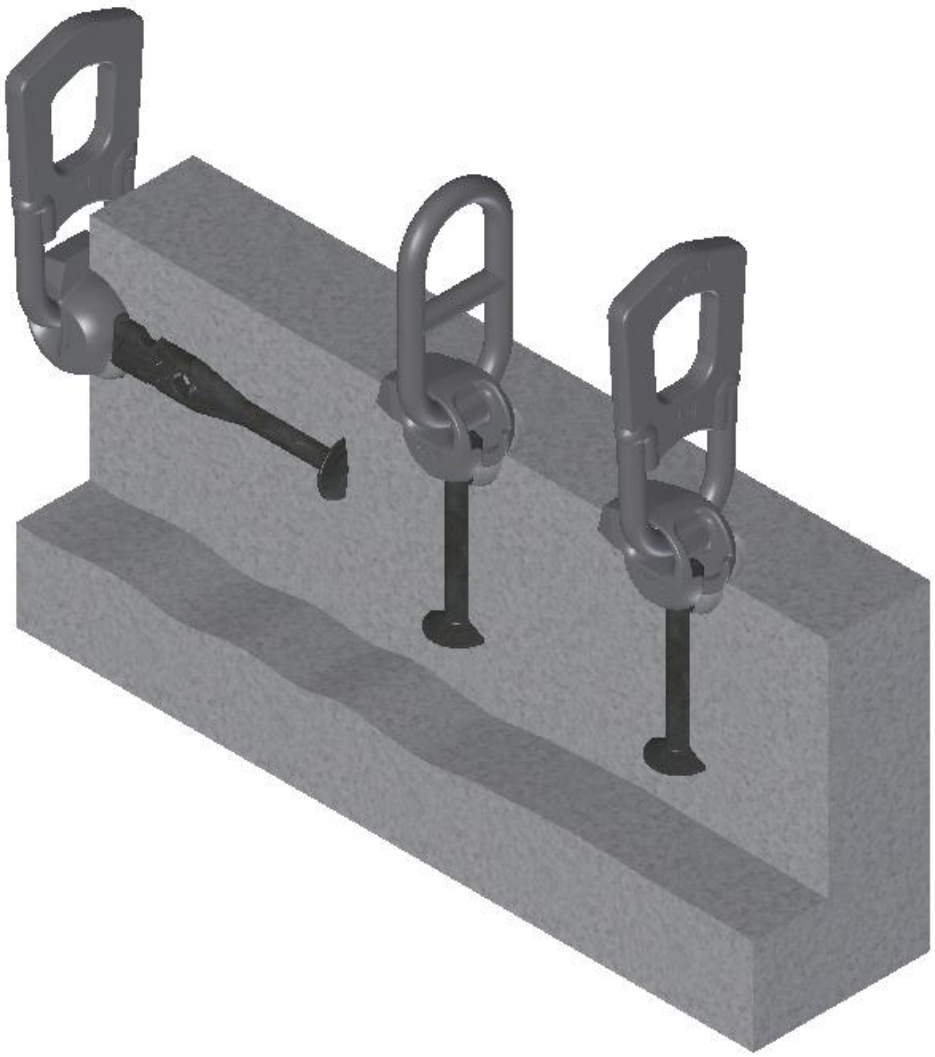
3D T- SLOT-ANCHOR SYSTEM



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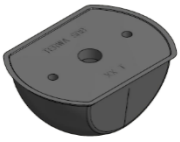
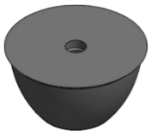
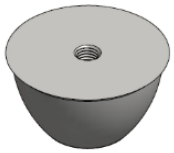
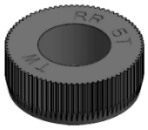
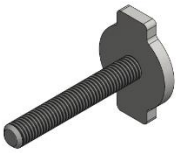
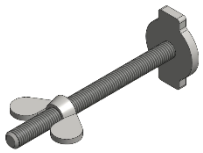
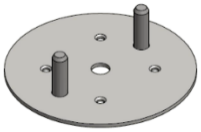
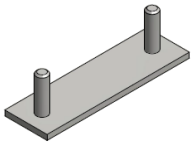
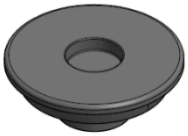
RB  Page 51	**SRB**  Page 51	**RBK**  Page 52	**RBP**  Page 52
MPB  Page 52	**SBK**  Page 52	**SBKM**  Page 53	**SBKM/SBPM**  Page 53
RR  Page 53	**IP**  Page 53	**IPD**  Page 54	**IPDV**  Page 54
TDV  Page 54	**OPR**  Page 54	**IPK**  Page 32	**TAF**  Page 54

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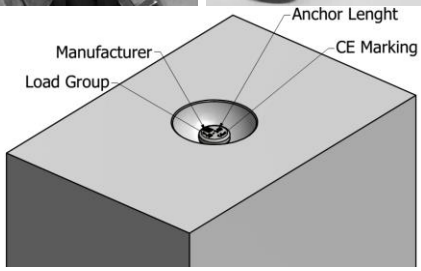
INTRODUCTION

The 3D T-slot Anchor System is fast to use and the use of a cheap T-Slot-anchor makes the application of this lifting system the most economic system.
The T-Slot anchor is built in the concrete element with the aid of a rubber recess former. After the pouring of the shuttering and after the concrete is hardened, the rubber ball can be removed. The TH2 lifting clutch fits exactly in the created hole and the prefab element can be pulled up out of the shuttering.
Some of the important advantages of these systems are:

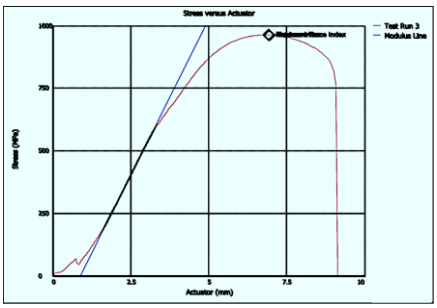
- Safe, simple and fast connection and disconnection between lifting anchors and lifting clutches.
- Anchors and links are designed for load capacities between **1.3 – 45 t**.
- High quality alloy material for lifting anchors usable in any environment.
- Available in hot-dip galvanized and stainless steel for corrosion protection.
- Perfect lifting and transport solution for most applications and precast elements.
- CE conform system. All Terwa lifting systems are CE marked which guarantees the alignment to the European regulations.
- The design for Terwa 3D Lifting Anchors and technical instructions are according to the national German rule VDI/BV-BS 6205:2012 “Lifting inserts and lifting insert for precast concrete elements”. Also, based on this rule the lifting systems must ensure that they have enough strength to avoid the concrete failure.
- The anchors are designed to resist at a minimum safety factor = 3.

Quality
Terwa control all the time the production process for the anchors from strength, dimensional, material quality point of views and all the required inspections for a superior quality system. All the products are tracked starting from the material acquisition to the final product, ready to be used.

Marking and traceability
All anchors and lifting clutches are CE marked and haves all necessary dates for traceability and load group.



Anchor testing
Terwa lifting anchors are designed to resist at a minimum safety factor of **3xload group**



CE MARKING

CE marking means that a product is produced and controlled in accordance with a harmonized European standard (hEN) or a European Technical Approval (ETA). ETA can be used as basis for CE marking in cases where no harmonized EN standard is available. However, ETA is voluntary and not required by EU directives or legislation.

Manufacturers may use CE marking to declare that their construction products meet harmonized European standards or have been granted ETA Approvals. These documents define properties the products must have to be granted the right to use CE marking and describe how the manufacture of these products is supervised and tested.

EU’s Construction Products Regulation takes effect in full on 1 July 2013. Detailed building parts, such as connections used in concrete constructions, do not have any harmonized EN standards, excluding lifting items and devices, which are regulated in the EU Machinery Directive. For steel constructions CE marking, will become mandatory as of 1 July 2014, as regulated in the EU Construction Products Directive.

PRODUCTS RANGE

LIFTING SYSTEM

- **LIFTING CLUTCHES**

"Terwa" offers different lifting clutches and a wide range of different recess formers. The difference between all systems is actually defined by the type of anchors.

- **TRANSPORT ANCHORS**

The anchors are forged from round carbon steel. Available in black (without surface treatment but slightly oiled) or hot dip galvanized, Terwa abbreviation **TV**. A small range of stainless steel anchors (A**2**-1.4301; AISI 304, Terwa abbreviation SS**2**) is available as well. All anchors are designed to fulfil a minimum safety factor of c=3.

RECESS FORMERS AND ACCESORIES

The anchors are fitted in the mould with a recess former. Obviously, the recess formers are available in the same range as the lifting clutches and the anchors. This is indicated by a load group, marked on the top.
The formers are mounted on the mould with fixing plates.

TECHNICAL INFORMATION – CHOOSING TYPE OF ANCHOR

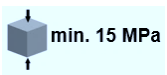
Terwa has in total 3 types of lifting systems:

- 1D Threaded lifting system
- 2D Strip anchor lifting system
- 3D T slot anchor lifting system

For all these types the way of choosing the anchor is identical and it depends on the way of lifting and/or experience is the reason of chosing one of the mentioned types.

The1D Threaded lifting system is mainly used when the hoisting angles are limited, while the 2D Strip anchor lifting system and the 3D T slot anchor lifting system can be used for all hoisting angles with a small limitation for the 2D Strip anchor lifting system. The difference between the 2D Strip anchor lifting system and the 3D T slot anchor lifting system is mainly caused by the experience in using the one or the other system.
For the calculation of the anchors Terwa also has software for this, with which calculations can be made.

SAFETY RULES

The anchors are embedded in the concrete elements. The lifting system is only connected to the anchor when required for lifting.
Ensure that the concrete has reached at least 15 MPa strength before starting the 

lifting.

It is essential, in designing the lifting system, to use the following safety factors against breaking:

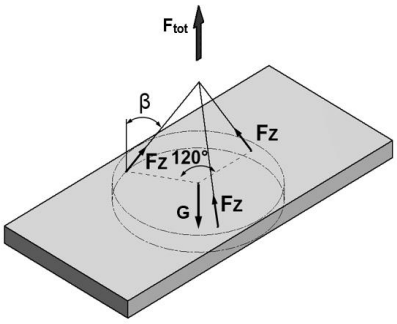
- **For steel component** **c = 3**
- **For concrete element** **c = 2.5**
- **For steel wires** **c = 4**

The maximum load permitted on the components quoted in the tables has been obtained by applying a safety factor on test data.

ANCHORS LIFTING CONDITIONS

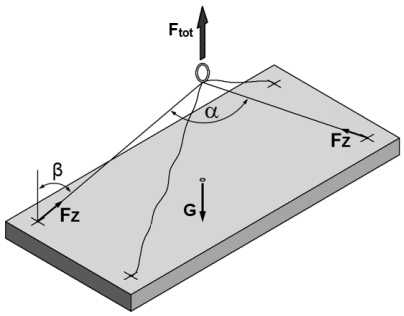
Using three anchors arranged at the same length on from each other like in the figure, can be assumed three load bearing anchors.

Load bearing anchors: **n=3**



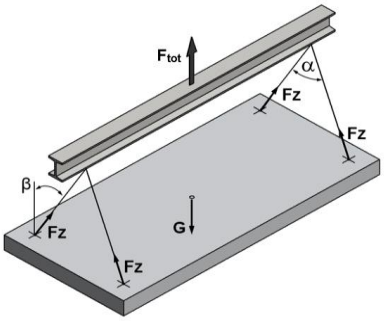
Using four anchors lifted without a spreader beam, only two anchors can be assumed load bearing anchors.

Load bearing anchors: **n=2**



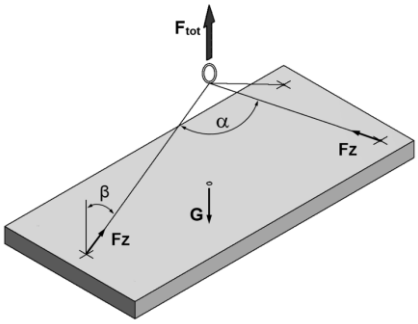
A perfect force distribution is assumed using a spreader beam.

Load bearing anchors: **n=4**



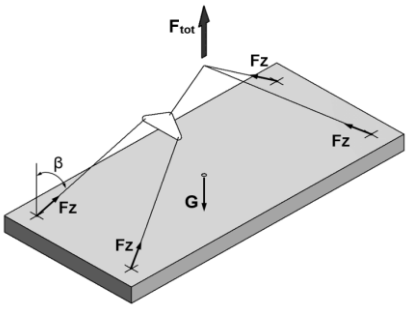
If the anchors are positioning asymmetrically only two bearing anchors can be assumed.

Load bearing anchors: **n=2**



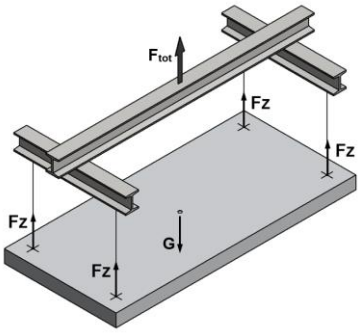
The compensated lifting slings ensure equal force distribution.

Load bearing anchors: **n=4**

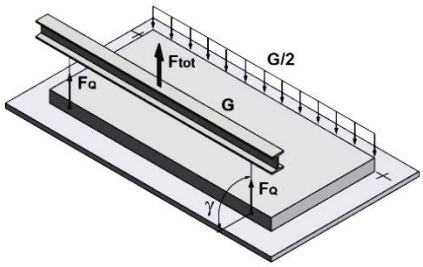


A perfect static weight distribution can be obtained using a lifting beam and two pairs of anchors set out symmetrically.

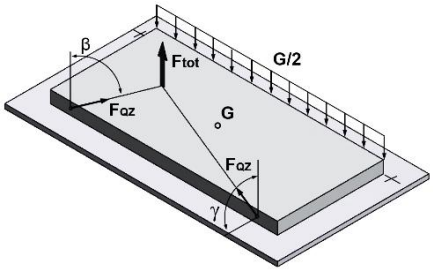
Load bearing anchors: **n=4**



When the element is lifted without lifting table at a straight angle and the contact is kept with the ground. Additional shear reinforcement is required.



When the element is lifted without lifting table, angled and the contact is kept with the ground. Additional shear reinforcement is required. ***ß ≤ 30°***



ASYMETRIC DISTRIBUTION OF THE LOAD

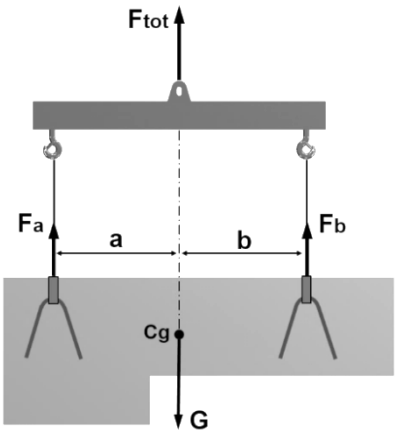
In case of asymmetrical elements before installing the anchors, calculate the loads based on the center of gravity position. The load of each anchor depends on the embedded position of the anchor in the precast unit and on the transporting mode:

a) If the arrangement of the anchors is asymmetrical in relation to the center of gravity, the individual anchor supports different loads. The load distribution in asymmetrical installed anchors when a spreader beam is used the forces on each anchor is calculated with the equation bellow:

$$F_a = F_{tot} \times \mathbf{b}/(\mathbf{a}+\mathbf{b})$$

$$F_b = F_{tot} \times \mathbf{a}/(\mathbf{a}+\mathbf{b})$$

Note: To avoid tilting of the unit during transport, the load should be suspended from the lifting beam such that its center of gravity (Cg) is directly below the crane hook.



b) In the case of transporting without lifting beam, the load on the anchor depends on the cable angle (ß).

INSTALLATION AND APPLICATION

Do not use for lift transport anchors which are incorrectly installed, damaged (ex: corrosion damage or with visible deformities). If the concrete is damaged the load capacity could be reduced and for this reason the anchor must not be used.

WELDING TO THE ANCHORS

Welding the anchors, for example, to the reinforcement mesh is **NEVER allowed**. The choosing of the material for the anchors in order to obtain the smallest anchor in relation to the highest safety does not allow any welding under normal circumstances.

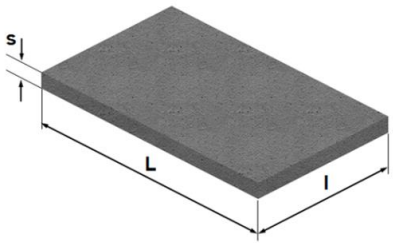
LOAD CAPACITY

Maximum load capacities, edge distances and installation values can be found in tables. For calculation the following factors must be taken into account.
The load capacity of the anchor depends on multiple factors such as:

- The deadweight of the precast concrete element “G”
- The strength of the concrete at the time of operating: lifting or transporting
- Number of load bearing anchors
- Anchor layout - the edge distance and spacing of the anchors
- The embedded depth of the anchor
- The load direction
- Dynamic loads
- Adhesion to the formwork
- The reinforcement arrangement

WEIGHT OF PRECAST UNIT

The total weight “G” of the precast reinforced concrete element is determined using a specific weight of: **ρ = 25kN/m³.** For precast elements which are made with a higher concentration of reinforcing elements in the calculation of weight, this must be considered.



$$\mathbf{G} = \boldsymbol{\rho} \times \mathbf{V}$$

$$\mathbf{V} = \boldsymbol{L} \times \boldsymbol{l} \times \boldsymbol{s}$$

Where:
V - volume of precast unit in [m³]
L – length in [m]
l – width in [m]
s – thickness in [m]

ADHESION TO FORMWORK COEFFICIENT

Adhesion forces between the mould and the concrete depend on the type of mould used.
Take account of

- Oiled formwork
- Taking away the side formwork

The value "H_a" of adhesion to the mould is calculated through the following equation:

$$\boldsymbol{H_a = q \times A\ [kN]}$$

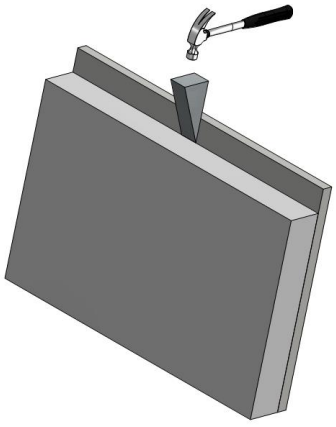
Where:
q – the adhesion to mould factor according with the material of the mould
y – the form factor (adhesion to mould factor according with the form of the element)
A – area of contact between the mould and the concrete unit when starting the lift.

Adhesion to the formwork	
oiled steel formwork	$q \geq 1\ kN/m^2$
varnished timber formwork	$q \geq 2\ kN/m^2$
rough timber formwork oiled	$q \geq 3\ kN/m^2$

In some cases, like π - panel or other special shaped elements an increased adhesion coefficient must be considered.

Adhesion to the formwork	
Double T beam	$\boldsymbol{H_a = 2 \times G\ [kN]}$
Ribbed elements	$H_a = 3 \times G\ [kN]$
Waffled panel	$H_a = 4 \times G\ [kN]$

Where: G - dead weight of the element



Adhesion to the formwork should be minimized before lifting the concrete element out of the formwork by removing as many parts of the formwork as possible.

Before lifting from the table, the adhesion to the formwork must be reduced as much as possible by removing the formwork from the concrete element (tilting the formwork table, short vibration for detachment, using wedges).

DYNAMIC LOADS COEFFICIENT

When the movement of the precast units is performed by lifting gear, dynamic forces which depend on the lifting gear used appear. The lifting classes are described in DIN 15018.

Lifting class	Lifting load coefficient "f" at lifting speed vh	
	Up to 90 m/min	Over 90 m/min
H 1	1.1 + 0.002 vh	1.3
H 2	1.2 + 0.004 vh	1.6
H 3	1.3 + 0.007 vh	1.9
H 4	1.4 + 0.009 vh	2.2

Lifting equipment	Dynamic coefficient "f"
Rail crane, swing-boom crane and fixed crane	1.3 *)
Lifting and transporting on level terrain	2.5
Lifting and transporting on uneven terrain	**≥ 4.0**
*) lower values may be appropriate in precast plants if special arrangements are made.	

For cranes with precision lifting, such as those in manufacturing plants the lifting load coefficient is $f = 1.1 \div 1.3$.

For cranes with precision lifting, such as those in manufacturing plants the lifting load coefficient is $f = 1.1 \div 1.3$.

IN THE PRECAST YARD:
- for lifting out of the formwork $f = 1.1$
- for tilting and transport $f = 1.3$

ON SITE:
- for tilt/transport/install $f = 1.5$
- when transporting suspended precast elements over uneven terrain, the lifting load coefficient used is $f > 2$.

For special transport and lifting cases the dynamic coefficient is established based on the tests or on proven experience.

LIFTING IN AN ANGLE – CABLE ANGLE COEFFICIENT

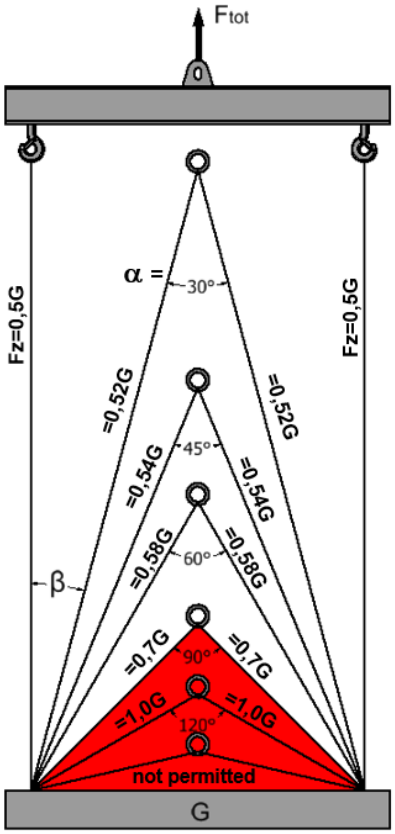
The load value applied on each anchor depends on the chain inclination which is defined by the angle β between the normal direction and the lifting chain.
The cable angle ß is determined by the length of the suspending cable. We recommend, if possible, that ß should be kept to a minimum ß ≤ 30°. The tensile force on the anchor is increased with an angle coefficient **''z''**.

$$\boldsymbol{F = F_{tot} \times z/n}$$

where**:**

z - cable angle coefficient; $\boldsymbol{z = 1/cos\beta}$

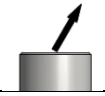
n - number of load bearing anchors



Cable angle ß	Spread angle a	Cable angle factor z
0°	-	1.00
7.5°	15°	1.01
15.0°	30°	1.04
22.5°	45°	1.08
30.0°	60°	1.16
*37.5°	75°	1.26
*45.0°	90°	1.41

*** preferred ß ≤ 30°**

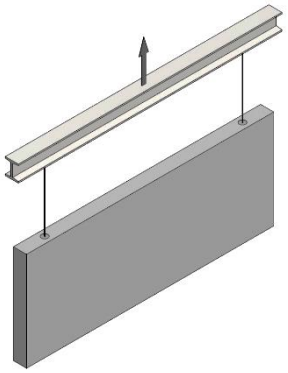
Note: If no lifting beam is used during transport, the anchor must be embedded symmetrically to the load.

Lifting symbols used in the documentation	
Axial pull in direction of anchor axis.	
Transverse pull perpendicular to the anchor axis.	
Angled pull, lifting at an angle to the anchor axis	

LOAD DIRECTIONS

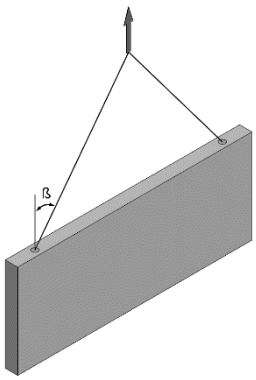
During the transportation and lifting various cases can occur, such tilt-up, rotation, hoisting and of course the installation. The lifting anchor and clutches most carry all this cases and combinations. Therefore, the load direction is a very important factor for a good anchor selection.

Axial load **ß = 0° to 10°**



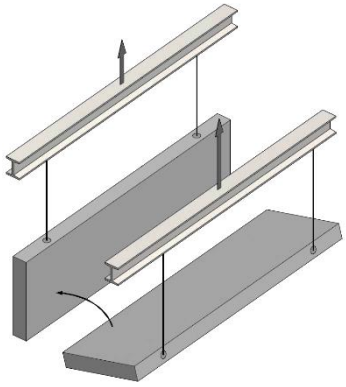
Diagonal load **ß = 10° to 45°**

Note: is recommended ***ß ≤ 30°***

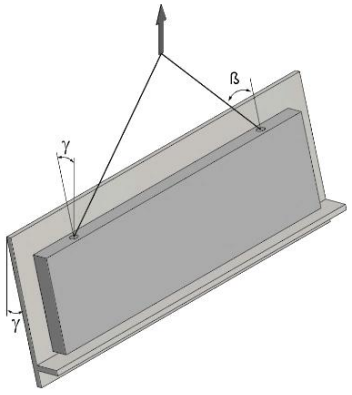


Tilting **ɣ = 90°**

Additional shear reinforcement steel must be used.

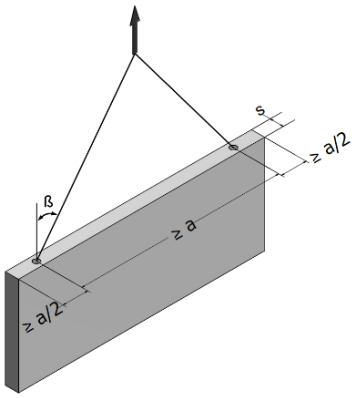


When a tilting table is used, the anchors can be used without the additional shear reinforcement steel, not exceeding the angle **ɣ < 15°**

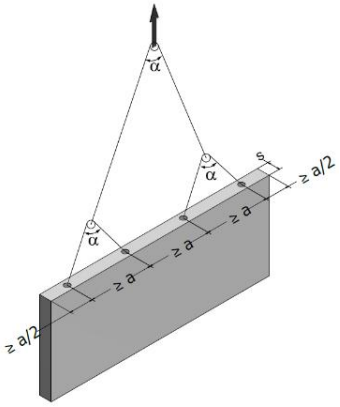


POSITIONATING THE ANCHORS IN WALLS

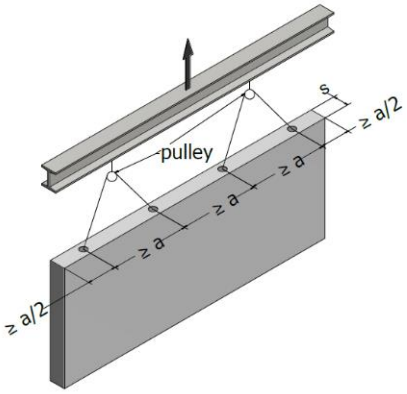
Load bearing anchors:
n=2

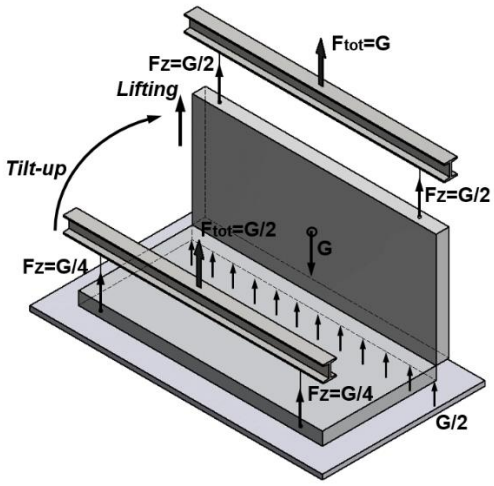


Load bearing anchors:
n=4



Load bearing anchors:
n=4





Lifting the walls from horizontal to vertical position without tilt-up table.

In this case, the anchors are loaded with a half of the element weight because a half of the element remains in contact with the casting table.

DETERMINATION OF ANCHOR LOAD

The load on each load bearing anchor is calculated with the following formula:

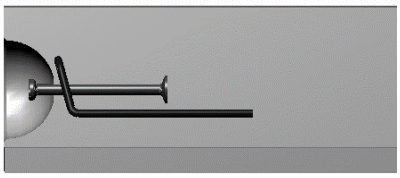
- **When de-mold** $\boldsymbol{F = (F_{tot} \times z)/n = [(G + H_a) \times f \times z]/n}$

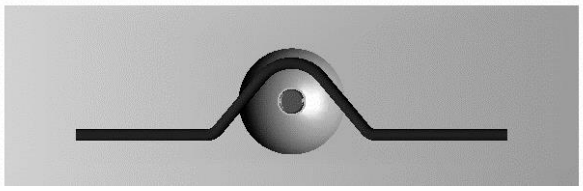
- **When tilting** $\boldsymbol{F = (F_{tot}/2 \times f \times z)/n = [(G/2 + H_a) \times f \times z]/n}$

During tilting, the concrete element remains supported on the ground, only the half of the forces have to be taken into account.
In the situation of tilting, load carrying capacity of sockets and anchors is limited to 50% of the axial load.

- **When lifting** $\boldsymbol{F = (F_{tot} \times f \times z)/n = (G \times f \times z)/n}$

When the action force of the most heavily loaded lifting is determined the choice of the type of the lifting anchor must be made. By means of the acting forces the type of the T-Slot-anchor can be determined. With the aid of the added tables can be determined which length of the T- Slot-anchor must be used dependably of the present concrete strength.
When lifting in an angle by using T-Slot-anchors no reduction is needed on the permissible load. For the vertical setting of small elements split reinforcement can be necessary by reason that the pressing force of the lifting hook will lead directly his forces into the concrete. In these cases it is good to work with the TKA-Tilt Slot-anchors.
Split reinforcement can be adjusted in the following way. The lifting clutch directly leads the pressing force to the concrete and starts approximately half way of the recess former. That is why the split reinforcement must be applied. See the drawing.





ANCHORING OF T-SLOT-ANCHORS

If the loading type of the T-Slot-anchors has been chosen, the length of the anchor has to be determined. Dependably of the form of the element and the strength of the concrete at the first loading, a T-Slot-anchor has to be chosen, which realizes a larger anchoring force than is calculated as the acting force. The admissible anchoring force is calculated with a safety factor of 2.5.
The foot of the T-Slot-anchor obtains the anchoring. At collapsing of the concrete a dish formed foot arises of the T-Slot-anchor a break out cone with an incline of 1:3. That is why those relatively small anchoring lengths will do.
In this technical documentation tables are added, to which in practice most of the situations can be filled in. It is also possible to make an exact calculation of the present situation. On request special tables can be made which fulfil the practical situation in the prefab factory or at the building site.

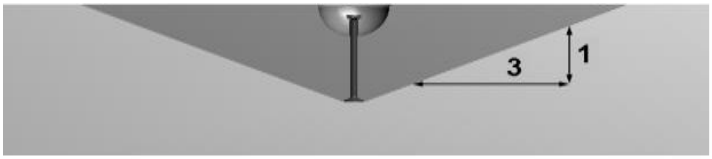
If it is possible divide elements in the groups below, than the following rule of thumb can be used. In case of inexperience with the 3D Slot-anchor system, additional information is always obtainable at “Terwa”.
Type of element:

- Beams: T-Slot-anchors with the standard length per loading type can be used.
- Horizontal plates T-Slot-anchors with a smaller length than standard can be used.
- Vertical plates T-Slot-anchors with a larger length than standard must be used.

OVERVIEW OF T-SLOT-ANCHORS LENGTHS

Loading class [kN]	Standard type T- Slot-anchor	Often used shortened T- Slot-anchor	Often used lengthened T-Slot-anchor
13	T 013-0120	T 013-0065	T 013-0240
25	T 025-0170	T 025-0085	T 025-0280
50	T 050-0240	T 050-0120	T 050-0340
75	T 075-0300	T 075-0150	T 075-0540
100	T 100-0340	T 100-0170	T 100-0680
150	T 150-0400	T 150-0210	T 150-0840
200	T 200-0500	T 200-0340	T 200-0500
320	T 320-0700	T 320-0500	T 320-1200

All deliverable types of T-Slot-anchors are mentioned in the product documentation and the pricelist and can be delivered in untreated, hot dip galvanizing or electrolytic galvanizing and stainless steel.



When calculating the admissible anchoring force, besides the length of the T-Slot-anchor, the present concrete strength is of main importance. Mostly the deforming strength is leading or the concrete strength that is realized at the first loading of the anchors. If there is any doubt about the admissible concrete force or that it is not possible to realize it, additional measurements have to be taken. For instance, the concrete force can be enlarged in the location of the T-Slot-anchor by adjusting isolation material. When you use isolation material, higher temperatures can be reached in the concrete and this gives a quicker force development.

The addition of extra reinforcement in the reinforcement nets almost never leads to improvement of the anchoring force. The anchoring force can only increase if the reinforcement is placed around and over the foot of the anchor.

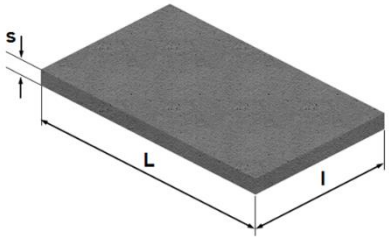
The anchoring force of the T-Slot-anchor is the biggest when the T-Slot-anchor is placed at a distance to the edge which is 3 times larger than the built in depth so that a complete break out cone can be created. If it is not possible to have an edge distance to all directions of 3 times the built in depth, a better anchoring must be obtained with the aid of a longer T-Slot-anchor. In the table, a situation is described which fulfils as well the edge distances in all directions of 3 times larger than the built in length as well the situation for which the edge distance is limited to 2 directions. With the aid of these tables a good impression can be obtained of what the real admissible force is in situations that are more or less comparable. In case of doubt, please contact “Terwa”.

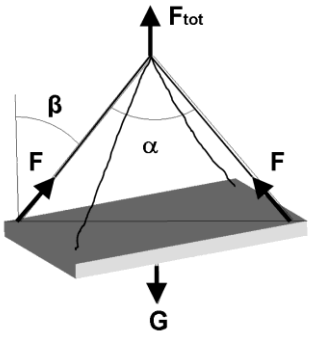
For vertical plates the possibility that a horizontal break out can occur must be taken into account. Here also the present vertical reinforcement has no effect for the anchoring force. The situation in the figure will become very critical if the thickness of the element is smaller than half the thickness of the chosen T-Slot-anchor. In this situation an additional discussion with “Terwa” is necessary.

To enlarge the vertical anchoring a hairpin can be adjusted which falls around the foot. In this situation it is also very helpful to use the TKA-Tilt Slot-anchor, an eye anchor or a rod anchor. With these lifting anchors the anchoring is obtained by a reinforcement hairpin through the eye of the anchor or by a ribbed rod.

CALCULATION EXAMPLES

Example 1: SLAB UNIT





The slab unit has the following dimensions:
$\boldsymbol{L = 5\ m}$,
$\boldsymbol{l = 2\ m}$,
$\boldsymbol{s = 0.2\ m}$

Weight $\boldsymbol{G = \rho \times V = 25 \times (5 \times 2 \times 0.2) = 50\ kN}$
Formwork area $\boldsymbol{A = L \times l = 5 \times 2 = 10\ m^2}$
Anchor number $\boldsymbol{n = 2}$

General dates:	Symbol	De-mould	Transport	Mount
Concrete strength at de-mold [MPa]		15	15	
Concrete strength on site [MPa]				35
Weight for element [kN]	G	50		
Element area in contact with formwork [m²]	A	10		
Cable angle factor at de-mold (β = 15.0°)	z	1.04	1.04	
Cable angle factor on site (β = 30.0°)	z			1.16
Dynamic coefficient at de-mold	f	1.1		
Dynamic coefficient at transport	f		1.3	
Dynamic coefficient on site	f			1.5

Adhesion to formwork factor for varnished timber formwork [kN/m²]	**q**	2		
Anchor number for de-mold	**n**	2		
Anchor number for transport at the plant	**n**		2	
Anchor number for transport on site	**n**			2

DE-MOULD AT THE PLANT:

Adhesion to formwork factor: q = 2 kN/m^2
Lifting load coefficient: f = 1.1
Cable angle factor: z = 1.04 (β = 15.0°)
Concrete strength: 15 MPa

$$F = \frac{[(G + q \times A) \times f \times z]}{n} = \frac{[(50 + 2 \times 10) \times 1.1 \times 1.04]}{2} = 40,04\ kN$$

TRANSPORT AT THE PLANT:

Dynamic coefficient: f = 1.3
Cable angle factor: z = 1.04 (β = 15.0°)
Concrete strength: 15 MPa

$$F = \frac{G \times f \times z}{n} = \frac{50 \times 1.3 \times 1.04}{2} = 33,80\ kN$$

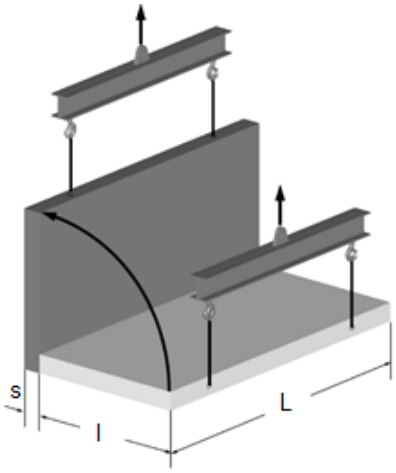
TRANSPORT AT SITE:

Dynamic coefficient: f = 1.5
Cable angle factor: z = 1.16 (β = 30.0°)
Concrete strength: 35 MPa

$$F = \frac{G \times f \times z}{n} = \frac{50 \times 1.5 \times 1.16}{2} = 43,50\ kN$$

An anchor in the **50 kN** range is required.

Example 2: WALL PANEL



The wall panel has the following dimensions:
$L = 6\ m$,
$l = 2\ m$,
$s = 0.18\ m$

Weight $G = \rho \times V = 25 \times (6 \times 2 \times 0.18) = 54\ kN$
Formwork area $A = L \times l = 6 \times 2 = 12\ m^2$
Anchor number $n = 2$

General dates:	**Symbol**	**De-mould**	**Tilting**	**Mount**
Concrete strength at de-mold [MPa]		15	15	
Concrete strength on site [MPa]				45
Weight for element [kN]	**G**	54		
Element area in contact with formwork [m²]	**A**	12		
Cable angle factor at de-mold (β = 0,0°)	**z**	1.0		
Cable angle factor at tilting (β = 0.0°)	**z**		1.0	
Cable angle factor on site (β = 30°)	**z**			1.16

Dynamic coefficient at de-mold	**f**	1.1		
Dynamic coefficient at tilting	**f**		1.3	
Dynamic coefficient on site	**f**			1.3
Adhesion factor for oiled steel formwork [kN/m²]	**q**	1.0		
Anchor number for de-mold	**n**	4		
Anchor number at tilting	**n**		2	
Anchor number for transport on site	**n**			2

DE-MOULD / TILT-UP AT THE PLANT:

Adhesion to formwork factor: q = 1 kN/m^2
Lifting load coefficient: f = 1.1
Cable angle factor: z = 1.04 (β = 15.0°)
Concrete strength: 15 MPa

$$F = \frac{[(G/2 + q \times A) \times f \times z]}{n} = \frac{[(54/2 + 1 \times 12) \times 1.1 \times 1]}{2} = 21,45\ kN$$

TRANSPORT AT THE PLANT:

Dynamic coefficient: f = 1.3
Cable angle factor: z = 1 (β = 0°)
Concrete strength: 15 MPa

$$F = \frac{G \times f \times z}{n} = \frac{54 \times 1.3 \times 1}{2} = 35,1\ kN$$

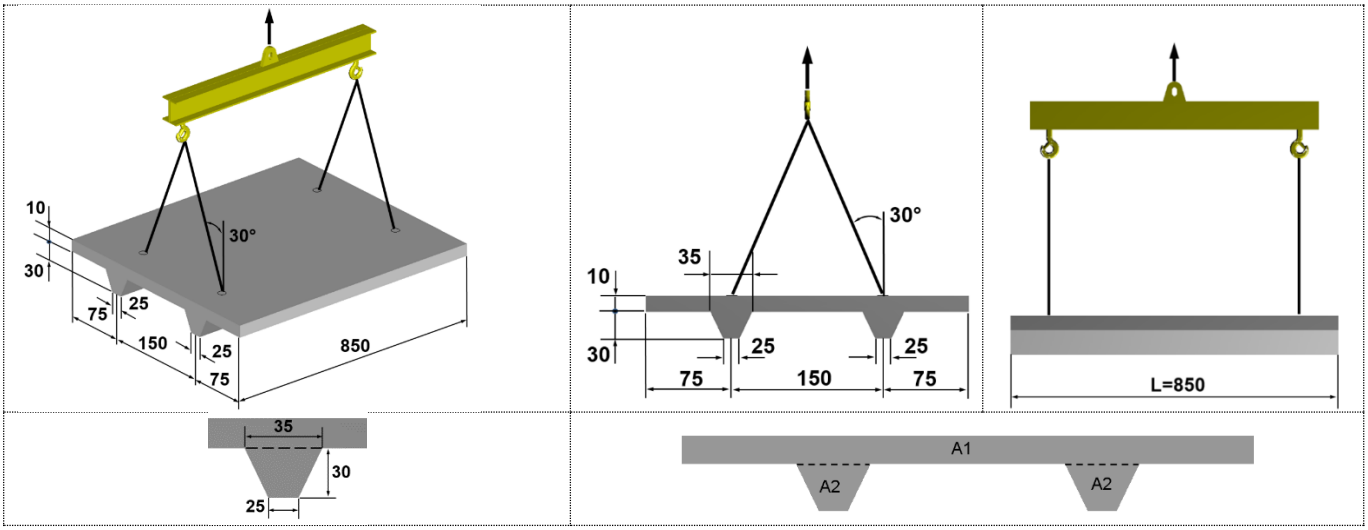
TRANSPORT AT SITE:

Dynamic coefficient: f = 1.3
Cable angle factor: z = 1.16 (β = 30.0°)
Concrete strength: 35 MPa

$$F = \frac{G \times f \times z}{n} = \frac{54 \times 1.3 \times 1.16}{2} = 40,72\ kN$$

Two anchors embedded on lateral side, **TKA type in the 50 kN range** are required. For tilting, additional reinforcement will be added (see page 30).

Example 3: DOUBLE-T BEAM



NOTE: Dimensions are in cm

General dates:	**Symbol**	**De-mould**	**Transport**
Concrete strength at de-mould and transport [MPa]		25	25
Weight for element [kN]	**G**	102	
Formwork area [m²]	**A**	35.8	

Cable angle factor at de-mould (ß = 30.0°)	**z**	1.16	
Cable angle factor on site (ß = 30.0°)	**z**		1.16
Lifting load coefficient at de-mould	**f**	1.0	
Lifting load coefficient at transport	**f**		1.3
Anchor number for de-mould and transport	**n**	4	4

Load capacity when lifting and transporting at the manufacturing plant.

Concrete strength when de-mould	≥ 25 MPa
Cable angle factor	z = 1.16 (ß = 30,0°)
Lifting load coefficient when transporting	f = 1.3
Lifting load coefficient when de-mould	f = 1.0
Anchor number	n = 4

$G = V\ x\ \rho = (A\ x\ L) x\ \rho = (A1 + A2\ x\ 2)\ x\ L\ \ x\ \rho = (0.1\ x\ 3 + 0.09\ x\ 2)\ x\ 8.5\ x\ 25 = 102\ kN$
L = 8.5 m
$A1 = 0.1\ x\ 3$ (m²)
$A2 = [(35 + 25)\ x\ 30]\ /2$ (cm²)
$A2 = [(0.35 + 0.25) x\ 0.3\ /2 = \ (0.6\ \ x\ 0.3)/2 = 0.09$ (m²)
Weight: $G = 102\ kN$
Adhesion to mould Ha = $2\ x\ G = 204\ kN$
Total load $F_{tot} = G\ + Ha = 102 + 204 = 306\ kN$

LOAD PER ANCHOR WHEN DE-MOULD:

$$\boldsymbol{F = \frac{Ftot\ x\ f\ x\ z}{n} = \frac{[(G + Ha) x\ f\ x\ z]}{n} = \frac{306\ x\ 1.0\ x\ 1.16}{4} = 88.74\ kN}$$

LOAD PER ANCHOR WHEN TRANSPORTING:

$$\boldsymbol{F = \frac{Ftot\ x\ f\ x\ z}{n} = \frac{G\ x\ f\ x\ z}{n} = \frac{102\ x\ 1.3\ x\ 1.16}{4} = 38.46\ kN}$$

An anchor in the 100 kN range is required (> 88.74 kN)

LIFTING ANCHORS

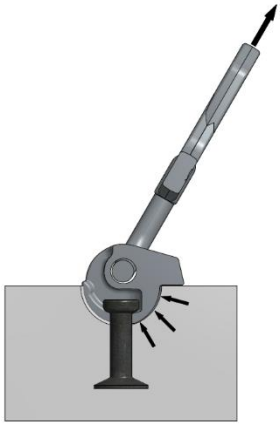
T – SLOT ANCHOR

BASIC PRINCIPLES FOR ANCHOR SELECTION

The T Slot Anchors are forged from round steel and are designed to a load force in the range of 13kN to 320kN. Proper for large precast elements such as slabs, beams, panels, pipes. Anchors from 13 kN to 320 kN are made from S355J2 steel and the 450 kN anchors are made from alloyed steel 42CrMo4 (w1.7225-EN-10083-1). In the same load group, anchors are available with different lengths. Longer anchors are installed for reduced edge spacing or for low concrete strengths. The load on the anchor is transmitted to the concrete through the anchor foot.

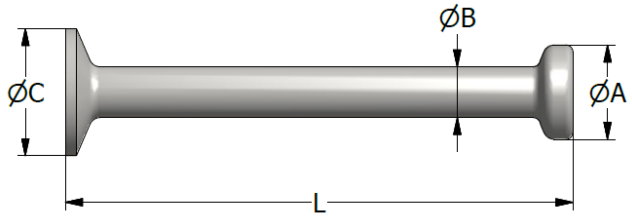
13 kN to 450 kN

Load transfer to the anchor foot



Angled lifting

The anchors must be fixed in the mould using recess formers. The recess former retains the anchor securely in position during the concrete pour. The recess former creates a void around the anchor head which corresponds to the lifting system head (shackle). The incorrect coupling of parts of different load groups is impossible. Another advantage is that the shackle rests against the concrete during angled pull and therefore the horizontal load is transferred into the concrete directly. For this reason additional reinforcement is not required in large units. In thin walls, additional reinforcement is necessary for angled lift, to absorb the transverse pulling forces.



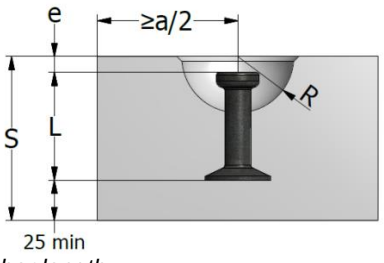
T slot black		T slot - hot dip galvanized		T slot stainless steel 1.4301 (AISI 304)		Load group	L	ØA	ØB	ØC
Description	Prod. No.	Description	Prod. No.	Description	Prod. No.	kN	mm	mm	mm	mm
Load group lifting clutch 13 kN										
T-013-0035	43795	T-013-0035-TV	43796	T-013-0035-SS2	44395	13	35	19	10	25
T-013-0040	43177	T-013-0040-TV	43178	T-013-0040-SS2	44405	13	40	19	10	25
T-013-0050	43180	T-013-0050-TV	43181	T-013-0050-SS2	43179	13	50	19	10	25
T-013-0055	43182	T-013-0055-TV	43183	T-013-0055-SS2	44406	13	55	19	10	25
T-013-0065	43184	T-013-0065-TV	43185	T-013-0065-SS2	43186	13	65	19	10	25
T-013-0085	43187	T-013-0085-TV	43188	T-013-0085-SS2	43189	13	85	19	10	25
T-013-0120	43190	T-013-0120-TV	43191	T-013-0120-SS2	43192	13	120	19	10	25
T-013-0240	43193	T-013-0240-TV	43194	T-013-0240-SS2	44407	13	240	19	10	25

T slot black		T slot - hot dip galvanized		T slot stainless steel 1.4301 (AISI 304)		Load group	L	ØA	ØB	ØC
Description	Prod. No.	Description	Prod. No.	Description	Prod. No.	kN	mm	mm	mm	mm
Load group lifting clutch 25 kN										
T-025-0045	43808	T-025-0045-TV	43809	T-025-0045-SS2	44408	25	45	26	14	35
T-025-0055	43195	T-025-0055-TV	43196	T-025-0055-SS2	44409	25	55	26	14	35
T-025-0065	43197	T-025-0065-TV	43198	T-025-0065-SS2	/	25	65	26	14	35
T-025-0070	43199	T-025-0070-TV	43200	T-025-0070-SS2	/	25	70	26	14	35
T-025-0085	43201	T-025-0085-TV	43202	T-025-0085-SS2	43203	25	85	26	14	35
T-025-0100	43204	T-025-0100-TV	43205	T-025-0100-SS2	/	25	100	26	14	35
T-025-0120	43206	T-025-0120-TV	43207	T-025-0120-SS2	43208	25	120	26	14	35
T-025-0140	43209	T-025-0140-TV	43817	T-025-0140-SS2	/	25	140	26	14	35
T-025-0170	43210	T-025-0170-TV	43211	T-025-0170-SS2	43212	25	170	26	14	35
T-025-0210	43820	T-025-0210-TV	44960	T-025-0210-SS2	/	25	210	26	14	35
T-025-0240	44961	T-025-0240-TV	44962	T-025-0240-SS2	/	25	240	26	14	35
T-025-0280	43213	T-025-0280-TV	43214	T-025-0280-SS2	/	25	280	26	14	35
Load group lifting clutch 50 kN										
T-050-0055	43536	T-050-0055-TV	/	T-050-0055-SS2	/	50	55	36	20	50
T-050-0065	43215	T-050-0065-TV	43216	T-050-0065-SS2	/	50	65	36	20	50
T-050-0075	43217	T-050-0075-TV	43218	T-050-0075-SS2	/	50	75	36	20	50
T-050-0080	43219	T-050-0080-TV	43220	T-050-0080-SS2	/	50	80	36	20	50
T-050-0085	43834	T-050-0085-TV	43221	T-050-0085-SS2	60235	50	85	36	20	50
T-050-0095	43222	T-050-0095-TV	43223	T-050-0095-SS2	/	50	95	36	20	50
T-050-0110	43224	T-050-0110-TV	43835	T-050-0110-SS2	/	50	110	36	20	50
T-050-0120	43225	T-050-0120-TV	43226	T-050-0120-SS2	43227	50	120	36	20	50
T-050-0140	43228	T-050-0140-TV	43836	T-050-0140-SS2	/	50	140	36	20	50
T-050-0150	43837	T-050-0150-TV	43838	T-050-0150-SS2	/	50	150	36	20	50
T-050-0160	43229	T-050-0160-TV	43230	T-050-0160-SS2	/	50	160	36	20	50
T-050-0170	46267	T-050-0170-TV	48684	T-050-0170-SS2	/	50	170	36	20	50
T-050-0180	43231	T-050-0180-TV	43232	T-050-0180-SS2	43233	50	180	36	20	50
T-050-0210	43234	T-050-0210-TV	43235	T-050-0210-SS2	/	50	210	36	20	50
T-050-0240	43236	T-050-0240-TV	43237	T-050-0240-SS2	43238	50	240	36	20	50
T-050-0340	43239	T-050-0340-TV	43240	T-050-0340-SS2	/	50	340	36	20	50
T-050-0480	43839	T-050-0480-TV	43840	T-050-0480-SS2	/	50	480	36	20	50
T-050-0680	43604	T-050-0680-TV	46342	T-050-0680-SS2	/	50	680	36	20	50
Load group lifting clutch 100 kN										
T-075-0085	43241	T-075-0085-TV	43841	T-075-0085-SS2	/	75	85	46	24	60
T-075-0095	43242	T-075-0095-TV	43243	T-075-0095-SS2	/	75	95	46	24	60
T-075-0100	47482	T-075-0100-TV	43626	T-075-0100-SS2	/	75	100	46	24	60
T-075-0120	43244	T-075-0120-TV	43245	T-075-0120-SS2	43246	75	120	46	24	60
T-075-0140	43842	T-075-0140-TV	43973	T-075-0140-SS2	/	75	140	46	24	60
T-075-0150	43247	T-075-0150-TV	43248	T-075-0150-SS2	/	75	150	46	24	60
T-075-0160	43249	T-075-0160-TV	43250	T-075-0160-SS2	/	75	160	46	24	60
T-075-0165	43251	T-075-0165-TV	43252	T-075-0165-SS2	60537	75	165	46	24	60
T-075-0170	43253	T-075-0170-TV	43974	T-075-0170-SS2	/	75	170	46	24	60
T-075-0200	43254	T-075-0200-TV	43255	T-075-0200-SS2	/	75	200	46	24	60
T-075-0240	44963	T-075-0240-TV	44964	T-075-0240-SS2	/	75	240	46	24	60
T-075-0280	48043	T-075-0280-TV	48044	T-075-0280-SS2	/	75	280	46	24	60
T-075-0300	43256	T-075-0300-TV	43257	T-075-0300-SS2	43258	75	300	46	24	60
T-075-0540	43259	T-075-0540-TV	43260	T-075-0540-SS2	/	75	540	46	24	60
T-075-0680	43843	T-075-0680-TV	43844	T-075-0680-SS2	/	75	680	46	24	60
Load group lifting clutch 100 kN										
T-100-0085	43261	T-100-0085-TV	43262	T-100-0085-SS2	/	100	85	46	28	70
T-100-0090	/	T-100-0090-TV	43263	T-100-0090-SS2	/	100	90	46	28	70
T-100-0100	43264	T-100-0100-TV	43845	T-100-0100-SS2	/	100	100	46	28	70
T-100-0110	43265	T-100-0110-TV	46269	T-100-0110-SS2	/	100	110	46	28	70
T-100-0115	43266	T-100-0115-TV	43267	T-100-0115-SS2	43268	100	115	46	28	70
T-100-0120	43269	T-100-0120-TV	43270	T-100-0120-SS2	/	100	120	46	28	70
T-100-0135	43271	T-100-0135-TV	43272	T-100-0135-SS2	60134	100	135	46	28	70
T-100-0140	43847	T-100-0140-TV	/	T-100-0140-SS2	/	100	140	46	28	70
T-100-0150	43273	T-100-0150-TV	43274	T-100-0150-SS2	/	100	150	46	28	70

T slot black		T slot - hot dip galvanized		T slot stainless steel 1.4301 (AISI 304)		Load group	L	ØA	ØB	ØC
Description	Prod. No.	Description	Prod. No.	Description	Prod. No.	kN	mm	mm	mm	mm
T-100-0170	43275	T-100-0170-TV	43276	T-100-0170-SS2	43277	100	170	46	28	70
T-100-0200	43848	T-100-0200-TV	44965	T-100-0200-SS2	/	100	200	46	28	70
T-100-0220	43278	T-100-0220-TV	43849	T-100-0220-SS2	/	100	220	46	28	70
T-100-0250	43279	T-100-0250-TV	43280	T-100-0250-SS2	60087	100	250	46	28	70
T-100-0340	43281	T-100-0340-TV	43282	T-100-0340-SS2	43283	100	340	46	28	70
T-100-0500	43514	T-100-0500-TV	/	T-100-0500-SS2	/	100	500	46	28	70
T-100-0540	47481	T-100-0540-TV	/	T-100-0540-SS2	/	100	540	46	28	70
T-100-0650	43284	T-100-0650-TV	43850	T-100-0650-SS2	/	100	650	46	28	70
T-100-0680	43285	T-100-0680-TV	43286	T-100-0680-SS2	/	100	680	46	28	70
T-100-1300	45168	T-100-1300-TV	/	T-100-1300-SS2	/	100	1300	46	28	70
Load group lifting clutch 200 kN										
T-150-0140	43851	T-150-0140-TV	43852	T-150-0140-SS2	/	150	140	70	38	80
T-150-0150	43853	T-150-0150-TV	43854	T-150-0150-SS2	/	150	150	70	38	80
T-150-0165	43287	T-150-0165-TV	43288	T-150-0165-SS2	/	150	165	70	38	80
T-150-0170	43855	T-150-0170-TV	/	T-150-0170-SS2	/	150	170	70	38	80
T-150-0200	43856	T-150-0200-TV	43857	T-150-0200-SS2	60133	150	200	70	38	80
T-150-0210	43289	T-150-0210-TV	43290	T-150-0210-SS2	/	150	210	70	38	80
T-150-0300	43291	T-150-0300-TV	43292	T-150-0300-SS2	/	150	300	70	38	80
T-150-0400	43293	T-150-0400-TV	43294	T-150-0400-SS2	/	150	400	70	38	80
T-150-0840	43295	T-150-0840-TV	43296	T-150-0840-SS2	/	150	840	70	38	80
Load group lifting clutch 200 kN										
T-200-0100	44927	T-200-0100-TV	/	T-200-0100-SS2	/	200	100	70	40	98
T-200-0165	43858	T-200-0165-TV	43297	T-200-0165-SS2	/	200	165	70	40	98
T-200-0170	47256	T-200-0170-TV	/	T-200-0170-SS2	/	200	170	70	40	98
T-200-0200	43298	T-200-0200-TV	44966	T-200-0200-SS2	/	200	200	70	40	98
T-200-0240	43859	T-200-0240-TV	/	T-200-0240-SS2	/	200	240	70	40	98
T-200-0250	43299	T-200-0250-TV	43300	T-200-0250-SS2	/	200	250	70	40	98
T-200-0340	43301	T-200-0340-TV	43302	T-200-0340-SS2	/	200	340	70	40	98
T-200-0500	43303	T-200-0500-TV	43304	T-200-0500-SS2	/	200	500	70	40	98
T-200-1000	43305	T-200-1000-TV	43515	T-200-1000-SS2	/	200	1000	70	40	98
Load group lifting clutch 320 kN										
T-320-0175	46268	T-320-0175-TV	/	T-320-0175-SS2	/	320	175	88	50	135
T-320-0280	43516	T-320-0280-TV	43306	T-320-0280-SS2	/	320	280	88	50	135
T-320-0320	46086	T-320-0320-TV	46087	T-320-0320-SS2	/	320	320	88	50	135
T-320-0500	43517	T-320-0500-TV	43307	T-320-0500-SS2	/	320	500	88	50	135
T-320-0700	43518	T-320-0700-TV	43308	T-320-0700-SS2	/	320	700	88	50	135
T-320-1200	43519	T-320-1200-TV	43309	T-320-1200-SS2	/	320	1200	88	50	135
Load group lifting clutch 450 kN										
T-450-0280	44567	T-450-0280-TV	44571	T-450-0280-SS2	/	450	280	88	50	135
T-450-0500	44568	T-450-0500-TV	44572	T-450-0500-SS2	/	450	500	88	50	135
T-450-0700	44569	T-450-0700-TV	44573	T-450-0700-SS2	/	450	700	88	50	135
T-450-1200	45846	T-450-1200-TV	45847	T-450-1200-SS2	/	450	1200	88	50	135

T- anchors are available in three variants: shot blasting, hot dip galvanized (TV) or stainless steel (SS2) on request.

Type T Anchor	Load Group	"R"	"e"
Description	[kN]	[mm]	[mm]
T-013-XXXX	13	30	10
T-025-XXXX	25	37	11
T-050-XXXX	50	47	15
T-075-XXXX	75	59	15
T-100-XXXX	100	59	15
T-150-XXXX	150	80	15
T-200-XXXX	200	80	15
T-320-XXXX	320	102	23
T-450-XXXX	450	102	23

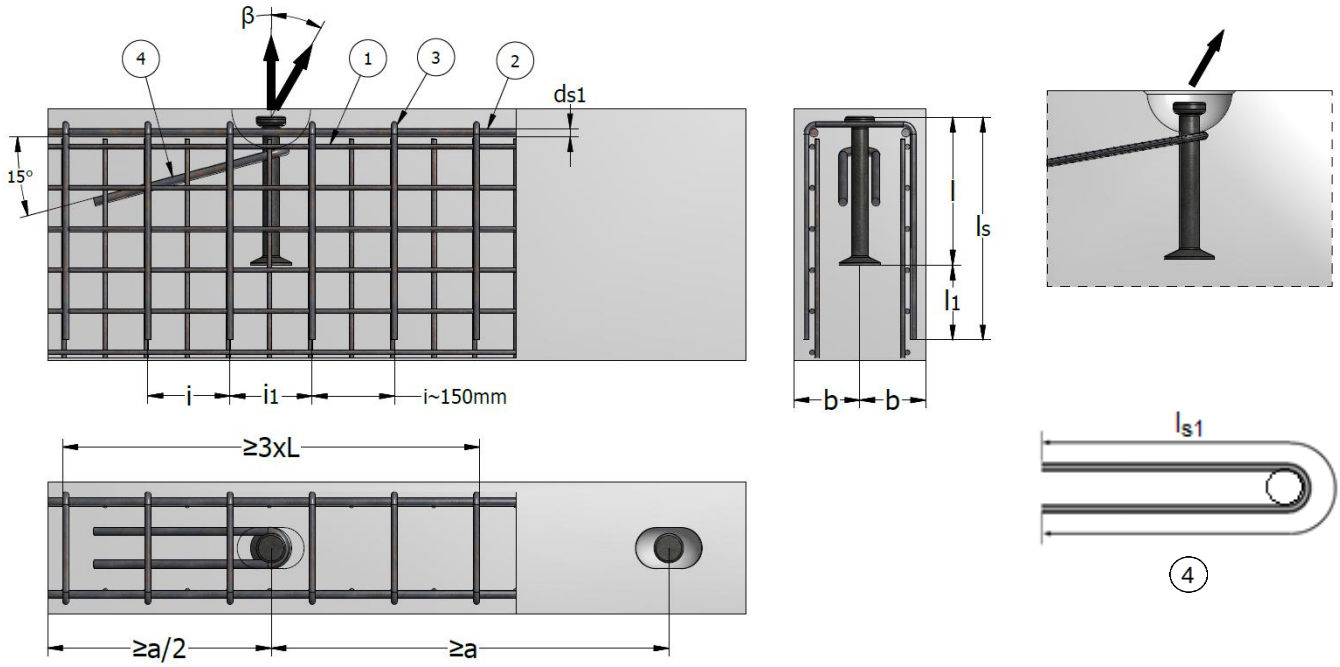


- *L = anchor length*
- *a/2 = edge distance*
- *e = cover to anchor head*
- *R = recess radius*

T-ANCHOR – INSTALATION AND REINFORCEMENT

REINFORCEMENT USED IN ANCHOR ZONE FOR ANGLED LIFT IN PANELS OR BEAMS

For angled pull it is required an additional reinforcement installed in opposite direction of the load. It is recommended to install this angle pull reinforcement as close as possible under the recess former and with full contact to the anchor.
The additional reinforcements necessary in the anchor zone for lifting the panels and beams at angles ß ≤ 45° are shown in the figures bellow and table 12, the concrete strength must be at least 15 MPa. It is recommended that the angle ß, where possible, should not exceed 30 °.

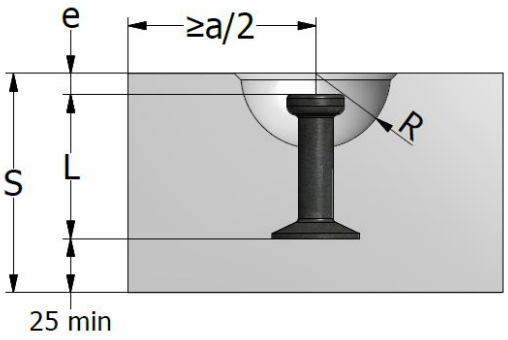


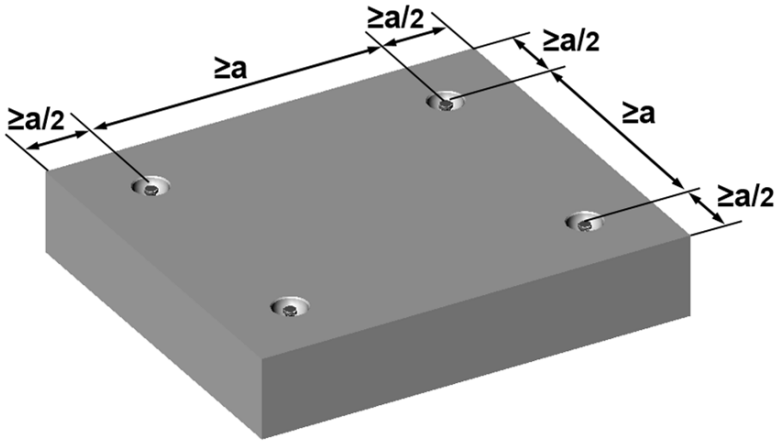
Note:

The bending radius will be established considering the EN 1992.
The diagonal reinforcement must be placed as close as possible under the recess former and installed in contact with the lifting anchor.
The reinforced zone must be ≥ 3 × anchor lenght "L". Those two stirrups in the vicinity of the anchor should be installed as close as possible to the recess former.
Length $l_s = l_1$ +Anchor length
The dimensions in pictures are in [mm]

Type of anchor	Load Group	Mesh reinforcement ①	Edge reinforcement B500B (both sides) ②	Stirrups - B500B ③						Angled pull reinforcement B500B ④
				Axial pull β < 30°			Angled pull β > 30° max. 45°			
			d_{s1}	Number of stirrups	„d"	„l_1"	Number of stirrups	„d"	„l_1"	Ø x l_{s1}
Symbol	[kN]	[mm²/m]	[mm]	[pcs]	[mm]	[mm]	[pcs]	[mm]	[mm]	[mm]
T-013-0xxx	13	2 x 60	Ø 10	≥ 2	Ø6	300	≥ 2	Ø6	450	Ø8 x 800
T-025-0xxx	25	2 x 100	Ø 10	≥ 2	Ø8	600	≥ 4	Ø8	600	Ø10 x 1500
T-050-0xxx	50	2 x 140	Ø 12	≥ 2	Ø10	750	≥ 4	Ø10	750	Ø16 x 2000
T-075-0xxx	75	2 x 160	Ø 12	≥ 4	Ø10	750	≥ 6	Ø10	750	Ø16 x 2300
T-100-0xxx	100	2 x 180	Ø 12	≥ 4	Ø10	750	≥ 8	Ø10	750	Ø20 x 2600
T-150-0xxx	150	2 x 240	Ø 16	≥ 4	Ø12	800	≥ 6	Ø12	1000	Ø25 x 3000
T-200-0xxx	200	2 x 350	Ø 16	≥ 6	Ø12	1000	≥ 10	Ø12	1000	2 x Ø25 x 3400
T-320-0xxx	320	2 x 400	Ø 16	≥ 8	Ø12	1000	≥ 10	Ø14	1100	2 x Ø25 x 3400
T-450-0xxx	450	2 x 500	Ø 20	≥ 10	Ø14	1400	≥ 12	Ø14	1450	2 x Ø25 x 3400

INSTALLATION OF T- ANCHOR IN SLABS





L = anchor length
a/2 = edge distance
e = cover to anchor head
R = recess radius

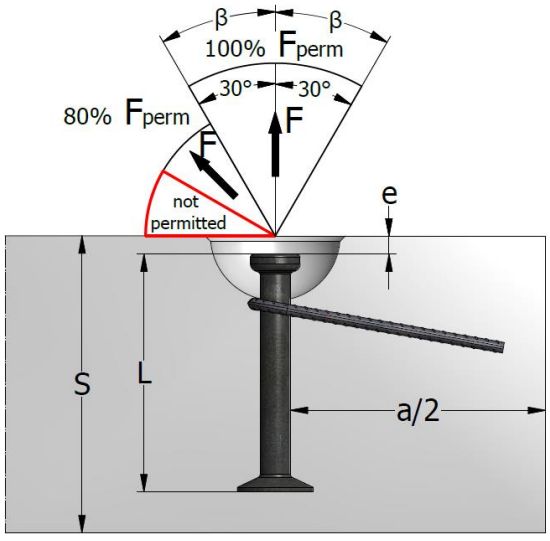
For slab units or de-mould of panels the edge distance of the "T" anchor (a) is: ***a/2 = 3 x (L + e)***

Required reinforcement

- **Mesh reinforcement -** (1)
- **Angled pull reinforcement -** (4)

T- ANCHOR – LOAD CAPACITY IN SLABS FOR ANY DIRECTION OF PULL							
Type of anchor	Load group	Minimum thickness	Load capacity for minimal thickness				Minimum spacing between anchors
			Axial pull $\beta < 30°$	Angled pull $\beta < 45°$	Axial pull and angled pull $\beta < 45°$		
		s	$f_{cu} \geq 15$ MPa	$f_{cu} \geq 15$ MPa	$f_{cu} \geq 25$ MPa	$f_{cu} \geq 35$ MPa	a
	[kN]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]
T-013-0040	13	75	3.0	2.4	3.9	4.6	180
T-013-0050		85	10.1	10.1	13.0	13.0	220
T-013-0065		100	13.0	11.1			260
T-013-0085		120		13.0			315
T-013-0120		155					375
T-025-0055	25	90	4.7	3.8	6.1	7.2	240
T-025-0065		100	13.8	13.8	7.2	21.1	285
T-025-0085		120	19.5	19.5	17.8	25.0	325
T-025-0120		155	25.0	22.8	25.0		410
T-025-0170		205		25.0			520
T-050-0085	50	125	20.1	20.1	26.0	30.8	360
T-050-0095		135	23.3	23.3	30.0	35.5	400
T-050-0120		160	31.7	31.7	41.0	48.5	475
T-050-0180		220	50.0	44.4	50.0	50.0	630
T-050-0240		280		50.0			735
T-075-0100	75	140	24.5	24.5	31.6	37.4	415
T-075-0120		160	31.3	31.3	40.4	47.8	490
T-075-0140		180	38.6	38.6	49.9	59.0	550
T-075-0165		205	48.6	48.6	62.7	74.2	620
T-075-0200		240	63.8	60.0	75.0	75.0	710
T-075-0300		340	75.0	75.0			910

T- ANCHOR – LOAD CAPACITY IN SLABS FOR ANY DIRECTION OF PULL							
Type of anchor	Load group	Minimum thickness	Load capacity for minimal thickness				Minimum spacing between anchors
			Axial pull $\beta < 30°$	Angled pull $\beta < 45°$	Axial pull and angled pull $\beta < 45°$		
		s	$f_{cu} \geq 15$ MPa	$f_{cu} \geq 15$ MPa	$f_{cu} \geq 25$ MPa	$f_{cu} \geq 35$ MPa	a
	[kN]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]
T-100-0115	100	155	29.1	29.2	37.5	44.4	470
T-100-0135		175	36.3	36.3	46.8	55.4	550
T-100-0150		190	42.0	42.0	54.3	64.2	590
T-100-0170		210	50.2	50.2	64.8	76.6	655
T-100-0200		240	63.2	63.2	81.7	96.6	730
T-100-0250		290	87.3	80.0	100.0	100.0	1020
T-100-0340		380	100.0	100.0	100.0	100.0	1195
T-150-0140	150	180	37.5	37.5	48.6	57.2	560
T-150-0165		205	47.3	47.3	61.1	72.3	640
T-150-0200		240	62.4	62.4	80.6	95.3	730
T-150-0300		340	113.0	113.0	145.8	150.0	1020
T-150-0400		440	150.0	138.6	150.0	150.0	1195
T-200-0200	200	240	61.6	61.6	79.5	94.1	780
T-200-0240		280	80.5	80.5	103.9	122.9	900
T-200-0340		380	134.9	134.9	174.2	200.0	1175
T-200-0500		540	200.0	192.6	200.0	200.0	1485
T-320-0200	320	248	62.4	62.4	80.5	95.3	800
T-320-0250		298	86.4	86.4	111.5	132.0	1000
T-320-0280		328	102.1	102.1	131.8	155.9	1065
T-320-0320		368	124.4	124.4	160.6	190.0	1120



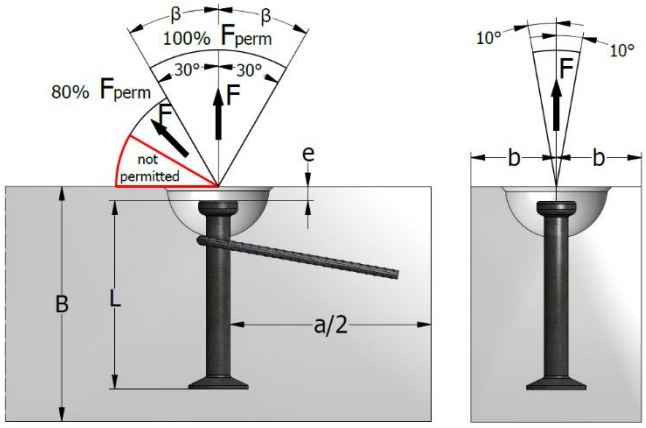
- ***Angled pull of 30° ≤ β ≤ 45° without angled pull reinforcement is only allowed for:***

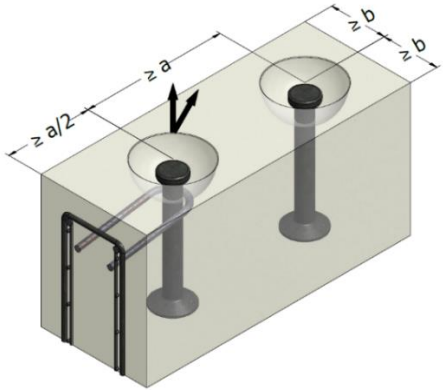
- *$f_{cu} \geq 15$ MPa + 3 times min. edge distance a/2*
- *$f_{cu} \geq 25$ MPa + 2.5 times min. edge distance a/2*
- *$f_{cu} \geq 35$ MPa + 2 times min. edge distance a/2*

- ***Angled pull with cables/chains spread of β > 45° is not permitted***

INSTALLATION OF T- ANCHOR IN BEAMS AND WALLS

LOAD CAPACITY IN BEAMS AND WALLS WITHOUT SPECIAL REINFORCEMENTS





The angled pull reinforcement must be mounted opposite the direction of the load
The diagonal reinforcement must be placed as close as possible under the recess former and installed in contact with the lifting anchor.

NOTES:

Required reinforcement (*see page 16*)

- **Mesh reinforcement - (1)**
- **Angled pull reinforcement - (4)**

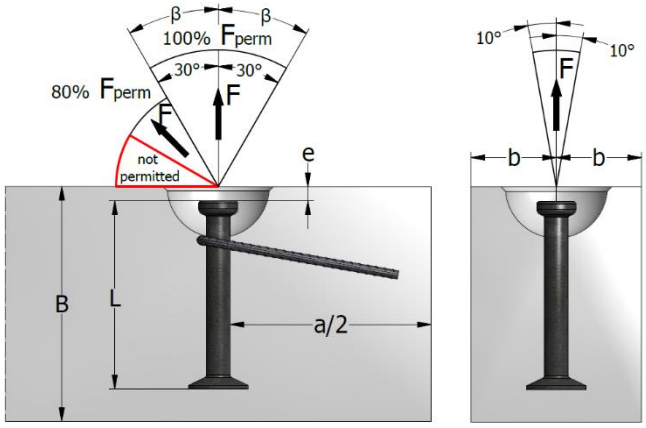
- ***Angled pull of 30° ≤ β ≤ 45° without angled pull reinforcement is only allowed for:***
  - *f_{cu} ≥ 15 MPa + 3 times min. edge distance a/2*
  - *f_{cu} ≥ 25 MPa + 2.5 times min. edge distance a/2*
  - *f_{cu} ≥ 35 MPa + 2 times min. edge distance a/2*
- ***Angled pull with cables/chains spread of β > 45° is not permitted***

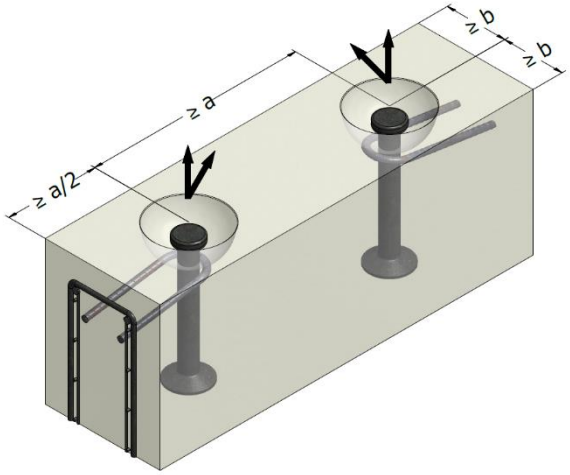
T- ANCHOR – LOAD CAPACITY IN BEAMS AND WALLS WITHOUT SPECIAL REINFORCEMENTS

Type of anchor	Load group	Minimum height of beams	Wall thickness	Load capacity				Spacing between anchors
				Axial pull β < 30°	Angled pull β < 45°	Axial pull and angled pull β < 45°		
		B	2 x b	f_{cu} ≥ 15 MPa	f_{cu} ≥ 15 MPa	f_{cu} ≥ 25 MPa	f_{cu} ≥ 35 MPa	a
	[kN]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]
T-013-0085	13	180	100	12.2	9.8	13.0	13.0	270
			120	13.0	11.2			
			140	13.0	12.5			
T-013-0120		250	80	13.0	10.7	13.0	13.0	375
			100	13.0	12.7			
			120	13.0	13.0			
T-013-0240		490	60	9.9	9.9	12.7	13.0	735
			80	13.0	13.0	13.0		
			100	13.0	13.0	13.0		
T-025-0120	25	250	120	18.1	14.5	23.3	25.0	375
			140	20.3	16.2	25.0		
			160	22.4	17.9	25.0		
T-025-0170		350	100	20.7	16.5	25.0	25.0	525
			120	23.7	19.0	25.0		
			140	25.0	21.3	25.0		
T-025-0280		570	80	18.4	18.4	23.8	25.0	855
			100	23.0	23.0	25.0		
			120	25.0	25.0	25.0		
T-050-0240	50	490	200	45.7	36.5	50.0	50.0	735
			220	49.1	39.2			
			240	50.0	41.9			
T-050-0340		690	160	50.0	40.6	50.0	50.0	1035
			180	50.0	44.4			
			200	50.0	48.0			
T-050-0480		970	140	46.1	46.1	50.0	50.0	1455
			160	50.0	50.0			
			180	50.0	50.0			

T- ANCHOR – LOAD CAPACITY IN BEAMS AND WALLS WITHOUT SPECIAL REINFORCEMENTS								
Type of anchor	Load group	Minimum height of beams	Wall thickness	Load capacity				Spacing between anchors
				Axial pull $\beta < 30°$	Angled pull $\beta < 45°$	Axial pull and angled pull $\beta < 45°$		
		B	2 x b	$f_{cu} \geq 15$ MPa 	$f_{cu} \geq 15$ MPa 	$f_{cu} \geq 25$ MPa 	$f_{cu} \geq 35$ MPa 	a
	[kN]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]
T-075-0200	75	410	240	45.1	36.0	58.2	68.8	610
			260	47.8	38.3	61.8	73.1	
			280	50.6	40.5	65.3	75.0	
T-075-0300		610	200	54.1	43.3	69.9	75.0	910
			220	58.1	46.5	75.0		
			240	62.2	49.7	75.0		
T-075-0540		1090	160	63.2	58.4	75.0	75.0	1630
			180	71.1	63.8			
			200	75.0	69.1			
T-100-0170	100	340	300	46.4	37.2	60.0	70.9	520
			350	52.1	41.7	67.3	79.6	
			400	57.6	46.1	74.4	88.0	
T-100-0340		680	280	76.6	61.3	98.9	100.0	1030
			300	80.7	64.5	100.0		
			320	84.7	67.7	100.0		
T-100-0680		1360	160	73.7	70.0	95.2	100.0	2050
			180	83.0	76.5	100.0		
			200	92.2	82.8	100.0		
T-150-0300	150	600	350	81.3	65.0	104.9	124.2	900
			400	89.5	71.9	116.0	137.2	
			500	106.2	85.0	137.1	150.0	
T-150-0400		800	350	102.5	82.0	132.3	150.0	1200
			400	113.2	90.6	146.2		
			450	123.7	99.0	150.0		
T-150-0840		1680	300	150.0	132.5	150.0	150.0	2520
			340	150.0	145.5			
			380	150.0	150.0			
T-200-0340	200	670	500	116.6	93.3	150.6	178.2	1010
			750	158.1	126.5	200.0	200.0	
			1000	196.2	156.9	200.0	200.0	
T-200-0500		990	400	134.8	107.9	174.1	200.0	1490
			500	159.4	127.5	200.0		
			600	182.8	146.2	200.0		
T-200-1000		1990	240	154.9	128.6	200.0	200.0	3000
			300	190.0	152.0	200.0		
			330	200.0	163.2	200.0		
T-320-0320	320	630	600	126.7	101.3	163.5	193.5	940
			800	157.2	125.7	2029	240.1	
			1200	177.2	141.8	228.8	270.1	
T-320-0700		1390	500	208.6	166.9	269.4	318.7	2080
			600	239.2	191.4	308.8	320.0	
			750	282.8	226.2	320.0	320.0	
T-320-1200		2390	400	272.5	218.0	320.0	320.0	3580
			450	297.7	238.2			
			500	320.0	257.8			
T-450-0500	450	990	800	226.0	180.8	291.8	345.3	1480
			1000	267.2	213.8	345.0	408.2	
			1500	358.4	286.7	450.0	450.0	
T-450-1200		2400	500	322.2	257.8	416.0	450	3580
			600	369.4	295.5	450.0		
			750	436.7	349.4	450.0		

LOAD CAPACITY IN WALLS WITH ADDITIONAL REINFORCEMENTS





The angled pull reinforcement must be mounted opposite the direction of the load
The diagonal reinforcement must be placed as close as possible under the recess former and installed in contact with the lifting anchor.

NOTES:

Required reinforcement (*see page 16*)

- **Mesh reinforcement -** (1)
- **Edge reinforcement -** (2)
- **Stirrups -** (3)
- **Angled pull reinforcement -** (4)

- ***Angled pull of 30° ≤ β ≤ 45° without angled pull reinforcement is only allowed for:***
  - *f_{cu} ≥ 15 MPa + 3 times min. edge distance a/2*
  - *f_{cu} ≥ 25 MPa + 2.5 times min. edge distance a/2*
  - *f_{cu} ≥ 35 MPa + 2 times min. edge distance a/2*
- ***Angled pull with cables/chains spread of β > 45° is not permitted***

T- ANCHOR – LOAD CAPACITY IN WALLS WITH ADDITIONAL REINFORCEMENTS

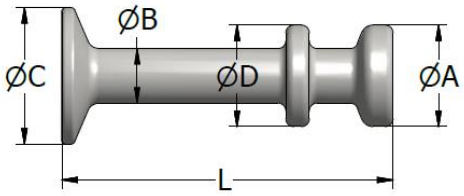
Type of anchor	Load group	Wall thickness	Load capacity				Spacing between anchors
			Axial pull β < 30°	Angled pull β < 45°	Axial pull and angled pull β < 45°		
		2 x b	f_{cu} ≥ 15 MPa	f_{cu} ≥ 15 MPa	f_{cu} ≥ 25 MPa	f_{cu} ≥ 35 MPa	a
	[kN]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]
T-013-0120	13	60	9.9	9.9	12.8	13.0	375
		80	13.0	13.0	13.0		
		100	13.0	13.0	13.0		
T-013-0240		60	9.9	9.9	12.8	13.0	735
		80	13.0	13.0	13.0		
		100	13.0	13.0	13.0		
T-025-0170	25	80	18.4	18.4	23.8	25.0	525
		100	23.0	23.0	25.0		
		120	25.0	25.0	25.0		
T-025-0280		80	18.4	18.4	23.8	25.0	855
		100	23.0	23.0	25.0		
		120	25.0	25.0	25.0		
T-050-0240	50	160	50.0	39.5	50.0	50.0	735
		180	50.0	46.1			
		200	50.0	50.0			
T-050-0340		120	39.5	32.9	50.0	50.0	1035
		140	46.1	39.5			
		160	50.0	46.1			
T-050-0480		100	32.9	32.9	42.5	50.0	1455
		120	39.5	39.5	50.0		
		140	46.1	46.1	50.0		
T-075-0300	75	160	63.2	56.6	75.0	75.0	910
		180	71.1	60.0			
		200	75.0	63.2			

T- ANCHOR – LOAD CAPACITY IN WALLS WITH ADDITIONAL REINFORCEMENTS

Type of anchor	Load group	Wall thickness 2 x b	Load capacity				Spacing between anchors
			Axial pull $\beta < 30°$	Angled pull $\beta < 45°$	Axial pull and angled pull $\beta < 45°$		
			$f_{cu} \geq 15$ MPa	$f_{cu} \geq 15$ MPa	$f_{cu} \geq 25$ MPa	$f_{cu} \geq 35$ MPa	a
	[kN]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]
T-075-0540		140	55.3	55.3	71.4	75.0	1630
		160	63.2	63.2	75.0		
		180	71.1	71.1	75.0		
T-100-0340	100	200	89.5	71.6	100.0	100.0	1030
		240	98.0	78.4			
		280	100.0	84.7			
T-100-0680		160	73.7	73.7	95.2	100.0	2050
		180	83.0	83.0	100.0		
		200	92.2	92.2	100.0		
T-150-0400	150	300	128.9	103.1	150.0	150.0	1200
		400	148.9	119.1			
		500	150.0	133.1			
T-150-0840		200	111.9	111.9	144.5	150.0	2520
		220	123.1	123.1	150.0		
		240	134.2	134.2	150.0		
T-200-0500	200	400	175.1	140.1	200.0	200.0	200.0
		500	187.2	149.7			
		600	200.0	183.4			
T-200-1000		240	154.9	154.9	200.0	200.0	200.0
		260	167.8	167.8			
		280	180.7	180.7			
T-320-0700	320	450	282.6	226.1	320.0	320.0	2080
		550	312.5	250.0			
		650	320.0	271.8			
T-320-1200		300	266.7	266.7	320.0	320.0	3580
		350	311.1	311.1			
		400	320.0	320.0			
T-450-1200	450	400	355.5	355.5	450	450	3580
		500	444.4	421.6			
		600	450.0	450.0			

P- ANCHOR

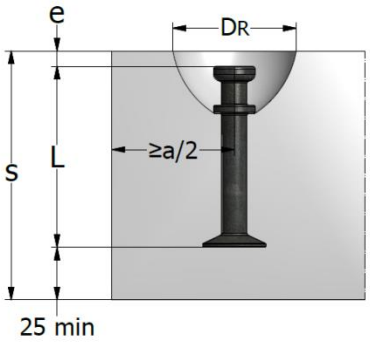
Forged from round carbon steel, P-slot anchor is designed to load forces in the range of 13 kN to 100 kN.
The collar below the anchor head seals the former when the anchor is pushed into the recess former.



Characteristics of P- anchors

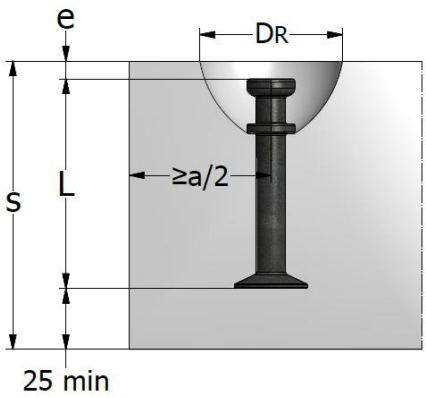
P-anchor black		P-anchor hot dip galvanized		P-anchor – stainless steel 1.4301 (AISI 304)		Load group	L	ØA	ØB	ØC	ØD
Descr.	Prod. No.	Descr.	Prod. No.	Descr.	Prod. No.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]
P-013-0055	44953	P-013-0055-TV	45848	P-013-0055-SS2	/	13	55	19	10	25	19
P-013-0065	46248	P-013-0065-TV	47470	P-013-0065-SS2	/	13	65	19	10	25	19
P-013-0085	43337	P-013-0085-TV	43338	P-013-0085-SS2	/	13	85	19	10	25	19
P-013-0120	43339	P-013-0120-TV	43340	P-013-0120-SS2	45710	13	120	19	10	25	19
P-013-0240	46205	P-013-0240-TV	46206	P-013-0240-SS2	/	13	240	19	10	25	19
P-025-0055	44281	P-025-0055-TV	44282	P-025-0055-SS2	/	25	55	26	14	35	26
P-025-0065	46211	P-025-0065-TV	/	P-025-0085-SS2	/	25	65	26	14	35	26
P-025-0085	43970	P-025-0085-TV	43341	P-025-0085-SS2	44507	25	85	26	14	35	26
P-025-0120	43342	P-025-0120-TV	43343	P-025-0120-SS2	44508	25	120	26	14	35	26
P-025-0170	43344	P-025-0170-TV	43345	P-025-0170-SS2	/	25	170	26	14	35	26
P-050-0075	47860	P-050-0075-TV	44639	P-050-0075-SS2	/	50	75	36	20	50	36
P-050-0090	46470	P-050-0090-TV	46468	P-050-0090-SS2	/	50	90	36	20	50	36
P-050-0110	46469	P-050-0110-TV	46467	P-050-0110-SS2	/	50	110	36	20	50	36
P-050-0120	45863	P-050-0120-TV	44640	P-050-0120-SS2	/	50	120	36	20	50	36
P-050-0240	45864	P-050-0240-TV	44615	P-050-0240-SS2	45189	50	240	36	20	50	36
P-100-0150	44614	P-100-0150-TV	/	P-100-0150-SS2	/	100	150	46	28	70	46

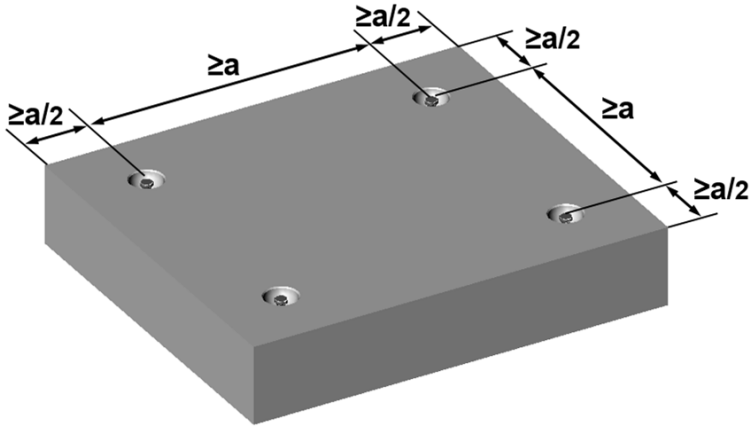
Type P Anchor Description	Load Group [kN]	D_R [mm]	e [mm]
P-013-XXXX	13	63	10
P-025-XXXX	25	74	11
P-050-XXXX	50	96	15
P-100-XXXX	100	122	15



- *L = anchor length*
- *a/2 = edge distance*
- *e = cover to anchor head*
- *D_R = recess diameter*

INSTALLATION OF P- ANCHOR IN SLABS

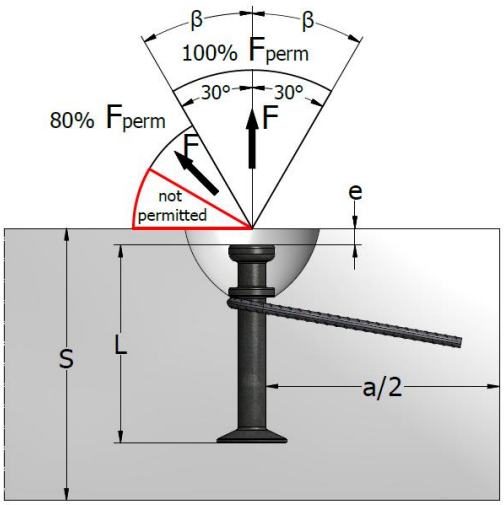




- *L = anchor length*
- *a/2 = edge distance*
- *e = cover to anchor head*
- *D_R = recess diameter*

For slab units or de-mould of panels the edge distance of the "T" anchor (a) is: ***a/2 = 3 x (L + e)***

P- ANCHOR – LOAD CAPACITY IN SLABS FOR ANY DIRECTION OF PULL							
Type of anchor	Load group	Minimum thickness	Load capacity for minimal thickness				Minimum spacing between anchors
			Axial pull β < 30°	Angled pull β < 45°	Axial pull and angled pull β < 45°		
		s	f_{cu} ≥ 15 MPa	f_{cu} ≥ 15 MPa	f_{cu} ≥ 25 MPa	f_{cu} ≥ 35 MPa	a
	[kN]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]
P-013-0065	13	100	13.0	10.4	13.0	13.0	260
P-025-0085	25	120	19.5	15.6	25.0	25.0	325
P-050-0110	50	150	29.5	23.6	38.1	45.1	450
P-100-0150	100	200	59.5	40.1	60.2	75.5	600

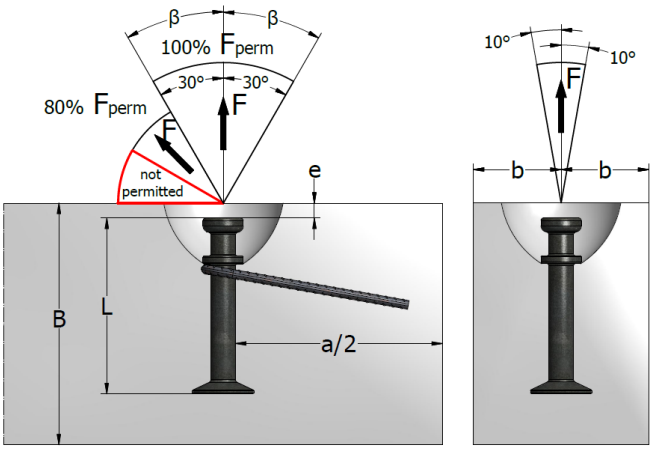


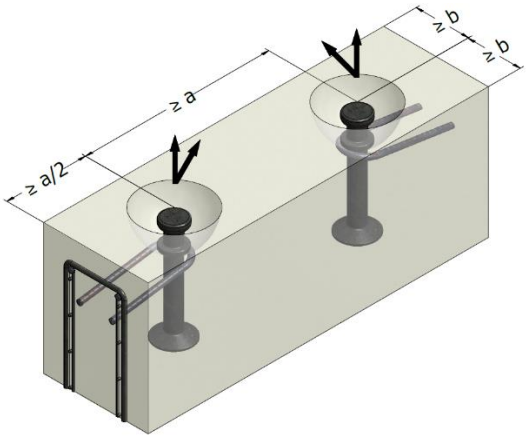
- ***Angled pull of 30° ≤ β ≤ 45° without angled pull reinforcement is only allowed for:***

- *f_{cu} ≥ 15 MPa + 3 times min. edge distance a/2*
- *f_{cu} ≥ 25 MPa + 2.5 times min. edge distance a/2*
- *f_{cu} ≥ 35 MPa + 2 times min. edge distance a/2*

- ***Angled pull with cables/chains spread of β > 45° is not permitted***

LOAD CAPACITY IN BEAMS AND WALLS WITH ADDITIONAL REINFORCEMENTS





The angled pull reinforcement must be mounted opposite the direction of the load
The diagonal reinforcement must be placed as close as possible under the recess former and installed in contact with the lifting anchor.

NOTES:

Required reinforcement (*see page 16*)

- **Mesh reinforcement -** (1)
- **Edge reinforcement -** (2)
- **Stirrups -** (3)
- **Angled pull reinforcement -** (4)

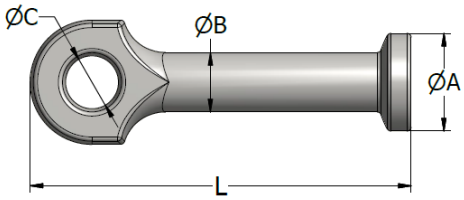
- ***Angled pull of 30° ≤ β ≤ 45° without angled pull reinforcement is only allowed for:***
  - *f_{cu} ≥ 15 MPa + 3 times min. edge distance a/2*
  - *f_{cu} ≥ 25 MPa + 2.5 times min. edge distance a/2*
  - *f_{cu} ≥ 35 MPa + 2 times min. edge distance a/2*
- ***Angled pull with cables/chains spread of β > 45° is not permitted***

P- ANCHOR – LOAD CAPACITY IN BEAMS AND WALLS WITH ADDITIONAL REINFORCEMENTS

Type of anchor	Load group	Minimum height of beams	Wall thickness	Load capacity				Spacing between anchors
				Axial pull β < 30°	Angled pull β < 45°	Axial pull and angled pull β < 45°		
		B	2 x b	f_{cu} ≥ 15 MPa	f_{cu} ≥ 15 MPa	f_{cu} ≥ 25 MPa	f_{cu} ≥ 35 MPa	a
	[kN]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]
P-013-0120	13	250	80	13.0	10.7	13.0	13.0	300
			100	13.0	12.7	13.0		
			120	13.0	13.0	13.0		
P-025-0120	25	250	120	18.1	14.5	23.3	25.0	380
			140	20.3	16.2	25.0		
			160	22.4	17.9	25.0		
P-025-0170		350	100	20.7	16.5	25.0	25.0	380
			120	23.7	19.0			
			140	25.0	21.8			
P-050-0240	50	500	200	45.6	36.5	50.0	50.0	500
			220	49.0	39.2			
			240	50.0	41.9			

O- ANCHOR

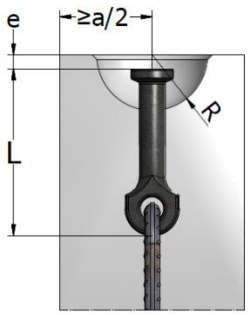
Forged from carbon steel, O-eye anchor are designed to load forces in the range of 13kN to 320kN.
The O-eye-anchor is provided with a hole, in which a reinforcement hairpin has to be placed to obtain a good anchoring in small elements, lightweight pre cast elements such as pre-stressed beams. Since the entire load is transferred to concrete reinforcement steel, it should be installed so as to maintain direct contact with the base of the hole in the anchor.
Use of this reinforcement is essential. Do not use anchors type O without this reinforcement.
For angled lift is necessary to use an additional reinforcement, similar to that mounted with t-slot anchor. It is recommended to install this angle pull reinforcement as close as possible under the recess former and with full contact to the anchor.
O anchors are available in two variants: shot blasting and hot dip galvanizing (TV).



Characteristics of O-Eye anchor

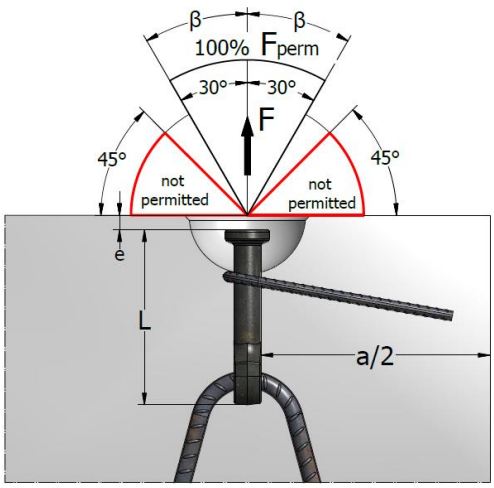
O- anchor black		O-anchor hot dip galvanized		Load group	L	ØA	ØB	ØC
Descr.	Product nr.	Descr.	Product nr.	[kN]	[mm]	[mm]	[mm]	[mm]
O-013-065	43328	O-013-065-TV	43329	13	65	19	10	9
O-025-090	43330	O-025-090-TV	43331	25	90	26	14	13
O-025-120	46261	O-025-120-TV	46262	25	120	26	14	13
O-050-090	43332	O-050-090-TV	43571	50	90	36	20	18
O-050-120	43333	O-050-120-TV	43334	50	120	36	20	18
O-100-115	43556	O-100-115 TV	43557	100	115	47	28	25
O-100-180	43335	O-100-180-TV	43336	100	180	47	28	25
O-200-250	43558	O-200-250 TV	43559	200	250	70	39	37
O-320-300	43560	O-320-300 TV	43561	320	300	88	50	47

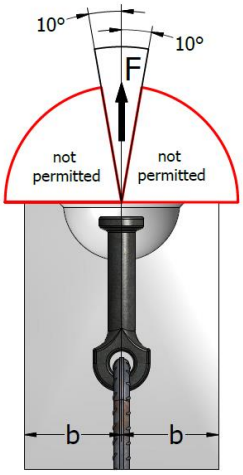
Type O Anchor Description	Load Group [kN]	R [mm]	e [mm]
O-013-XXXX	13	30	10
O-025-XXXX	25	37	11
O-050-XXXX	50	47	15
O-100-XXXX	100	59	15
O-200-XXXX	200	80	15
O-320-XXXX	320	102	23

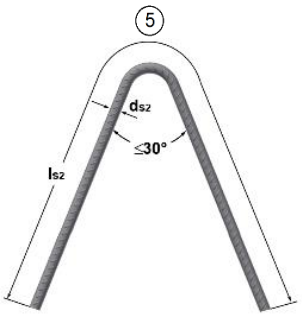


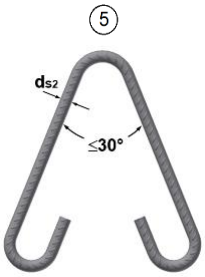
- *L = anchor length*
- *a/2 = edge distance*
- *e = cover to anchor head*
- *R = recess radius*

LOAD CAPACITY IN BEAMS AND WALLS WITH ADDITIONAL REINFORCEMENTS









- The angled pull reinforcement must be mounted opposite the direction of the load
- The diagonal reinforcement must be placed as close as possible under the recess former and installed in contact with the lifting anchor.
- The additional reinforcement must be bent at an angle of 30° as shown. The rebar may be shortened if required, the ends can be bend into hook.

NOTES:

Required reinforcement ***(see page 16)***

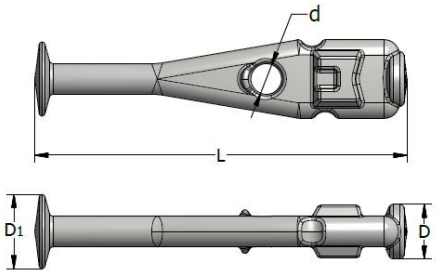
- **Mesh reinforcement -** (1)
- **Angled pull reinforcement -** (4)
- **Additional reinforcement -** (5)

- ***Angled pull of 30° ≤ β ≤ 45° without angled pull reinforcement is only allowed for:***
  - *f_{cu} ≥ 15 MPa + 3 times min. edge distance a/2*
  - *f_{cu} ≥ 25 MPa + 2.5 times min. edge distance a/2*
  - *f_{cu} ≥ 35 MPa + 2 times min. edge distance a/2*
- ***Angled pull with cables/chains spread of β > 45° is not permitted***

O- ANCHOR – LOAD CAPACITY AND REINFORCEMENTS											
O-anchor type	Load group	Minimum thickness	Spacing between anchors	Mesh reinforcement (1)	O-anchor reinforcement Dimensions l_{s2} (5)				Load capacity Axial pull	Load capacity angled pull ß ≤ 45°	
		"2 x b"	"a"		f_{cu} ≥ 15 MPa	f_{cu} ≥ 25 MPa	f_{cu} ≥ 35 MPa	d_{s2}	f_{cu} ≥ 15 MPa	f_{cu} ≥ 15 MPa	f_{cu} ≥ 25 MPa
	[kN]	[mm]	[mm]	[mm²/m]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
O-013-0065	13	80	500	2 x 60	700	550	450	8	13.0	10.4	13.0
O-025-0090	25	80	600	2 x 100	1000	800	650	10	25.0	20.0	25.0
O-050-0120	50	100	750	2 x 140	1700	1400	1100	16	50.0	40.0	50.0
O-100-0180	100	140	1200	2 x 180	2000	1600	1300	20	100.0	80.0	100.0
O-200-0250	200	180	1500	2 x 350	3000	2400	2000	32	200.0	160.0	200.0
O-320-0300	320	260	1800	2 x 400	3800	2700	2200	40	320.0	256.0	320.0

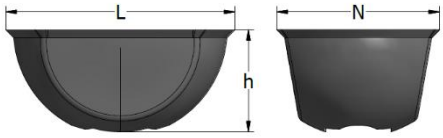
TKA-TILT-ANCHOR

Forged from carbon steel, they are designed to a load force in the range of 13 kN to 50 kN.
TKA anchors can carry loads of between 13 kN and 50 kN. These anchors are used for tilt and transport thin concrete walls. Usually this type of anchor is used together with additional reinforcing steel. The TKA anchor must be fixed in the mould using a specific recess formers RBK. The recess former retains the anchor securely in position during the concrete pour. The IPK is mounted in the RBK in order to stabilize the RBK during pouring and hardening.
TKA anchors are available in two variants: shot blasting and hot dip galvanizing (TV).



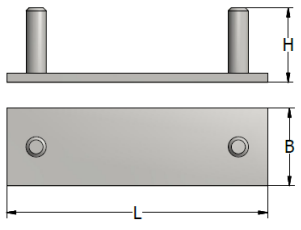
TKA-anchor black		TKA-anchor hot dip galvanized		Load group	L	Ø D	Ø D_1	Ø d
Descr.	Product nr.	Descr.	Product nr.	[kN]	[mm]	[mm]	[mm]	[mm]
TKA-013-0120	44476	TKA-013-0120-TV	44804	13	120	19	23	11
TKA-025-0170	44477	TKA-025-0170-TV	44805	25	170	25	34	16
TKA-050-0240	44478	TKA-050-240-TV	44806	50	240	36	50	21

Characteristics of RBK balls:



RBK-recess former		Load group	Length L	Height H	Width B
Descr.	Product nr.	[kN]	[mm]	[mm]	[mm]
RBK-13	43946	13	70	32	49
RBK-25	43947	25	86	38	60
RBK-50	43948	50	110	53	78

Characteristics of IPK plates:

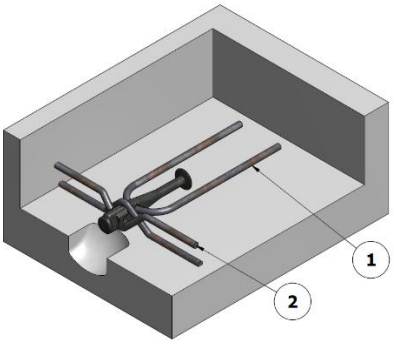


IPK-plates		Load group	Length L	Height H	Width B
Descr.	Product nr.	[kN]	[mm]	[mm]	[mm]
IPK -13	47225	13	54	16	15
IPK -25	47224	25	67	16	20
IPK -50	47223	50	84	24	25

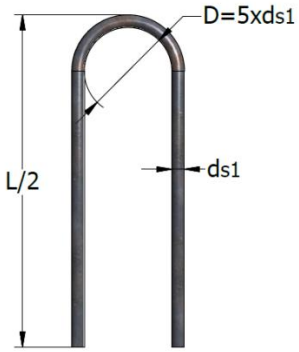
For pitching additional reinforcements have to be installed in the anchor zone. Take care to anchors placement so that they ensure the load transfer. The RBK recess former is removed out of the hardened concrete and the lifting device can be connected.
The shackle nose must be oriented towards the direction of lifting.

REINFORCEMENT USED IN ANCHOR ZONE FOR ANGLED LIFT IN PANELS OR BEAMS

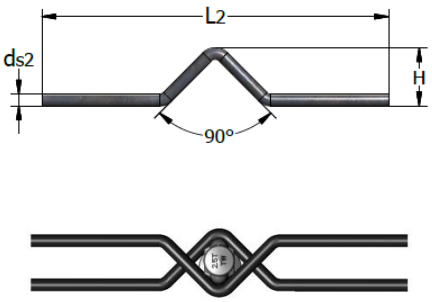
Additional reinforcements:



Reinforcement 1

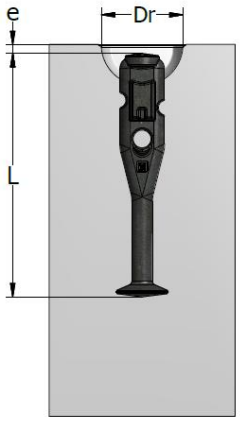


Reinforcement 2



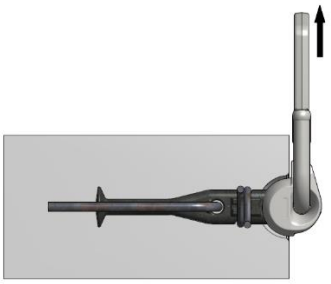
TKA- ANCHOR – LOAD CAPACITY AND REINFORCEMENTS							
TKA-anchor type	Load group	Mesh reinforcement	Reinforcement 1			Reinforcement 2	
			ds_1	L(straight)	L(bended)	ds_2	L_2
	[kN]	[mm²/m]	[mm]	[mm]	[mm]	[mm]	[mm]
TKA-013-0120	13	131	10	1035	500	10	500
TKA-025-0170	25	2 x 131	10	1635	800	12	800
TKA-050-0240	50	2 x 140	12	2240	1100	16	1000

Type TKA Anchor Description	Load Group [kN]	D_R [mm]	e [mm]
TKA-013-0120	13	70	10
TKA-025-XXXX	25	86	11
TKA-050-XXXX	50	110	15

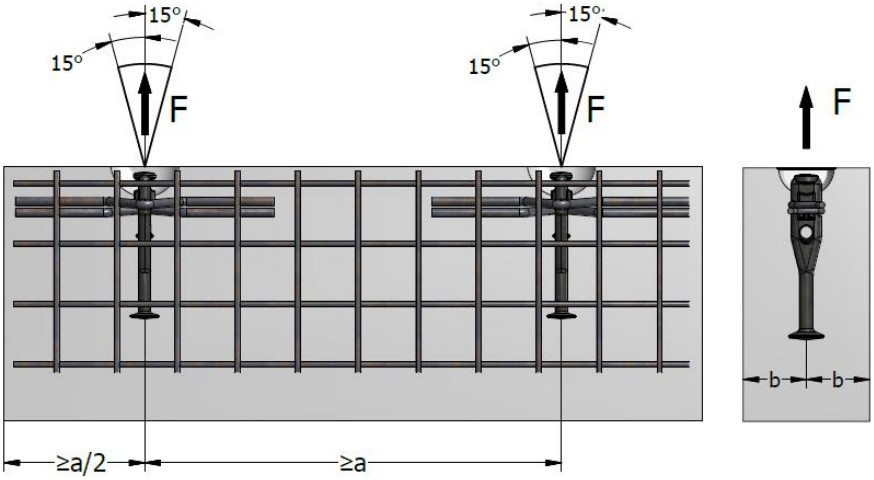


- *L = anchor length*
- *e = cover to anchor head*
- *Dr = recess dimension*

TRANSVERSE LIFT



ANGLED LIFT

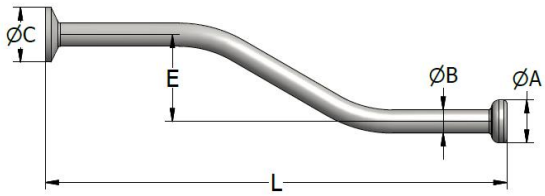


Permissible load:

TKA-anchor type	Axial Load	Element thickness 2 x b	Transverse lift		Axial pull ang angled pull ß ≤ 15º	
			Concrete strength		Concrete strength	
			15 MPa	25 MPa	15 MPa	25 MPa
	[kN]	[mm]	[kN]	[kN]	[kN]	[kN]
TKA-013-0120	13	80	3.0	3.6	11.0	13.0
		100	4.0	4.6	12.0	13.0
		120	5.0	5.6	13.0	13.0
TKA-025-0170	25	100	7.8	10.1	25.0	25.0
		110	9.0	11.6	25.0	25.0
		120	10.3	12.5	25.0	25.0
		130	11.6	12.5	25.0	25.0
		140	12.5	12.5	25.0	25.0
TKA-050-0240	50	120	13.8	17.8	31.2	40.0
		130	14.6	18.8	33.1	42.7
		140	15.6	20.1	35.0	45.2
		150	17.3	22.3	36.8	47.5
		160	19.1	24.6	38.7	50.0
		180	20.9	25.0	42.2	50.0
		200	22.6	25.0	45.7	50.0

TSG – OFFSET ANCHOR

The TSG anchor is designed to a load force in the range of 13kN to 320kN. This type of anchor is mainly used in sandwich panels. The anchor head must be positioned on the axis of symmetry of the sandwich precast panel. To ensure a safe load transfer the anchor leg must be positioned on the middle of the load bearing layer.
TSG anchors are available in two variants: shot blasting and hot galvanizing (TV).

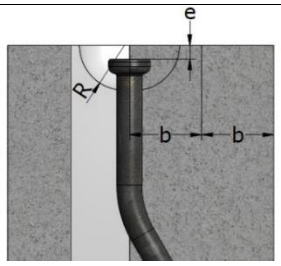


TSG- ANCHOR – DIMENSIONS

TSG black		TSG hot dip galvanized		Load group	L	ØA	ØB	ØD	E
Description	Product no.	Description	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]
TSG-013-0227	43087	TSG-013-0227-TV	43088	13	227	19	10	25	50
TSG-025-0268	43089	TSG-025-0268-TV	43090	25	268	26	14	35	50
TSG-050-0466	43093	TSG-050-0466-TV	43094	50	466	36	20	50	60
TSG-075-0664	43095	TSG-075-0664-TV	43096	75	664	46	24	60	70
TSG-100-0667	43097	TSG-100-0667-TV	43100	100	667	46	28	70	70
TSG-150-0825	43101	TSG-150-0825-TV	43102	150	825	70	38	80	90
TSG-200-0986	43103	TSG-200-0986-TV	43104	200	986	70	40	98	90
TSG-320-1150	45912	TSG-320-1150-TV	45913	320	1150	88	50	135	150

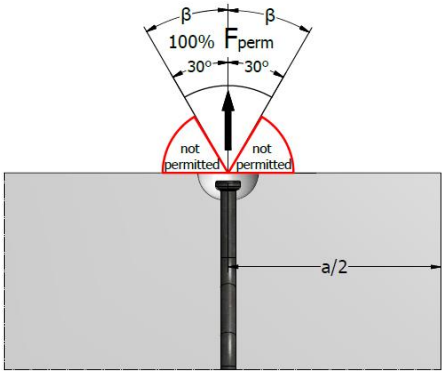
TSG - ANCHOR ARRANGEMENT

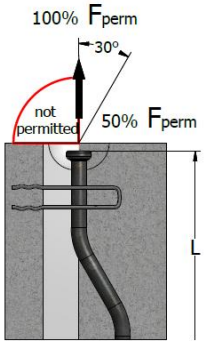
Type TSG Anchor	Load Group	"R"	"e"
Description	[kN]	[mm]	[mm]
TSG-013-0227	13	30	10
TSG-025-0268	25	37	11
TSG-050-0466	50	47	15
TSG-075-0664	75	59	15
TSG-100-0667	100	59	15
TSG-150-0825	150	80	15
TSG-200-0986	200	80	15
TSG-320-1150	320	102	23



- *L = anchor length*
- *a/2 = edge distance*
- *e = cover to anchor head*
- *R = recess radius*

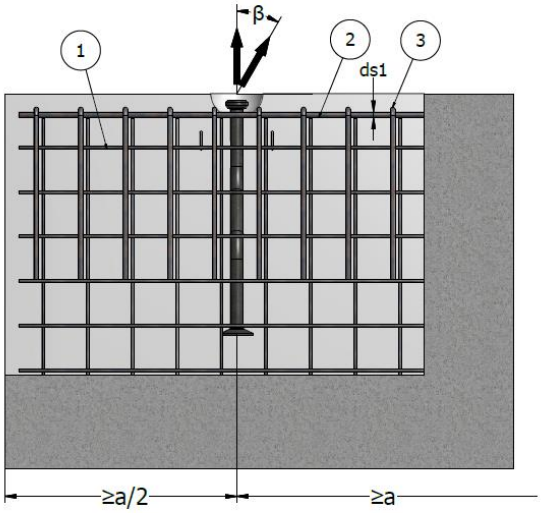
TSG - LOAD CAPACITY IN BEAMS AND WALLS - ADDITIONAL REINFORCEMENTS

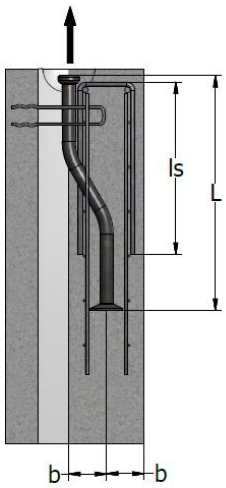


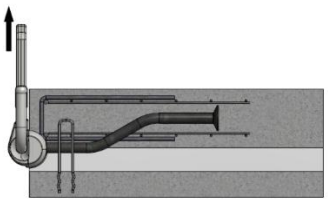


Angled pull with cables/chains spread of β > 30° is not permitted

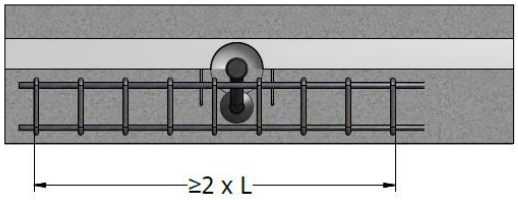
For tilt-up operation is recommended to use a tilt-up table.







Additional sandwich hairpin anchor installed near the anchor is beneficial.



Note:

The bending radius will be established considering the EN 1992.

The diagonal reinforcement must be placed as close as possible under the recess former and installed in contact with the lifting anchor.

The reinforced zone must be ≥ 3 × anchor lenght "L". Those two stirrups in the vicinity of the anchor should be installed as close as possible to the recess former.

Length $l_s = l_1$ +Anchor length

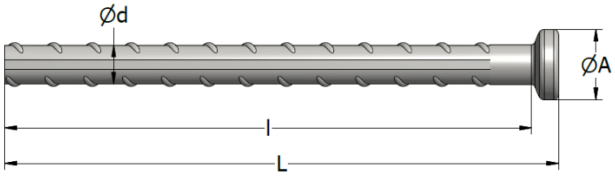
Type of anchor	Load Group	Mesh reinforcement (1)	Edge reinforcement B500B (both sides) (2)	Stirrups - B500B (3)	
				Axial pull β < 30°	
			d_{s1}	„d"	„ls"
Symbol	[kN]	[mm²/m]	[mm]	[mm]	[mm]
TSG-013-0227	13	2 x 60	Ø 10	Ø6	400
TSG-025-0268	25	2 x 100	Ø 10	Ø8	600
TSG-050-0466	50	2 x 140	Ø 12	Ø10	750
TSG-075-0664	75	2 x 160	Ø 12	Ø10	1000
TSG-100-0667	100	2 x 180	Ø 12	Ø10	1000
TSG-150-0825	150	2 x 240	Ø 16	Ø10	1000
TSG-200-0986	200	2 x 350	Ø 16	Ø12	1100
TSG-320-1150	320	2 x 400	Ø 16	Ø12	1100

TSG- ANCHOR – LOAD CAPACITY IN WALLS WITH ADDITIONAL REINFORCEMENTS							
Type of anchor	**Load group**	**Wall thickness**	**Load capacity**				**Spacing between anchors**
			Axial pull β < 30°		**Transverse lift**		
		2 x b	**f_{cu} ≥ 15 MPa** 	**f_{cu} ≥ 25 MPa** 	**f_{cu} ≥ 15 MPa** 	**f_{cu} ≥ 25 MPa** 	**a**
	[kN]	**[mm]**	**[kN]**	**[kN]**	**[kN]**	**[kN]**	**[mm]**
TSG-013-0227	13	80	13.0	13.0	6.5	6.5	260
TSG-025-0268	25	100	15.9	20.3	9.5	12.2	370
		140	20.5	25.0	12.2	12.5	
TSG-050-0466	50	100	35.2	45.4	21.2	25.0	820
		140	45.3	50.0	25.0	25.0	
TSG-075-0664	75	120	50.9	65.8	30.5	37.5	1210
		150	60.2	75.0	36.0	37.5	
TSG-100-0667	100	140	66.5	86.0	39.9	50.0	1220
		180	80.3	100.0	48.2	50.0	
TSG-150-0825	150	180	103.2	133.0	61.9	75.0	1500
		220	120.0	150.0	72.0	75.0	
TSG-200-0986	200	200	135.1	174.4	81.1	100.0	2030
		250	159.7	200.0	95.9	100.0	

TKS- ANCHOR

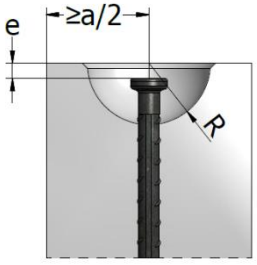
Forged from rebar steel, TKS slot anchor are designed to a load force in the range of 25kN to 150kN.

The TKS-Rod Slot-anchor is provided with a ribbed rod to which a good anchoring can be obtained. For situations in which an anchoring foot cannot be used, a TKS-Rod Slot-anchor with an adjusted length can realize a sufficient anchoring. This anchor is the best solution especially in very thin elements.



TKS-Slot-anchor type - black		Load group	Length L	Length l (anchoring)	Ø d	Ø A
Description	**Product no.**	**[kN]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**
TKS-025-0400	43667	25	400	374	14	26
TKS-025-0520	43668	25	520	494	14	26
TKS-050-0580	43669	50	580	548	20	36
TKS-050-0790	47429	50	790	758	20	36
TKS-050-0900	43670	50	900	868	20	36
TKS-075-0750	43671	75	750	706	24	47
TKS-075-1150	43672	75	1150	1106	24	47
TKS-100-0870	43673	100	870	826	28	47
TKS-100-1300	43674	100	1300	1256	28	47
TKS-150-1080	43675	150	1080	1015	34	70
TKS-150-1550	43676	150	1550	1485	34	70

Type TKS Anchor	Load Group	"R"	"e"
Description	**[kN]**	**[mm]**	**[mm]**
TKS-025-XXXX	25	37	11
TKS-050-XXXX	50	47	15
TKS-075-XXXX	75	59	15
TKS-100-XXXX	100	59	15
TKS-150-XXXX	150	80	15

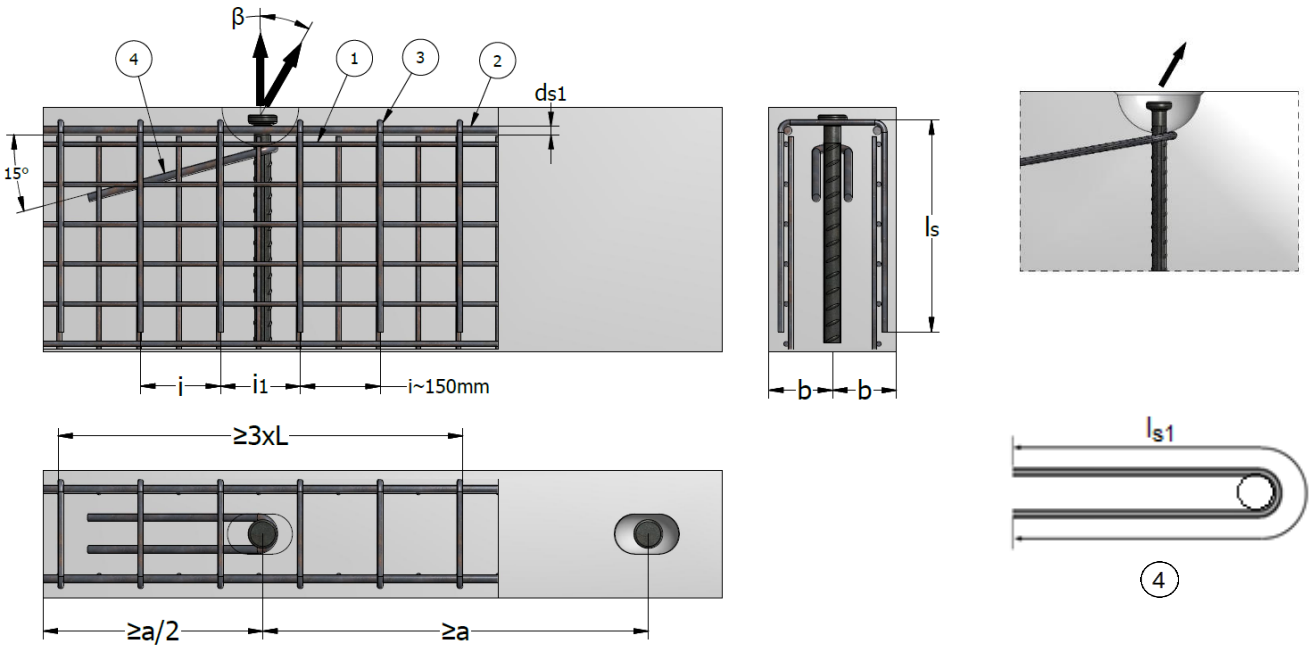


- *L = anchor length*
- *a/2 = edge distance*
- *e = cover to anchor head*
- *R = recess radius*

TKS-ANCHOR – INSTALATION AND REINFORCEMENT

REINFORCEMENTS TYPES USED IN THE ANCHOR ZONE FOR PANELS AND BEAMS FOR ANGLE LIFT

Panels and beams containing only basic reinforcements such as wire mesh, stirrups and edge reinforcement must only be lifted in the axial direction or at an angle not exceeding 30°.
For angled pull is required an additional reinforcement installed in opposite direction of the load. It is recommended to install this angle pull reinforcement as close as possible under the recess former and with full contact to the anchor.
The additional reinforcements necessary in the anchor zone for lifting the panels and beams at angles ß ≤ 45° are shown in the table, the concrete strength must be at least 15 MPa. It is recommended that the angle ß, where possible, should not exceed 30°.
The stirrups will be installed on both sides of the anchor on an area equal to 3 x length of anchor. These two stirrups in the vicinity of the anchor should be installed as close as possible to the recess former.



Note:

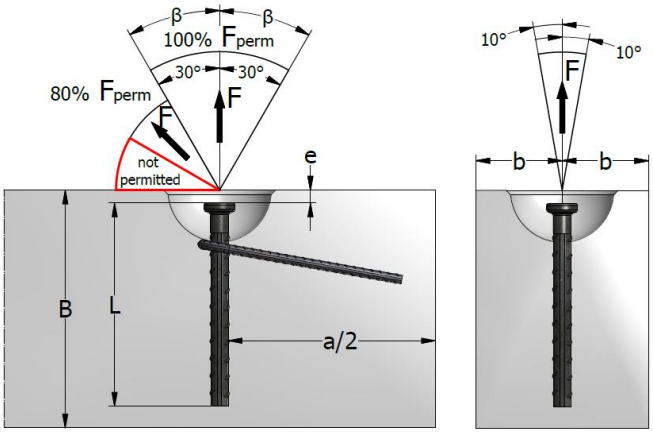
The bending radius will be established considering the EN 1992.
The diagonal reinforcement must be placed as close as possible under the recess former and installed in contact with the lifting anchor.
The reinforced zone must be $\geq 3 \times$ anchor lenght "L". *Those two stirrups in the vicinity of the anchor should be installed as close as possible to the recess former.*
No stirrups required if element thickness is 2 x b > s_{min} – see table below.

Type of anchor	Load Group	Elem. thickness	Mesh reinforcement (1)	Edge reinforcement B500B (both sides) (2)	Stirrups - B500B (3)			Angled pull reinforcement B500B (4)
					Axial pull β < 30° and angled pull 30° < β < 45°			
		2 x b		d_{s1}	Elem. Thickness „s_{min}"	„d"	„l_1"	Ø x l_{s1}
Symbol	[kN]	[mm]	[mm²/m]	[mm]	[mm]	[mm]	[mm]	[mm]
TKS-025-0400	25	80	2 x 100	-	90	Ø8	600	Ø10 x 600
		100/120				-	-	
TKS-025-0520		100				-	-	
TKS-050-0580	50	100/120	2 x 140	Ø 12	120	Ø10	750	Ø12 x 1000
		140/160				-	-	
TKS-050-0900		120				Ø10	850	
TKS-075-0750	75	120/140	2 x 160	Ø 12	140	Ø10	750	Ø20 x 1000
		160				-	-	
TKS-075-1150		140				Ø10	900	
TKS-100-0870	100	140	2 x 180	Ø 14	160	Ø10	800	Ø20 x 1100
TKS-100-1300		160				Ø10	950	
TKS-150-1080	150	160	2 x 240	Ø 14	200	Ø12	1020	Ø25 x 1100
TKS-150-1550		200				Ø12	1200	

TSG - LOAD CAPACITY IN BEAMS AND WALLS

Anchor type	Load group	Concrete element thickness	The recommended minimum thickness	Axial pull $\beta < 30°$		Angled pull $\beta > 30°$ max. $45°$	
		„2 x b"	„s min"	f_{cu}≥ 15 MPa	f_{cu}≥ 25 MPa	f_{cu}≥ 15 MPa	f_{cu}≥ 25 MPa
	[kN]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]
TKS-025-0400	25	80	90	25.0	25.0	20.0	25.0
		100		25.0	25.0	20.0	25.0
		120		25.0	25.0	20.0	25.0
TKS-025-0520		100		25.0	25.0	20.0	25.0
TKS-050-0580	50	100	120	41.0	50.0	32.6	50.0
		120		44.2	50.0	35.3	50.0
		140		47.0	50.0	37.6	50.0
		160		50.0	50.0	40.0	50.0
TKS-050-0900		120		50.0	50.0	40.0	50.0
TKS-075-0750	75	120	140	66.0	75.0	52.8	75.0
		140		70.0	75.0	56.0	75.0
		160		75.0	75.0	60.0	75.0
TKS-075-1150		140		75.0	75.0	60.0	75.0
TKS-100-0870	100	140	160	95.0	100.0	76.0	100.0
TKS-100-1300		160		100.0	100.0	80.0	100.0
TKS-150-1080	150	160	200	144.0	150.0	115.2	150.0
TKS-150-1550		200		150.0	150.0	150.0	150.0

It is recommended that the angle ß, where possible, should not exceed 30°.



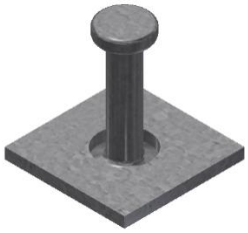
- ***Angled pull of 30° ≤ β ≤ 45° without angled pull reinforcement is only allowed for:***

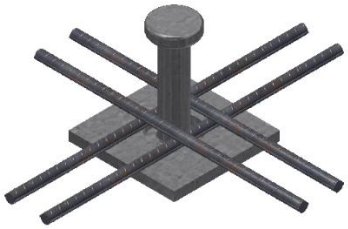
- *f_{cu} ≥ 15 MPa + 3 times min. edge distance a/2*
- *f_{cu} ≥ 25 MPa + 2.5 times min. edge distance a/2*
- *f_{cu} ≥ 35 MPa + 2 times min. edge distance a/2*

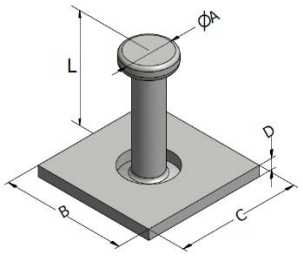
- ***Angled pull with cables/chains spread of β > 45° is not permitted***

TPA – PLATE ANCHOR

TPA anchors are fitted with a welded base plate. They are designed to a load force in the range of 25kN, 50kN and 100kN. This type of anchors is mostly used in thin panels. It is essential, that this type of anchor is used in combination with rebar steel. TPA anchors are available in two variants: shot blasting and hot galvanizing (TV).

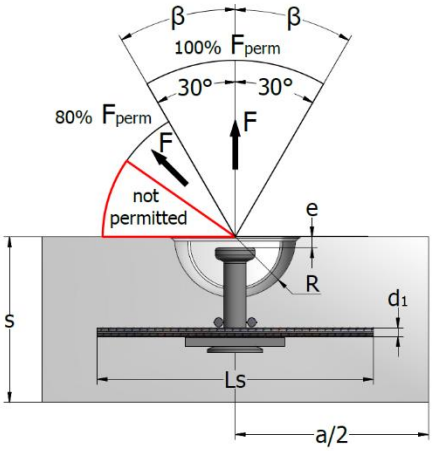






TPA black		TPA hot dip galvanized		Load group	L	ØA	B	C	D
Description	Product no.	Description	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]
TPA-025-055	43507	TPA-025-055-TV	44394	25	55	26	70	70	6
TPA-025-085	43978	TPA-025-085-TV	45341	25	85	26	70	70	6
TPA-025-120	43508	TPA-025-120-TV	44398	25	120	26	70	70	6
TPA-050-055	43509	TPA-050-055-TV	45343	50	55	36	90	90	8
TPA-050-065	43510	TPA-050-065-TV	44400	50	65	36	90	90	8
TPA-050-095	43511	TPA-050-095-TV	45345	50	95	36	90	90	8
TPA-050-110	43512	TPA-050-110-TV	44402	50	110	36	90	90	8
TPA-100-115	43513	TPA-100-115-TV	45347	100	115	46	90	90	10

TPA-ANCHOR ARRANGEMENT



- *L = anchor length*
- *e = cover to anchor head*
- *R = recess radius*

- ***Angled pull of 30° ≤ β ≤ 45° without angled pull reinforcement is only allowed for:***

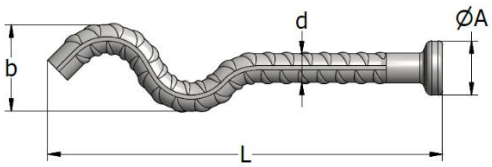
- *f_{cu} ≥ 15 MPa + 3 times min. edge distance a/2*
- *f_{cu} ≥ 25 MPa + 2.5 times min. edge distance a/2*
- *f_{cu} ≥ 35 MPa + 2 times min. edge distance a/2*

- ***Angled pull with cables/chains spread of β > 45° is not permitted***

TPA- ANCHOR – LOAD CAPACITY IN SLABS WITH ADDITIONAL REINFORCEMENTS									
TPA-anchor type	Load group	Minimum thickness "s"	L	e	R	d_1	L_s	Axial pull β < 30° and angled pull 30° < β < 45°	
								f_{cu}≥ 15 MPa	f_{cu}≥ 25 MPa
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]
TPA-025-055	25	85	55	11	37	8	200	10.8	14.0
TPA-025-085	25	115	85	11	37	10	250	17.0	21.0
TPA-025-120	25	150	120	11	37	10	300	25.0	25.0
TPA-050-055	50	90	55	15	47	12	450	14.0	18.6
TPA-050-065	50	100	65	15	47	12	450	16.0	20.8
TPA-050-095	50	125	95	15	47	12	450	28.0	35.0
TPA-050-110	50	145	110	15	47	12	450	34.0	43.8
TPA-100-115	100	150	115	15	59	16	600	34.5	44.5

TWA – WAVE ANCHOR

Forged from rebar steel, TWA slot wave anchor are designed to a load force in the range of 20kN to 150kN.
The TWA-waved-anchor is provided with a ribbed rod forged in a wave shape to which a good anchoring can be obtained. This wave shape enabled the anchor to transfer the force gradually into the concrete. This anchor is the best solution especially in thin columns and beams.

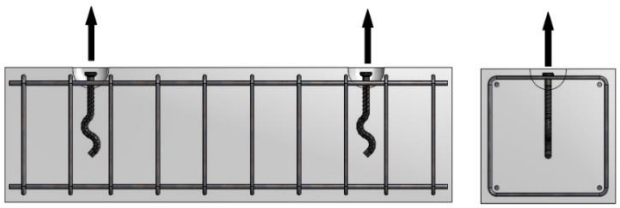


TWA-anchor type - black		Load group	Axial load	Length L	Width b	d	Ø A
Description	Product no.	[kN]	[kN]	[mm]	[mm]	[mm]	[mm]
TWA-020-0145	49364	20	20	145	38	14	26
TWA-025-0190	49365	25	25	190	38	14	26
TWA-040-0230	49366	40	40	230	53	20	36
TWA-063-0270	49367	63	63	270	63	25	46
TWA-080-0300	49368	80	80	300	80	28	46
TWA-100-0325	49369	100	100	325	80	28	46
TWA-125-0350	49370	125	125	350	95	32	70
TWA-150-0400	49371	150	150	400	103	36	70

EXEMPLE OF USE FOR TWA-ANCHOR

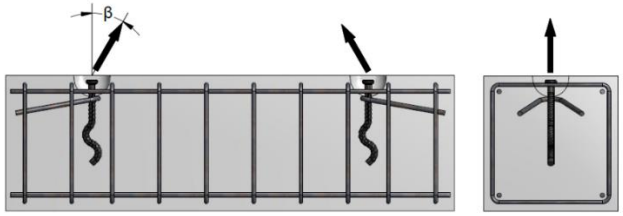
Axial lift

-lifting with the help of a spreader beam



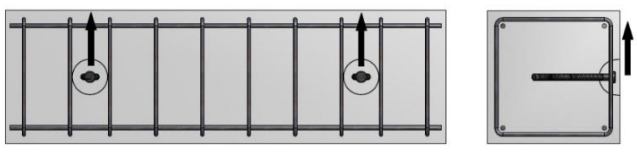
Angle lift up to 45°

- lifting with the help of a two-sling set
- the angle lift in direction of free edge is not admissible
- an angled lift reinforcement is recommended to be installed in the vicinity of the anchor.



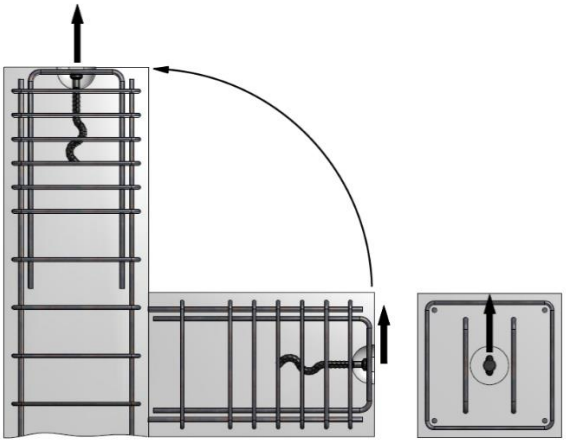
Tilt and transport

-during tilting only half of the forces have to be taken into account



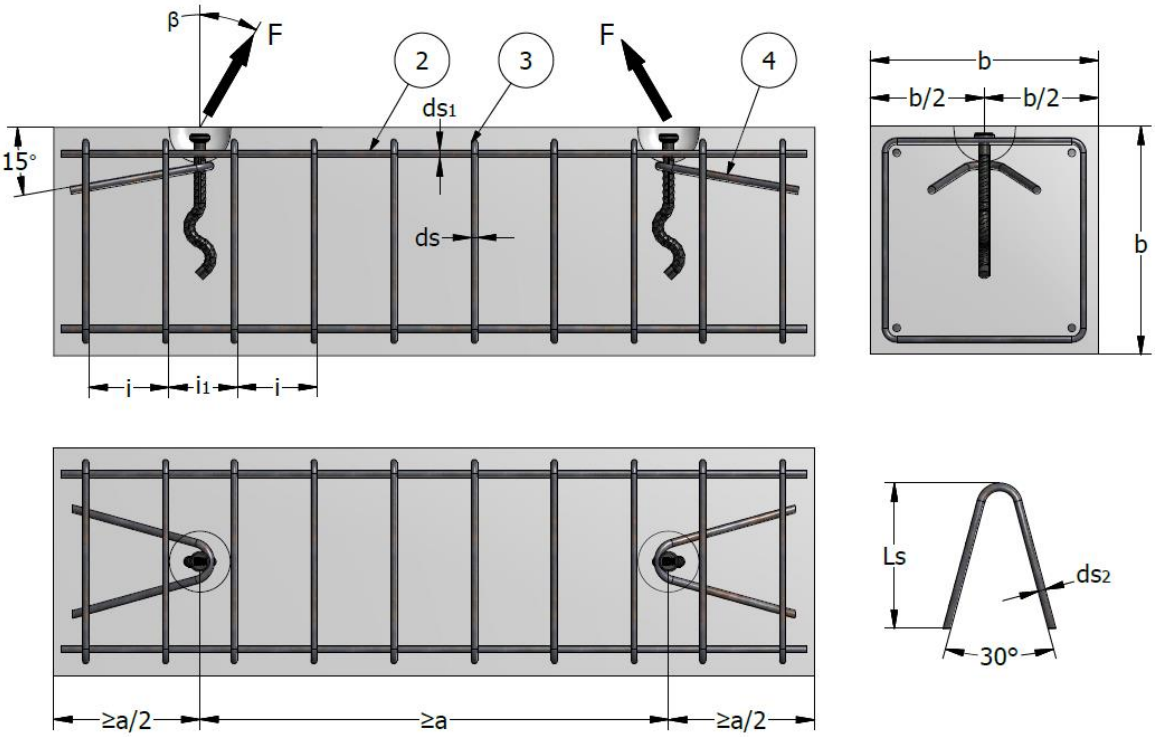
Tilt and lift by the column head

-the reinforcement stirrups in the area of the column head are installed close enough so that load can be transferred safely. It is recommended to add additional U-stirrups close to the anchor.



TWA-WAVE-ANCHOR ARRANGEMENT

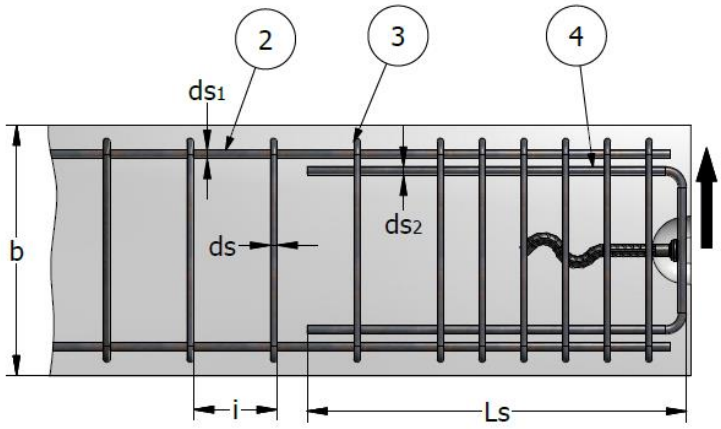
REINFORCEMENTS TYPES USED IN THE ANCHOR ZONE FOR BEAMS – ANGLE LIFT

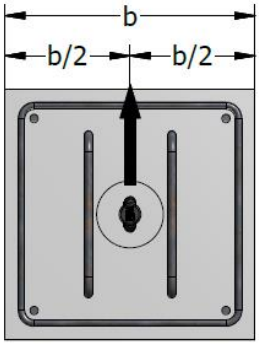


Permissible load for angle lift up to 45º, additional reinforcement is required – angle lift reinforcement.

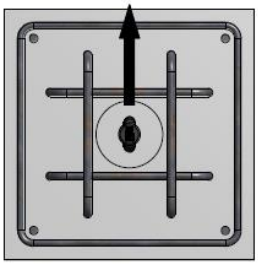
Anchor type	Load group	Load capacity Angle lift ß ≤ 45º	Concrete element dimensions			Edge reinforcement B500B (2)	Stirrups B500B (3)		Angle lift reinforcement B500B (4)	
		Concrete strength f_{cu}≥ 15 MPa	"a/2"	„a"	„b"	„d_{s1}"	„i"	„d_s"	„d_{s2}"	„L"
	[kN]	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TWA-020-0145	20	20	350	700	170	12	150	6	8	300
TWA-025-0190	25	25	450	900	205	14	150	6	8	350
TWA-040-0230	40	40	600	1200	260	16	200	8	8	400
TWA-063-0270	63	63	700	1400	300	20	200	10	12	450
TWA-080-0300	80	80	750	1500	360	25	200	10	12	550
TWA-100-0325	100	100	800	1600	380	25	200	12	14	600
TWA-125-0350	125	125	850	1700	400	25	200	14	16	650
TWA-150-0400	150	150	1000	2000	1000	28	200	20	16	800

REINFORCEMENTS TYPES USED IN THE ANCHOR ZONE FOR BEAMS – TILTING AND VERTICAL LIFT





TWA - 2,0 - 4,0t

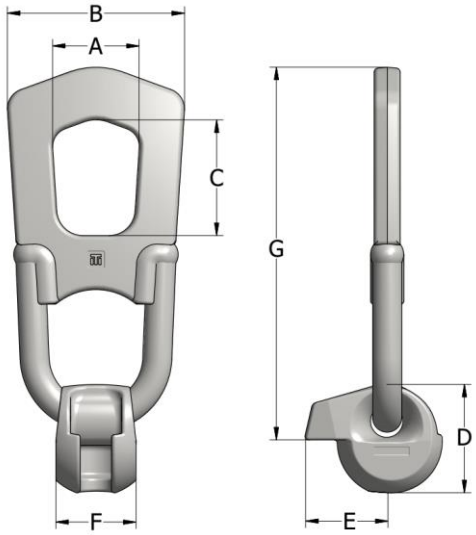

TWA - 6,3 - 15,0t

Anchor type	Load group	Load capacity Tilting	Concrete element dimensions	Edge reinforcement B500B (2)	Stirrups B500B (3)		U-stirrups B500B (4)	
		Concrete strength f_{cu}≥ 15 MPa	„b"	„d_{s1}"	„i"	„d_s"	„d_{s2}"	„Ls"
	[kN]	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TWA-020-0145	20	10	170	12	30-30-50-50-125	6	6	500
TWA-025-0190	25	12,5	205	14	30-30-50-50-125	6	8	500
TWA-040-0230	40	20	260	16	30-50-50-50-50-150	8	10	600
TWA-063-0270	63	31,5	300	20	30-30-50-50-50-150	10	8	700
TWA-080-0300	80	40	360	25	30-50-50-50-50-50-250	10	10	750
TWA-100-0325	100	50	380	25	30-50-50-50-50-50-250	12	10	900
TWA-125-0350	125	62,5	400	25	30-50-50-50-50-50-250	14	12	950
TWA-150-0400	150	75	1000	28	30-50-50-50-50-50-50-300	20	14	1000

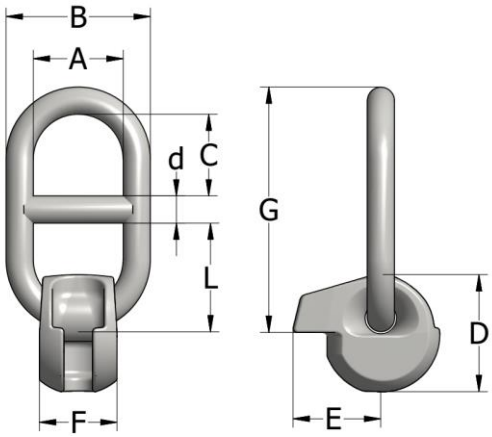
Additional U-stirrups close to the anchor for erecting and vertical lifting by the column head
- 2-pcs for TWA 20 – 40kN
- 4-pcs for TWA 63 – 150kN

LIFTING CLUTCHES TH2 AND THR2

The 3D Lifting Systems TH2 and THR2 are made of high quality steel and they are designed with a safety factor of 5. Every Lifting System is individually tested and is supplied with a unique certificate tested for a safety factor is 3 times the working load. The special design of the clutch ensures a tight and safe connection to the anchor. Obviously, the shackle fits the hemispherical cavity created by recess former perfectly.
The lifting clutch, recess former and anchor only correspond when they are from the same load group. The load group is clearly marked on the lifting clutch.



TH2



THR2

Specifications of the TH2

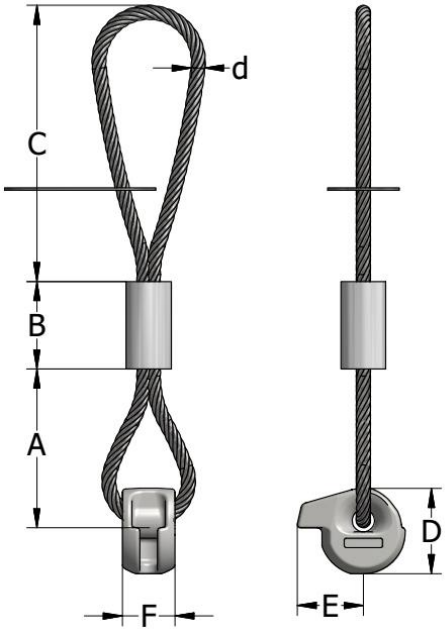
TH2 lifting system		Load group	A	B	C	D	E	F	G
Type	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TH2 13	43143	13	48	77	60	55	40	33	165
TH2 25	43144	25	50	92	75	68	55	42	205
TH2 40/50	43145	50	68	121	86	88	64	57	240
TH2 75/100	43146	100	84	170	110	108	90	77	346
TH2 150/200	43147	200	124	230	140	146	118	115	520
TH2 320	43148	320	155	303	175	195	160	155	590
TH2 450	44500	450	155	303	175	195	160	155	590

Specifications of the THR2

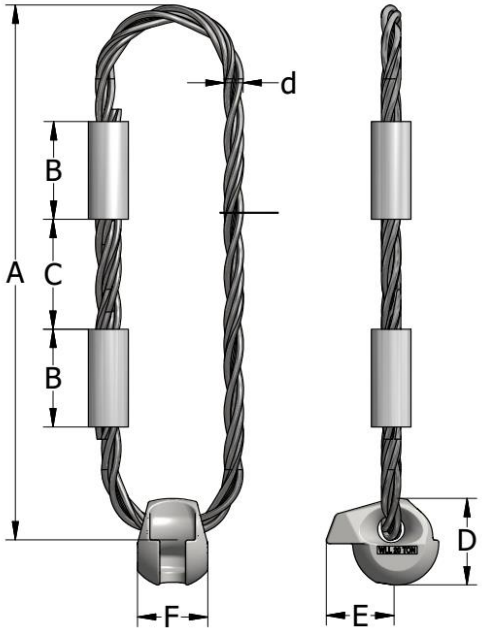
TH2 lifting system		Load group	A	B	C	d	L	D	E	F	G
Type	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
THR2 40/50	45281	50	66	106	60	20	80	88	64	57	180
THR2 75/100	45279	100	90	146	58	28	68	108	90	77	210

LIFTING CLUTCHES TH1

The 3D Lifting Systems TH1 are made of high quality steel and they are designed with a safety factor of 5. All the Lifting System are individually tested and is supplied with a unique certificate. The safety factor is 3 times the working load.
The special design of the clutch ensures a tight and safe connection to the anchor. Obviously, the shackle fits the hemispherical cavity created by recess former perfectly.
The lifting clutch, recess former and anchor only correspond when they are from the same load group. The load group is clearly marked on the lifting clutch.



TH1 1.3 – 10T

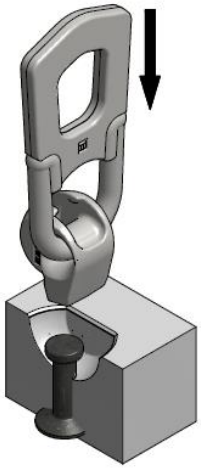


TH1-15/20T

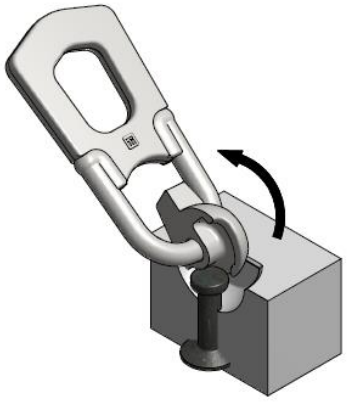
Specifications of the TH1

TH1 lifting system		Load group	A	B	C	D	E	F
Type	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TH1 13	61536	13	100	54	176	55	40	33
TH1 25	61537	25	120	90	195	68	55	42
TH1 50	61538	50	200	100	295	88	64	57
TH1 75/100	61539	100	240	140	325	108	90	77
TH1 150/200	61540	200	876	160	180	146	118	115

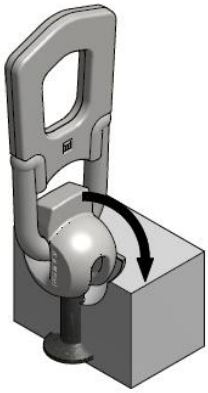
OPERATING INSTRUCTIONS



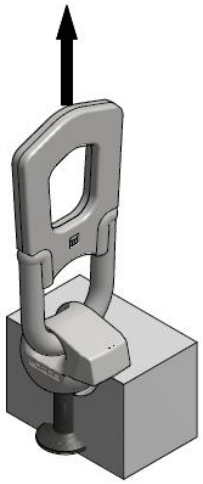
1
The clutch is brought in the right position.



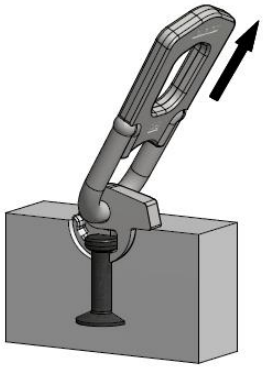
2
Rotate the shackle, until the opening corresponds with the anchor head.



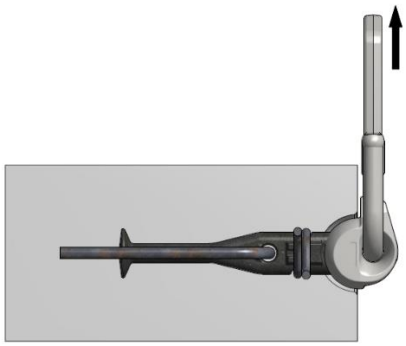
3
The shackle rotates to its locking position.



4
The nose of the shackle is pushed against the concrete element.

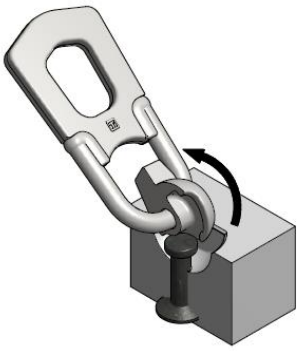


Angled lifting

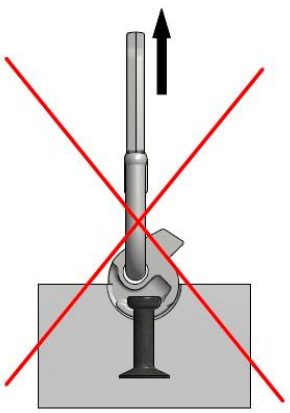


Tilt-up lifting

When pitching the concrete unit with the 3D Lifting System, the nose must be in the same direction with the load (see picture above). Due to the counterweight of the nose, the shackle remains connected, even in an unloaded state. To release the 3D Lifting System, the load hook is lowered and the shackle is turned up and out. Only after the Lifting System is completely detached of the recess and anchor, the crane can be withdrawn. The 3D lifting System can remain attached to the crane hook till another use.



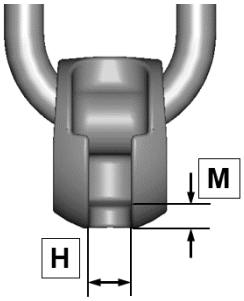
Release operation after lifting



If the shackle remains in the position showed above, the lifting of the concrete unit is not possible.

LIFTING CLUTCHES - SYSTEM MAINTENANCE

In common with all lifting devices, the lifting system TH1, TH2, THR2 must be checked at least twice a year by trained personnel. Any defects found should be corrected before use. It is important to determine the amount of wear. The lettering and identification of the lifting system must be visible. If the shackle is deformed or the mouth opening is enlarged, the 3D Lifting System must be taken out of use and cannot be repaired. If the limiting dimensions given in tables bellow are exceeded for “H” or fall below for “M” a further use of the Lifting System is not safe. Repairs, especially welding operations to the Lifting System are strictly forbidden. Do not combine our products with accessories from other manufacturers.



Shackle dimensions

Checking TH calibre

For each type a checking calibre is available on command.

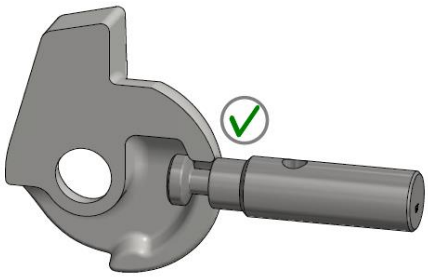
TYPE	TH2 NUMBER	H MAXIMUM [mm]	M MINIMUM [mm]	CALIBER “GO/NO-GO” NUMBER
TH2 13	43143	13	5.5	46193
TH2 25	43144	18	7	46194
TH2 50	43145	24	9	46195
TH2 100	43146	33	12	46196
TH2 200	43147	45	18	46197
TH2 320	43148	56	25	46198
TH2 450	44500	56	25	46199

TYPE	THR2 NUMBER	H MAXIMUM [mm]	M MINIMUM [mm]	CALIBER “GO/NO-GO” NUMBER
THR2 40/50	45281	24	9	46195
THR2 75/100	45279	33	12	46196

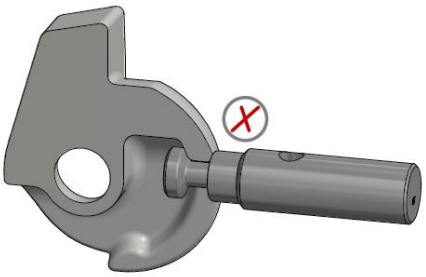
DIMENSION “M” CHECKING

The dimension “M” must be checked in this zone with risk of fracture during usage.

ACCEPTABLE
Dimension “M” is larger than minimum permitted.

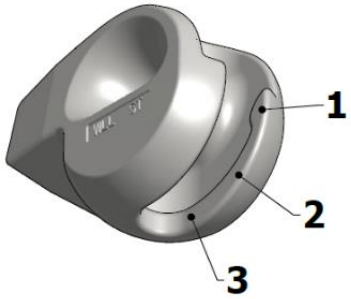


NOT ACCEPTABLE
In this case dimension “M” is less than allowed.



DIMENSION "H" CHECKING

The "H" dimension must be checked in at least 3 zones with risk of enlargement during usage.



PRIMARY ZONE

ACCEPTABLE Dimension "H" is less than maximum permitted.	NOT ACCEPTABLE In this case dimension "H" is larger than allowed.
	

SECONDARY ZONE

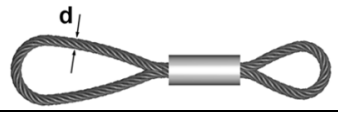
ACCEPTABLE Dimension "H" is less than maxim permitted.	NOT ACCEPTABLE In this case dimension "H" is larger than allowed.
	

THE THIRD ZONE

ACCEPTABLE Dimension "H" is less than maxim permitted.	NOT ACCEPTABLE In this case dimension "H" is larger than allowed.
	

WIRE CABLE CHECKING

The connection elements (bracket) to the crane hook, with visible mark of damage or excessive wear must be withdrawn immediately. The wear on the bracket must be lower than the limits showed in the table below.



Cable type	Number of visible ruptured wires over a length of		
	3d	6d	30d
Braided cable	4	6	16

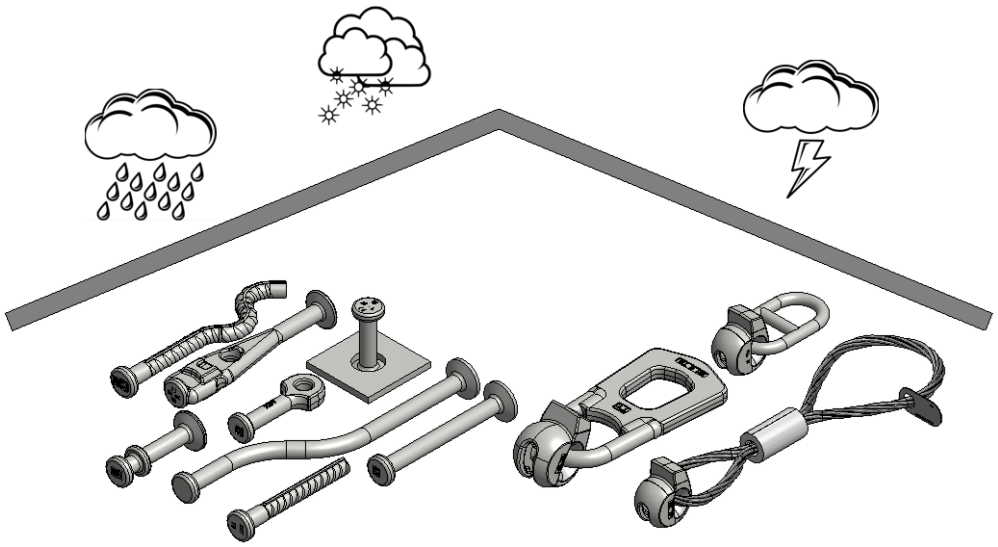
d = cable diameter

WIRE CABLES SHOULD BE CHECKED FOR THE FOLLOWING FLAWS:

- Kinking
- One braid broken
- Separating of the outer layer of braids
- Crushing braids
- Crushing at the shackle contact point with more than 4 ruptured wires on braided cables, or more than 10 ruptured wires on cable laid rope
- Corrosion marks
- Damage or severe wear on the closing bush.
- Signs of slipping between the cable and the closing bush
- High number of ruptured wires. The cable with a number of ruptured wires as in the table above must be taken out of use.

STORAGE REQUIREMENTS

Lifting systems and anchors must be stored and protected in dry conditions, under a roof. Large temperature variations, snow, ice, humidity, or salt and sea water impact may cause damage to anchors and shorten the standing time.



ATTACHMENT OF THE SLOT - ANCHORS IN CONCRETE

To link together the TH2 lifting clutch with the T-Slot-anchor there must be a cavity in the concrete. This cavity has a spherical form and can be either a half ball or a small ball slot. Different aiding kits are available to realize this recess. For a half ball cavity the TH2 lifting clutch can be attached in any direction and eventually can turn during lifting in the cavity till the lifting hook has arrived in its good position. The most usable is the RB recess former.

RECESS FORMERS

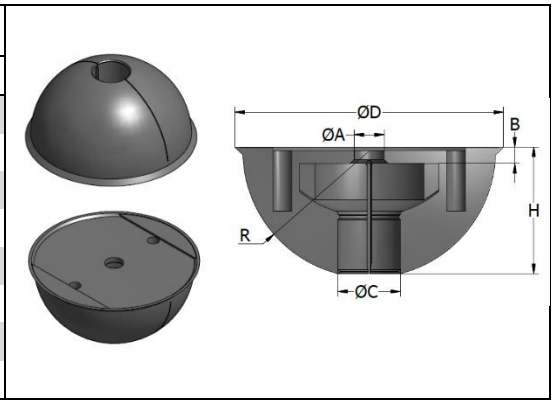
The anchors are fitted in the mould with a recess former. The cavity former, enables the lifting clutch to fit over the anchor. Because of the special design, there is no sharp edge in the precast element. Obviously, the recess formers are available in the same range as the lifting clutches and the anchors. This is indicated by a load group, marked on the top.
The formers are mounted on the mould with fixing plates. After de-mould of the element, the recess formers can be removed easily. Another option is represented by the magnetic and steel recess formers.

The standard recess formers are manufactured out of rubber shore 65° - 70°. The rubber used has a good resistance to de-mould oil. The formers will keep their original shape, even when they are heated up to 120°C. They can be used many times. The steel magnetic recess formers are manufactured without rubber.

RB – STANDARD RUBER RECESS FORMER

The RB rubber recess former is used in combination with the T slot anchor, O-anchor, TPA anchor, TKS anchor and TSG anchor.

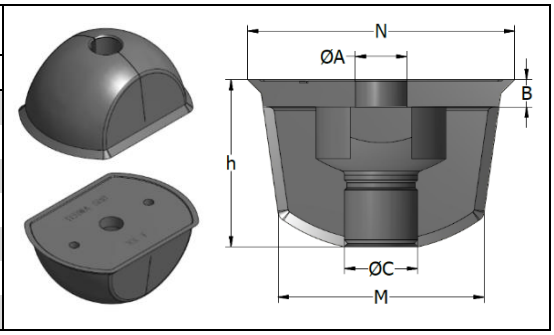
Rubber recess former RB		Load group	R	ØA	B	ØC	ØD	H
Description	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
RB-013	43905	13	30	9.5	9	10	66	32
RB-025	43906	25	37	14	7.5	14	80	39
RB-040/050	43907	50	47	15	11	20	100	48
RB-075	43908	75	60	15	10.5	24	128	61
RB-100	43909	100	60	15	10.5	28	128	61
RB-150	43910	150	80	19	10.5	38	170	80
RB-200	43911	200	80	19	10.5	40	170	80
RB-320/450	43677	320/450	108	22	15	50	236	107



SRB – NARROW RUBBER RECESS FORMER

The SRB narrow rubber recess former is used in combination with the T slot anchor, O-anchor, TPA anchor, TKS anchor and TSG anchor. Because of the minimal width it is often used for thin elements, such as panels.

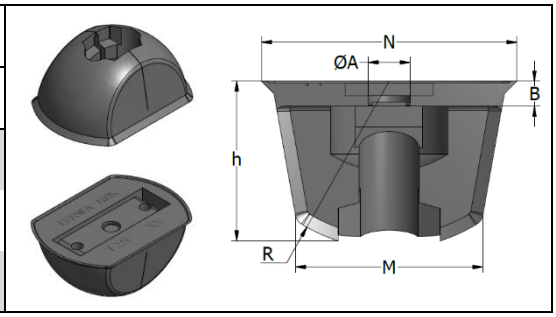
Rubber recess former SRB		Load group	ØA	B	ØC	h	M	N
Description	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
SRB-013	43949	13	9.5	7	10	29.5	37	47
SRB-025	43950	25	14	6	14	39	44	59
SRB-050	43951	50	15	8	20	49	60	78
SRB-075	43952	75	15	8	24	58	77	97
SRB-100	43953	100	15	8	28	58	77	97
SRB-150	49519	150	15	8	38	86	120	145
SRB-200	43954	200	15	8	40	86	120	145



RBK – TKA RUBBER RECESS FORMER

The **RBK** rubber recess former is used in combination with the TKA tilt-up anchor

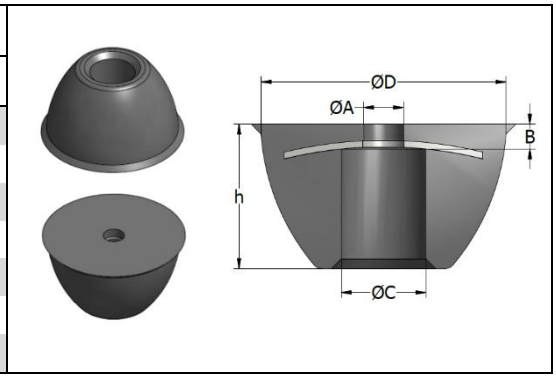
Rubber recess former RBK		Load group	R	ØA	B	h	M	N
Description	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
RBK-013	43946	13	33	8	6	32	36	49
RBK-025	43947	25	40	10	6	38	44	60
RBK-050	43948	50	55	12	8	53	55	78



RBP – RUBBER RECESS FORMER

The **RBP** rubber recess former is used in combination with the P anchor with collar

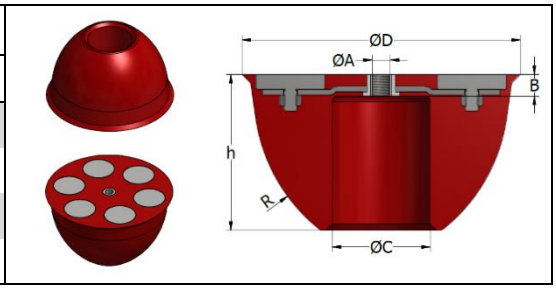
Rubber recess former RBP		Load group	h	ØA	B	ØC	ØD
Description	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]
RBP-13-55 shore	44809	13	36	10	7	18.5	63
RBP-13-70 shore	43759	13	36	10	7	18.5	63
RBP-25-55 shore	44810	25	43.5	12	7	25.5	74
RBP-25-70 shore	43760	25	43.5	12	7	25.5	74
RBP-50-55 shore	44811	50	54	12	8	35.5	96
RBP-50-70 shore	44283	50	54	12	8	35.5	96
RBP-100-70 shore	44284	100	72	14	10	45	122



MPB – MAGNETIC RECESS FORMER

The MPB it is made of polyurethane and can be used in combination with a P anchor. These recess formers are mostly applied in an upside down position.

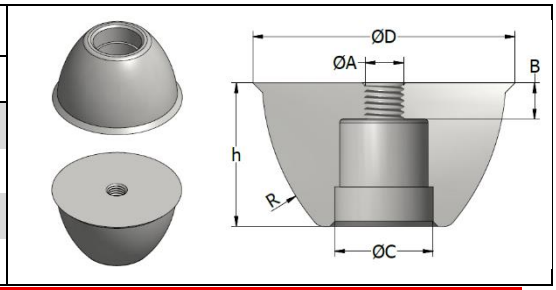
Magnetic recess former MPB		Load group	ØA	B	ØC	ØD	h	R
Description	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
MPB-013	45865	13	M 10	5	18,5	64	33	32
MPB-025	46080	25	M 10	7	25,5	80	43,5	69
MPB-050	46081	50	M 10	8	35,5	101	54	65
MPB-100	46082	75/100	M 10	10	45,5	129	72	80



SBK – STEEL RECESS FORMER

The SBK steel recess former is made of steel S355JO and is used in combination with T slot anchor, O anchor, TPA anchor, TKS anchor and TSG anchor. When these anchors are used a rubber ring RR should be fitted as well. These recess formers are mostly applied in an upside down position.

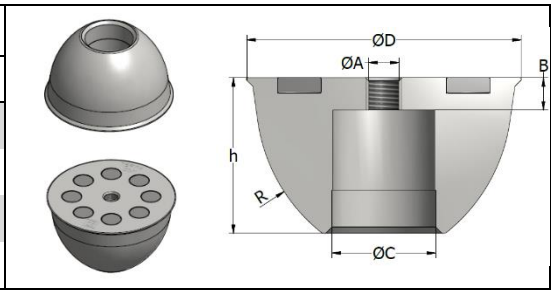
Round steel recess former SBK		Load group	ØA	B	ØC	ØD	h	R
Description	Product no.	[kN]		[mm]	[mm]	[mm]	[mm]	[mm]
SBK-013	44404	13	M12	11	20	63	36	32
SBK-025	45855	25	M12	11	30	80	43.5	69
SBK-050	45856	50	M12	13	37	101	54	65
SBK-100	45857	100	M16	15	48	129	72	80



SBKM – STEEL RECESS FORMER WITH MAGNET

The SBKM steel recess former with magnets is made of stainless steel W 1.4305 EN 10088 and is used in combination with T slot anchor, O anchor, TPA anchor, TKS anchor and TSG anchor. When these anchors are used a rubber ring RR should be fitted as well. These recess formers are mostly applied in an upside down position.

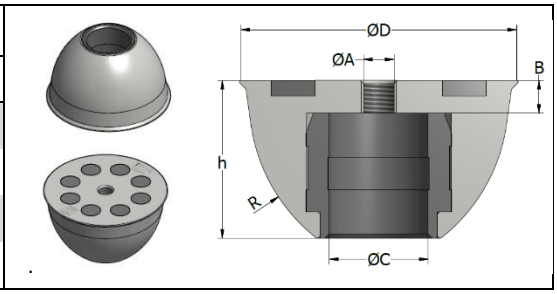
Round steel recess former SBKM		Load group	ØA	B	ØC	ØD	h	R
Description	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
SBKM-013	48722	13	M12	11	20	66.5	36	32
SBKM-025	48723	25	M12	11	30	80	43.5	69
SBKM-050	48724	50	M12	13	37	100	54	65
SBKM-100	48725	100	M16	15	48	129	72	80



SBPM – STEEL RECESS FORMER WITH MAGNET AND RUBBER INSERT

The SBPM steel recess former with magnets and rubber insert is made of stainless steel W 1.4305 EN 10088 and is used in combination with P anchor (figure 81). These recess formers are mostly applied in an upside down position.

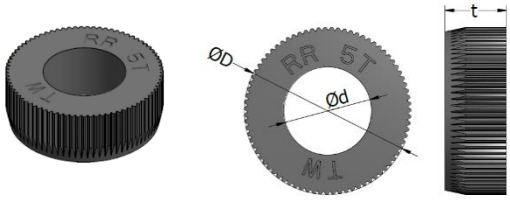
Round steel recess former SBPM		Load group	ØA	B	ØD	h	R
Description	Product no.	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]
SBPM-13	60669	13	M12	11	64	36	32
SBPM-25	60670	25	M12	11	78	43.5	69
SBPM-50	60671	50	M12	13	98	54	65
SBPM-100	60672	100	M16	15	127	72	80



RR – RUBBER RING

The rubber ring is used when a T slot anchor, O anchor, TPA anchor, TKS anchor and TSG anchor is fitted in a SBKM steel recess former or SBK.

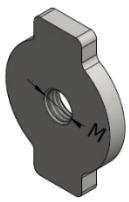
Rubber ring RR		Load group	D	d	t
Description	Product no.	[kN]	[mm]	[mm]	[mm]
RR-013	43966	13	21	10	11
RR-025	43967	25	31	14	12
RR-040/050	43968	50	38	20	14
RR-075	43813	75	49	24	20
RR-100	43969	100	49	28	20



FIXING ACCESORIES FOR THE RUBBER RECESS FORMERS

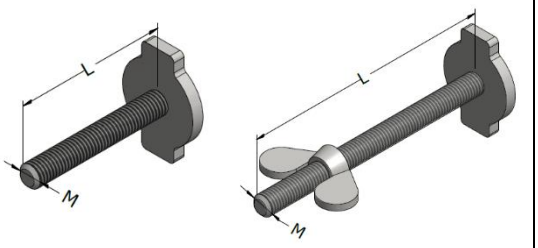
IP – FIXING PLATE

Fixing plate IP		Load group	Thread
Description	Product no.	[kN]	M
IP-013	43913	13	M8
IP-025	43914	25	M10
IP-050	43915	50	M10
IP-075/100	43916	75/100	M12
IP-150/200	43917	150/200	M12
IP-320	43918	320	M16



IPD – FIXING PLATE WITH THREAD ROD / IPDV – FIXING PLATE WITH THREAD ROD AND WING NUT

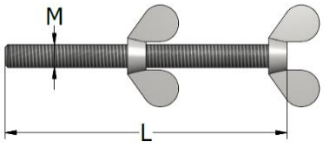
Fixing plate with thread rod IPD		Load group	Thread	L
Description	Product no.	[kN]	M	[mm]
IPD-013	44051	13	M 8	100
IPD-025	44052	25	M 10	100
IPD-050	44053	50	M 10	100
IPD-075/100	44054	75/100	M 12	100
IPD-150/200	44055	150/200	M 12	100
IPD-320	44056	320	M 16	100



TDV – THREAD HOLDING SCREW

The TDV is used for mounting the recess former on the steel formwork. It is fitted with two wing nuts, of which the one at the end is locked.

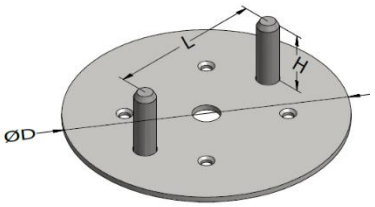
TDV		Load group	Thread	L
Description	Product no.	[kN]	[mm]	[mm]
TDV-3D-013	44589	13	M8	110
TDV-3D-025/050	44590	25–50	M10	110
TDV-3D-075/200	44591	75–200	M12	110
TDV-3D-320	44592	320	M16	110



OPR – MOUNTING PLATE

The OPR is available for mounting the RB recess former to the formwork. The recess former can be fitted easily on the two pins. The OPR also ensures that the recess former remains completely closed while pouring the concrete. The OPR can be nailed or welded to the formwork.

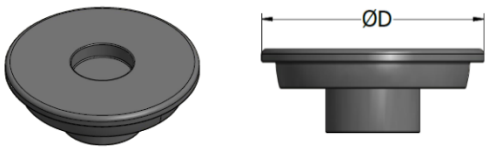
Holding plate OPR		Rubber recess former RB	Load group	D	L	H
Description	Product no.	Description	[kN]	[mm]	[mm]	[mm]
OPR-013	46058	RB-013	13	66	38	17
OPR-025	46059	RB-025	25	80	50	20
OPR-050	46060	RB-050	50	100	60	26
OPR-075/100	46061	RB-075/100	75/100	128	80	31
OPR-150/200	46062	RB-150/200	150/200	170	110	39
OPR-320	46063	RB-320	320	236	128	54



TAF – PROTECTION COVER

The TAF-protection cover ensures a good protection for the anchor and the recess against water, ice or dirt.

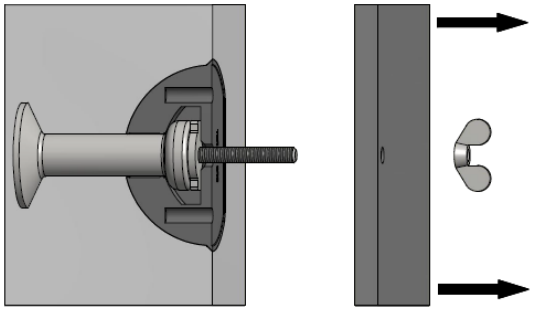
Protection cover TAF		Load group	D
Description	Product no.	[kN]	[mm]
TAF-013	43170	13	70
TAF-025	43171	25	85
TAF-050	43172	50	104
TAF-075/100	43173	75/100	130
TAF-150/200	46517	150/200	175
TAF-320	46519	320	241



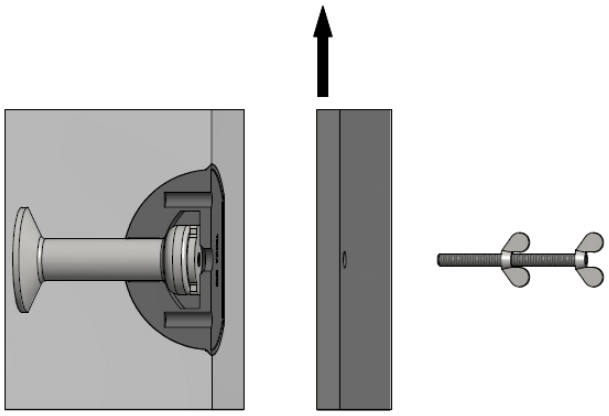
GENERAL INSTRUCTIONS FOR INSTALLATION AND USE

RUBBER RECESS FORMERS

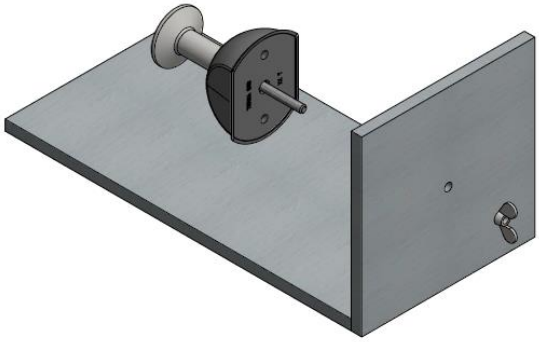
- *If the formwork can only be removed sideways, the fixing plate with a threaded rod IPD or IPDV should be used.*

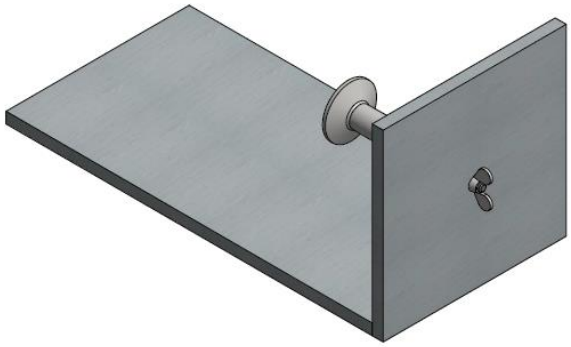


- *If the formwork can only be removed vertically, the fixing plate IP in combination with the threaded screw TDV should be used.*

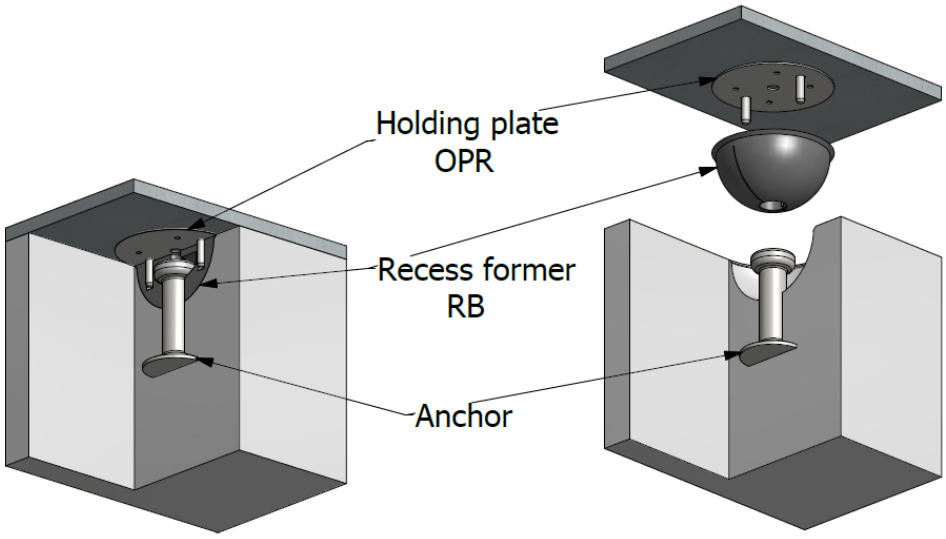


- *The fixing plate with a threaded rod IPD or IPDV and the anchor are fitted in the opened recess former. The recess former is mounted to the formwork with the wing nut. The nut is then tightened securing the recess former and the anchor firmly in position.*

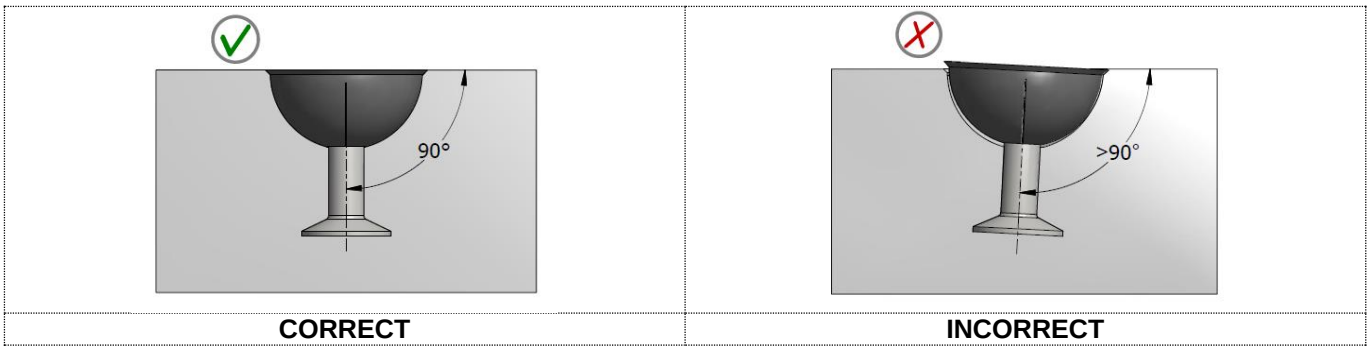




- *In case of wooden formwork, the recess former can be mounted with the OPR mounting plate. The pins on the OPR ensure that the recess former remains closed during the process of pouring concrete. The OPR is mounted to the formwork with nails.*



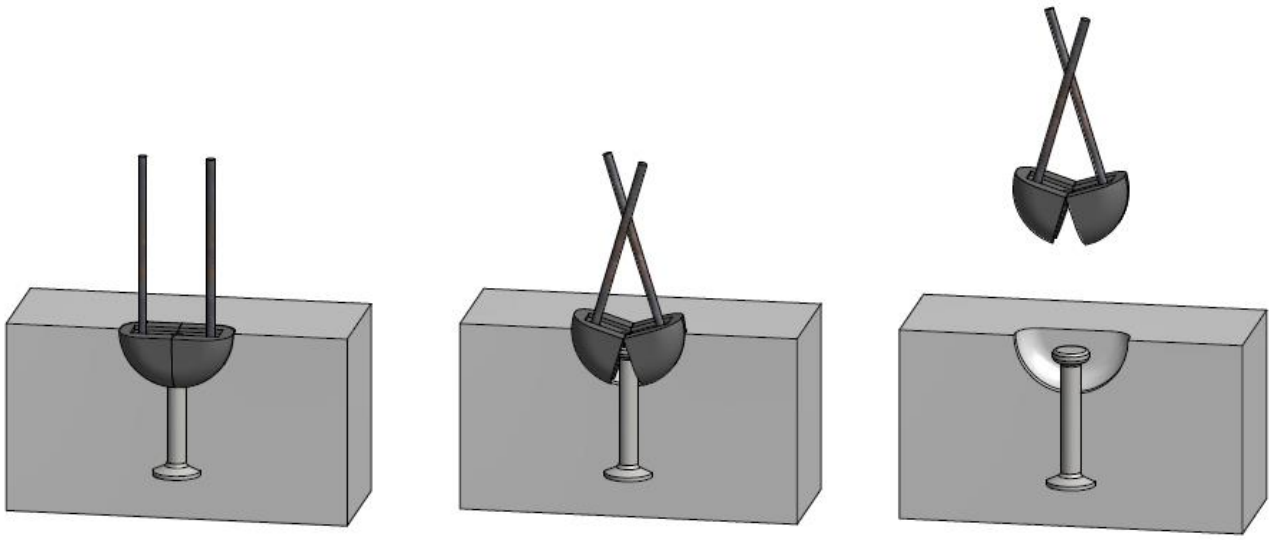
ANCHOR - INSTALLATION



CORRECT	INCORRECT

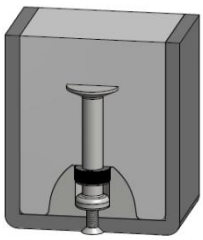
REMOVAL OF THE RUBBER RECESS FORMER

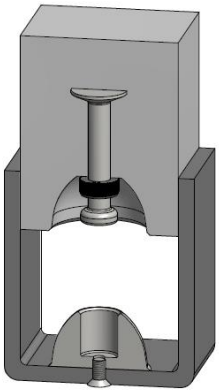
Two pieces of re-bar steel can be inserted in the recess former holes. With the use of these rods, the former bends open and it can be taken from the anchor. Before this, the excessive concrete should be removed. Do not use a hammer or any other tools. This can damage the recess former.



STEEL AND MAGNETIC RECESS FORMER

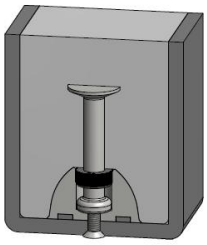
Steel recess former - SBK

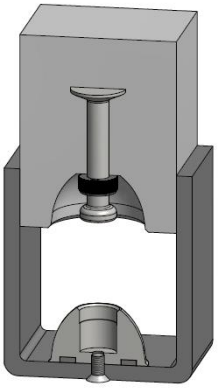




The steel recess formers SBK and SBKM are always used in combination with a rubber ring. The rubber ring ensures that the anchor is fitted tight in the former. Moreover, the rubber ring prevents concrete pouring in the recess former.
It is recommended that both the anchor head and rubber ring are greased with formwork oil before installation. When the pre cast element is lifted out of the mould, the anchor and the rubber ring detach themselves easily from the recess former.

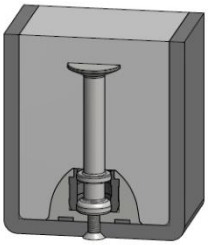
Steel recess former with magnets - SBKM

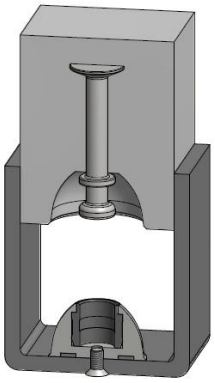




When using the magnetic recess former it is very important that the surface of the formwork is clean. After de-mould the magnetic former can be removed from the formwork with a screw.

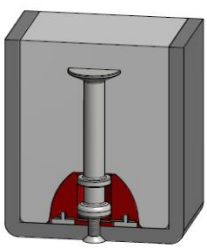
Steel recess former with magnets for P-anchor - SBPM

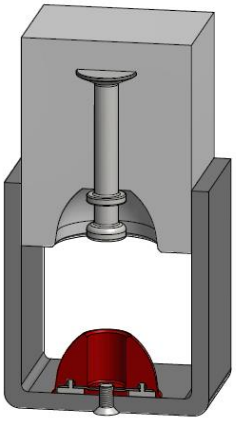




The SBPM steel recess former with magnets and rubber insert is made of stainless steel W 1.4305 EN 10088 and is used in combination with P anchor. These recess formers are mostly applied in an upside down position.

Magnetic recess former for P-anchor - MPB





The MPB recess former with magnets is made of polyurethane resin and is used in combination with P anchor. These recess formers are mostly applied in an upside down position.

All the situations mentioned in this leaflet are valid for most of the cases. For variant situations or elements for which this instruction cannot be used you can always get advice from “Terwa”.

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