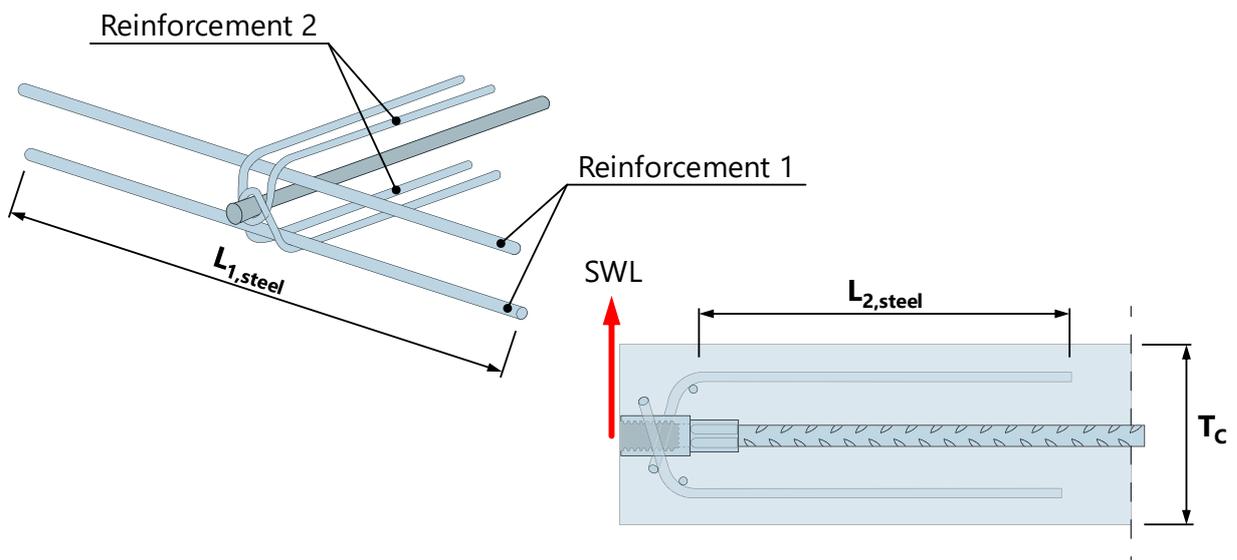

Figure 8. RTA, RWTL and RWTS lifting anchors diagonal pull reinforcement

Table 10. RTA, RWTL and RWTS lifting anchors diagonal pull reinforcement

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

5.2.3. Tilting reinforcement

When the element is lifted from the side or is tilted resulting in lateral pull ($\gamma \geq 15°$), additional reinforcement according to Figure 9 and Table 11 must be installed. 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 9. RTA, RWTL and RWTS lifting anchors tilting reinforcement

Table 11. RTA, RWTL and RWTS lifting anchors reinforcement for lateral pull

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

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

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

5.3. Actions on lifting inserts

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

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

5.3.1. Number and actions of lifting inserts

The number of load bearing lifting inserts and the load acting on the lifting inserts shall be determined corresponding with the individual lifting situations. The statistical system of lifting inserts must be accounted for in these calculations. Actions from all individual lifting situations must be calculated according to Sections 5.3.2 to 5.3.10.

After actions placed on lifting inserts are determined, the safe working load (SWL) in Section 4 shall then be compared with the actions. The safety concept requires that action E does not exceed the safe working load SWL. The following formula must be satisfied for all actions on lifting inserts

$$E \leq SWL$$

where:

E – action on lifting insert, see Sections 5.3.2 to 5.3.10, in kN

SWL – safe working load of lifting insert, see Section 4, in kN

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

5.3.2. Statical system

Lifting equipment used in lifting pre-cast elements shall allow determinate load distribution to all present lifting inserts. Figure 10 gives examples of statically indeterminate systems where only two lifting inserts carry the load. The load distribution is not clearly defined in these applications. Therefore, these statically indeterminate systems shall be avoided.
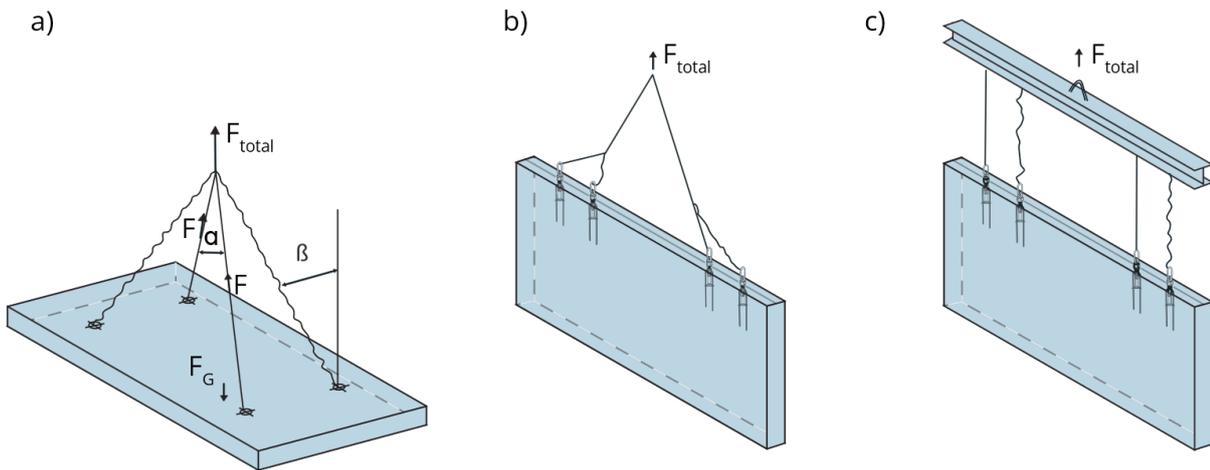
Figure 10. Examples of statically indeterminate lifting systems which should not be used

   a) statically indeterminate system. Load bearing inserts n = 2.

   b) statical system without clearly defined load-bearing mechanism. Load bearing inserts n = 2.

   c) statically indeterminate load distribution to the lifting inserts of a wall element. Load bearing inserts n = 2.

To ensure a statically determinate system and that all lifting inserts carry their required part of the load in case of applications with more than two lifting inserts transport aids such as sliding or rolling couplings or balancing beams shall be used.
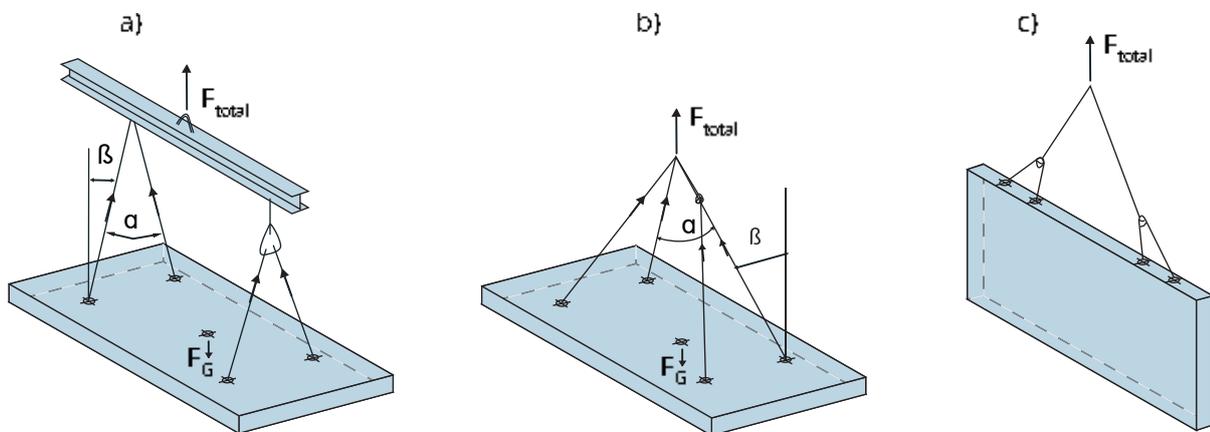
Figure 11. Transportation aids for the statically determined lifting of slabs and wall elements

   a) balancing beam and rolling coupling. Load bearing inserts n = 4.

   b) sliding coupling. Load bearing inserts n = 4.

   c) rolling coupling. Load bearing inserts n = 4.

In case of inclined lifting slings, the lifting inserts are loaded by combined tension and shear loads. The inclination β according to Figure 11 governs the level of combined tension and shear loads to be taken into account in the design.

If three lifting inserts are located in slab and situated in star pattern with same distance to the centre of gravity with equal inclinations of 120° (Figure 12) it is ensured that all three lifting inserts experience the same load.
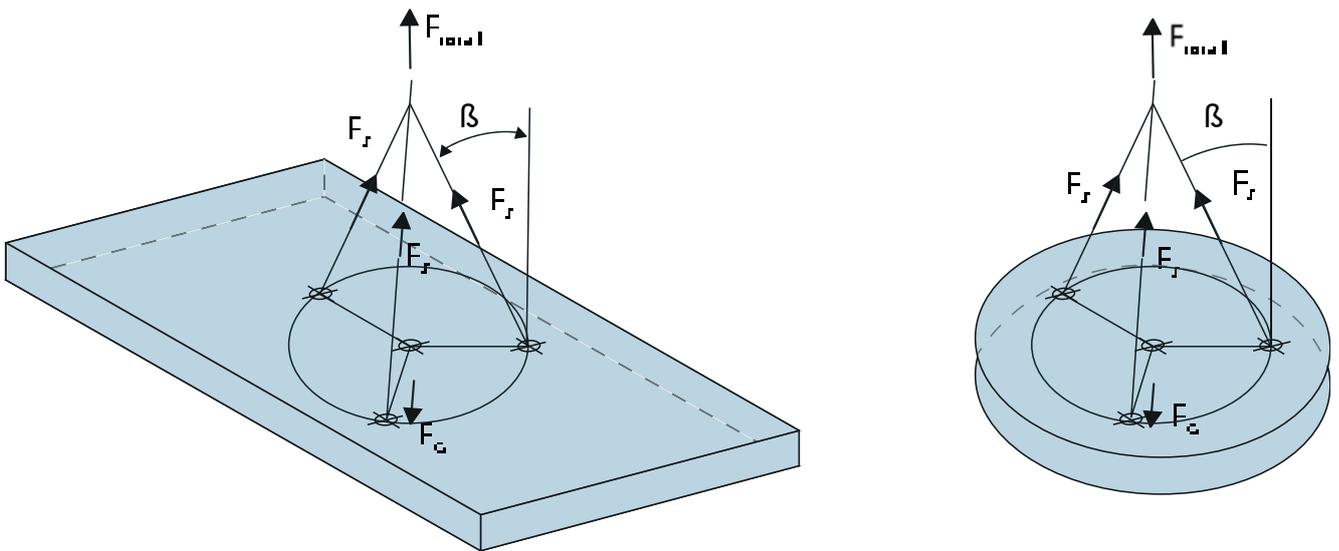

Figure 12. Statically determinate load distribution by means of lifting inserts in star pattern

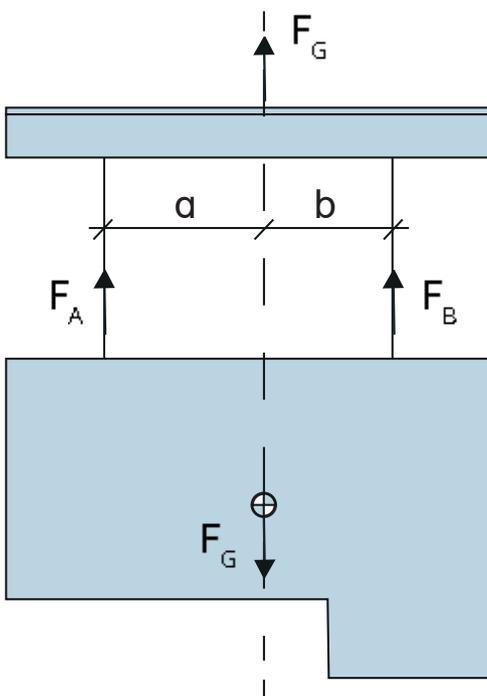### 5.3.3. Load distribution for non-symmetrical insert layout

Figure 13. Load distribution for non-symmetrical insert layout using spreader beam

If the inserts are not installed symmetrically to the load's centre of gravity, the load distribution to different inserts 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 insert to centre of gravity, in m

b – distance from insert to centre of gravity, in m

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

5.3.4. Spread angle

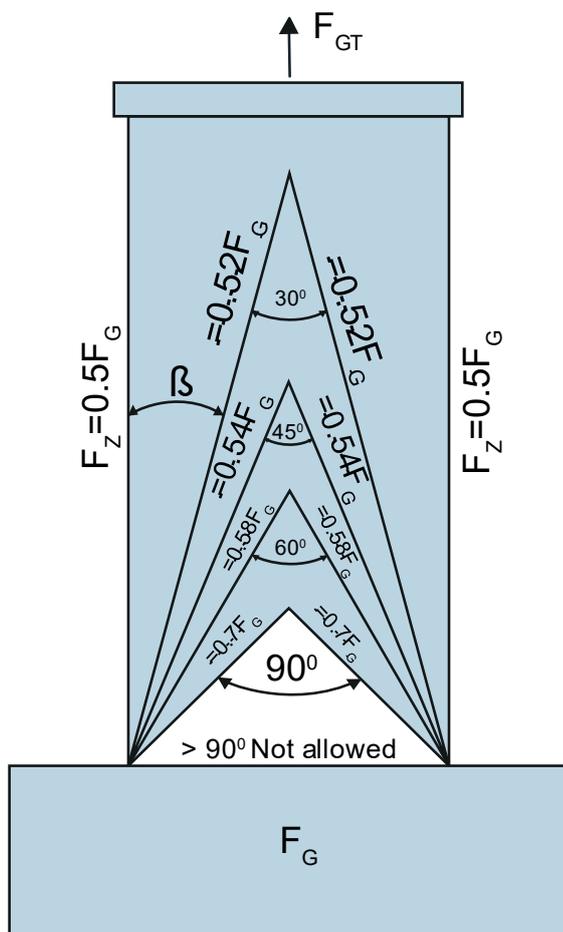The influence of spread angle on the actions for lifting inserts must be considered.

Figure 14. Spread angle factors

Table 12. 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

5.3.5. 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 m³

ρ_G – density of the concrete, in kN/m³

5.3.6. Adhesion and form friction

Adhesion and form friction are assumed to act simultaneously during the lifting of the precast element from the formwork. The action 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 13, in kN/m²

A_f – contact area between concrete and formwork, in m²

Table 13. 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 13 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.

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5.3.7. 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 considered 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 14.

Table 14. Dynamic factor Ψdyn according to VDI/BV-BS6205:2012

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 14 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 14 the factor Ψ_{dyn} shall be determined on the base of tests or engineering judgement.

5.3.8. Load condition "erection in combination with adhesion and form friction"
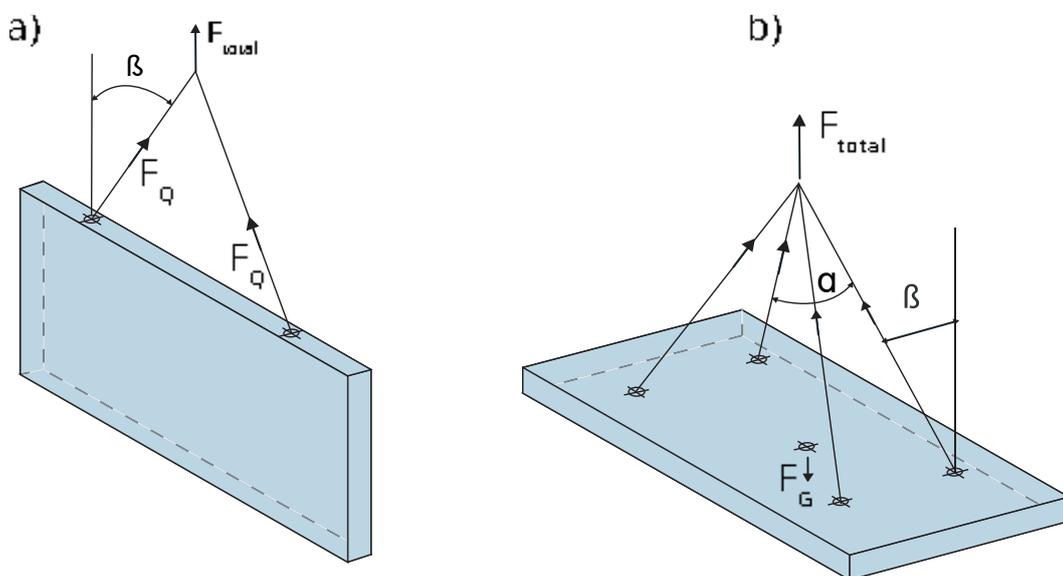
Figure 15. Erection in combination with adhesion and form friction

When pre-cast elements are lifted from form according to the action F_Q on lifting inserts is

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

where:

F_Q – load acting on individual lifting insert, in kN

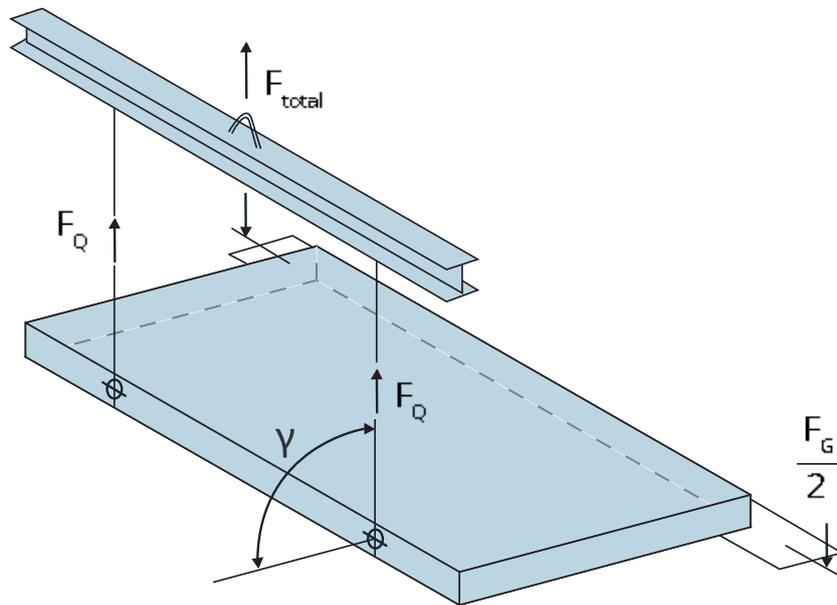F_G – self-weight of the pre-cast element, Section 5.3.5, in kN

F_{adh} – action due to adhesion and form friction, Section 5.3.6, in kN

z – factor for combined tension and shear,

z = 1 / cos β, angle β in accordance with Figure 15.

Note: in case of only tension z = 1.

n – number of lifting anchors carrying the load.

Figure 16. Erection in combination with adhesion and form friction, lifting with balancing beam

When pre-cast elements are lifted from form according to the action F_Q on lifting inserts is:

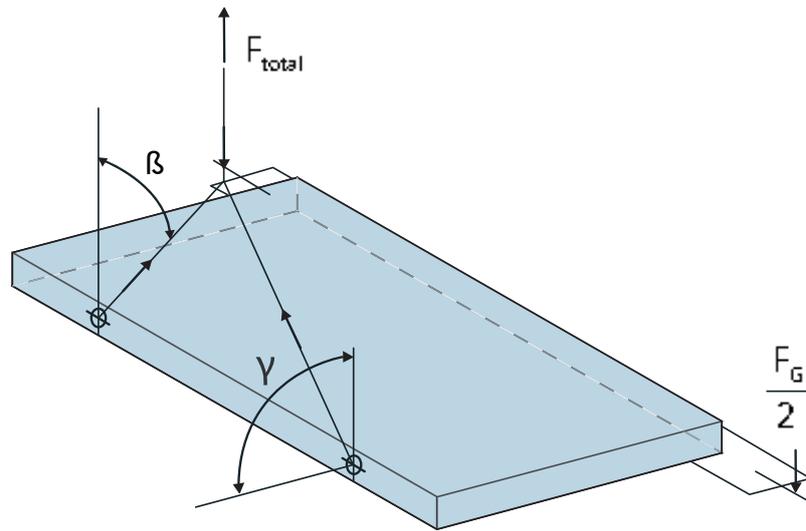$$F_Q = \left(\frac{F_G}{2} + F_{adh}\right)/n$$

where:

F_Q – load acting on individual lifting insert, in kN

F_G – self-weight of the pre-cast element, Section 5.3.5, in kN

F_{adh} – action due to adhesion and form friction, Section 5.3.6, in kN

n – number of lifting anchors carrying the load.

Figure 17. Erection in combination with adhesion and form friction, lifting with chains

When pre-cast elements are lift from form according to the action F_Q on lifting inserts is:

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

where:

F_Q – load acting on individual lifting insert, in kN

F_G – self-weight of the pre-cast element, Section 5.3.5, in kN

F_{adh} – action due to adhesion and form friction, Section 5.3.6, in kN

z – factor for combined tension and shear

$z = 1 / \cos \beta$, angle β in accordance with Figure 17.

n – number of lifting anchors carrying the load.

5.3.9. 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.
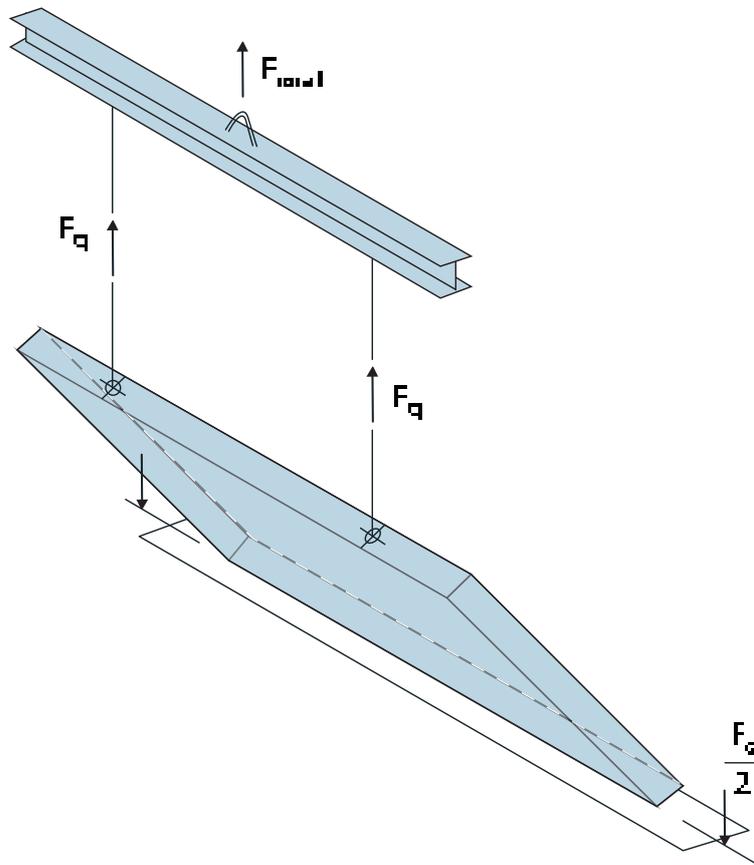
Figure 18. Element erection with balancing beam

Erection with balancing beam, action on lifting insert is:

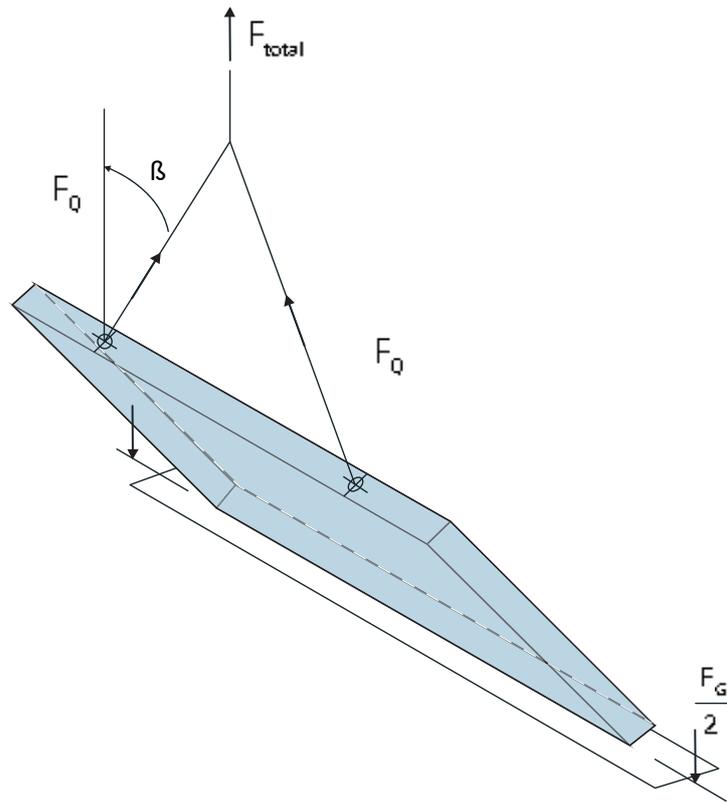$$F_Q = \left(\frac{F_G}{2}\right) \cdot \psi_{dyn}/n$$

where:

F_Q – shear load acting on individual lifting insert, in kN

Note: 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 5.3.5, in kN

ψ_{dyn} – dynamic factor, Section 5.3.7

n – number of lifting anchors carrying the load.

Figure 19. Element erection with chains

For transverse shear (lifting according to Figure 19) action on lifting insert is:

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

where:

F_{QZ} – inclined shear load acting on individual lifting insert, in kN

Note: inclined and perpendicular to the longitudinal axis of the precast element e.g. during lifting from the horizontal position

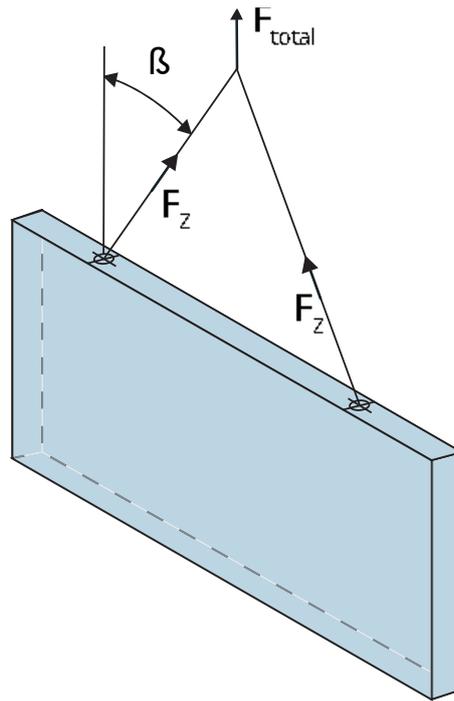F_G – self-weight of the pre-cast element, Section 5.3.5, in kN

ψ_{dyn} – dynamic factor, Section 5.3.7

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.

5.3.10. Load condition "lifting and handling under combined tension and shear"

Figure 20. Lifting and handling under combined tension and shear

The load condition "lifting and handling under combined tension and shear" is presented in Figure 20. This is the most common lifting procedure. Action on lifting insert is:

$$F_Z = F_G \cdot \Psi_{dyn} \cdot z/n$$

where:

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

F_G – self-weight of the pre-cast element, Section 5.3.5, in kN

Ψ_{dyn} – dynamic factor, Section 5.3.7

z – factor for combined tension and shear

$z = 1 / \cos \beta$, angle β in accordance with Figure 20.

n – number of lifting anchors carrying the load.

6. INSTALLATION

6.1. Attachment to formwork

RTA, RWTL and RWTS lifting anchors must be attached securely so it cannot move during casting of the concrete. Concrete must be compressed carefully. The lifting anchor itself 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.

6.2. Supervision of installation

6.2.1. Installation of RTA, RWTL and RWTS lifting anchors

Following controls should be done by the user.

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
- required additional reinforcement is assembled

During the casting:

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

After the casting:

- the position of the lifting anchor is according to designs
- the thread is intact and free of concrete

NOTES

TECHNICAL MANUAL REVISIONS

11.02.2026 (AV)

- New layout
- The list of sizes reduced

SUPPORT MATERIAL

DESIGN TOOLS

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