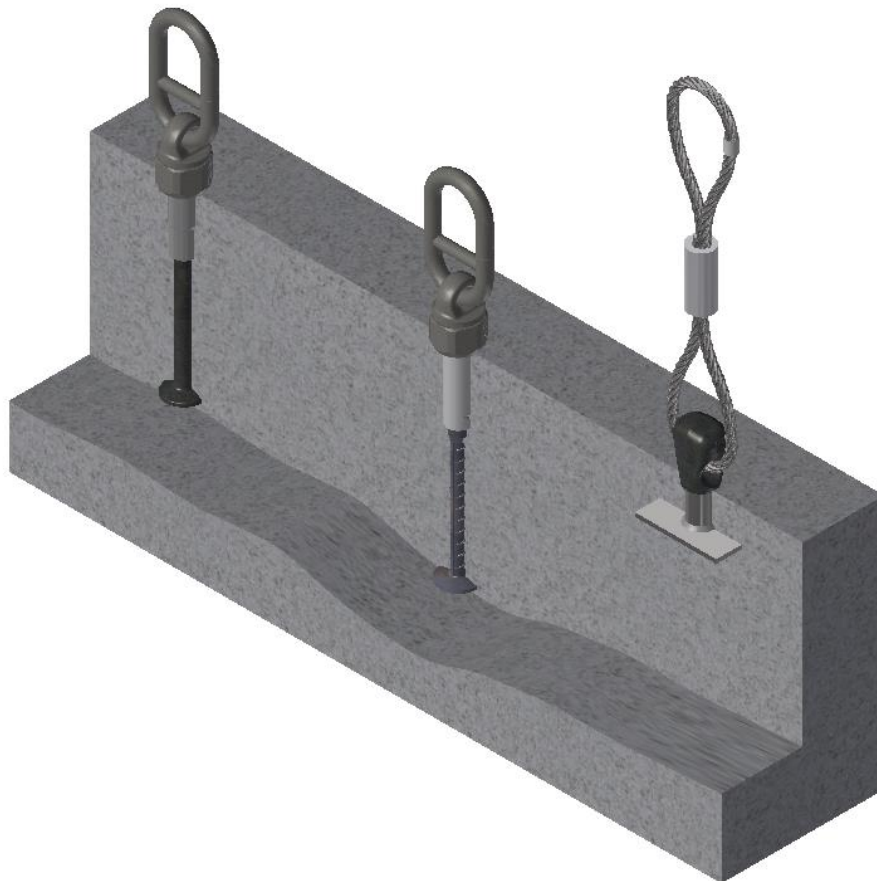


TECHNICAL DOCUMENTATION



LIFTING SYSTEMS | 1D-HD THREADED LIFTING SYSTEM



OVERVIEW






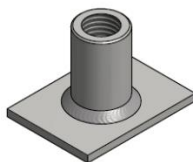





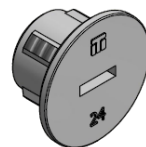



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FIXING ACCESSORIES			
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INTRODUCTION

HD threaded lifting systems are used in the precast industry and are suitable for lifting, transporting and installing precast concrete elements on site.

Some of the advantages of this system include:

- a wide range of lifting sockets
- capability of establishing a connection in a safe, simple manner
- the lifting systems can be re-used.
- CE conforming system. All Terwa lifting systems have the CE marking which guarantees conformance with the European regulations

The threaded lifting system combines a lifting anchor embedded in a concrete unit and a lifting device.

The design for Terwa threaded lifting anchors and technical instructions complies with the national German guideline VDI/BV-BS6205 "Lifting inserts and lifting insert for precast concrete elements". Based on this guideline, the manufacturer must also ensure that the lifting systems have enough strength to prevent concrete failure.

A failure of lifting anchors and lifting anchor devices can endanger human lives and may lead to significant damage. Therefore, lifting anchors and lifting devices must be produced with high quality and carefully selected. They are designed for the respective application and used by skilled personnel according to lifting and handling instructions.

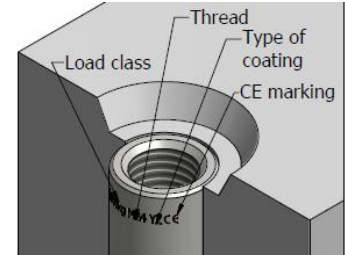
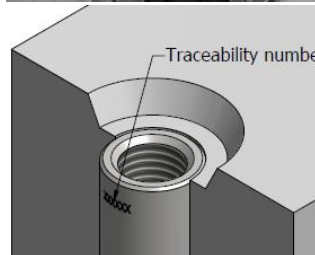
Quality

Terwa continuously controls the anchor production process in terms of strength, dimensional and material quality, and performs all of the required inspections for a superior quality system. All of the products are tracked from material acquisition to the final, ready to use product.



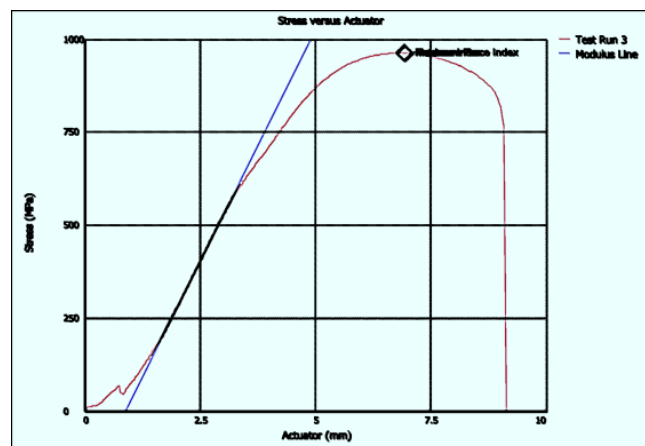
Marking and traceability

All anchors and lifting clutches have the CE marking and all data necessary for traceability, thread type and load class.



Anchor testing

Terwa lifting anchors are designed to resist at a minimum safety factor of **3x load group**



Application of lifting anchor system

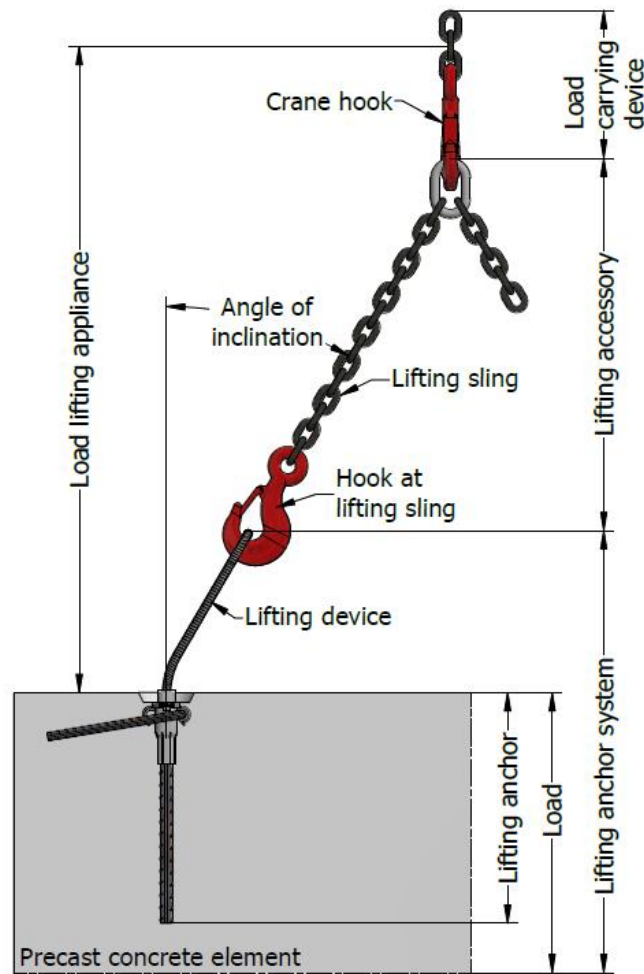
Load carrying devices - are equipment that is permanently connected to the hoist for attaching lifting devices, lifting accessory or loads.

Lifting accessory – equipment that creates a link between the load carrying device and the lifting device.

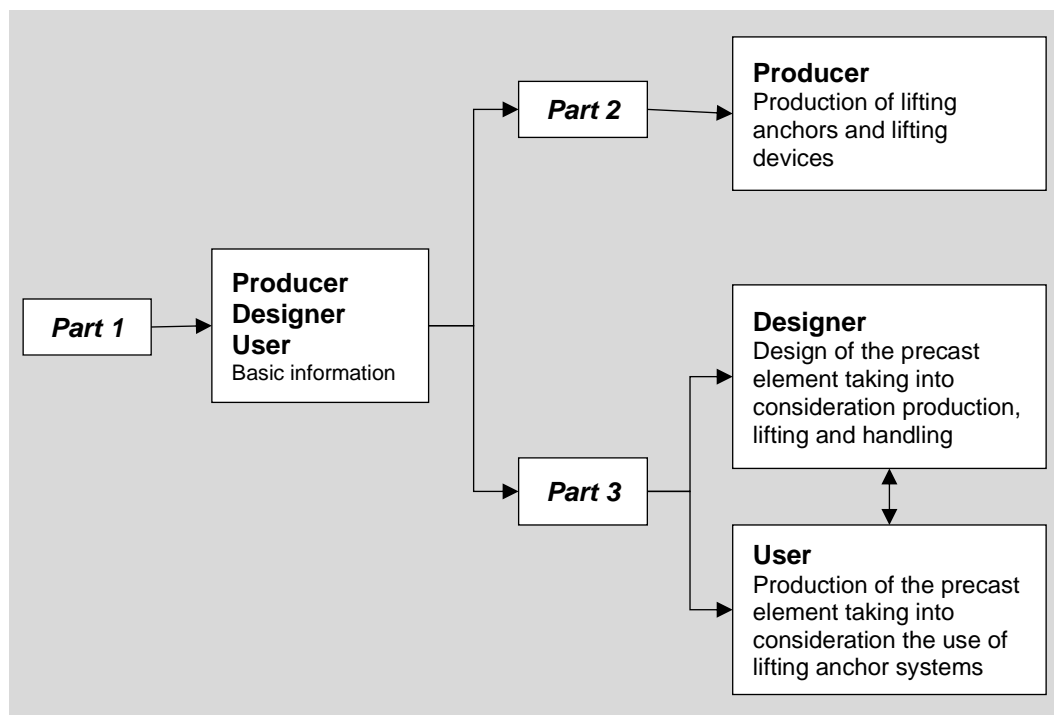
Lifting device (lifting key) – equipment that connects the loads to the load carrying device by means of lifting accessories.

Lifting anchor – steel part embedded in the concrete element, which is intended as an attachment point for the lifting device.

Lifting anchor system - consists of a lifting anchor (insert), which is permanently anchored in the precast concrete element and the corresponding lifting device, which is temporarily fixed to the embedded lifting anchor.



Interaction between the parts of the series of guidelines VDI/BV-BS 6205



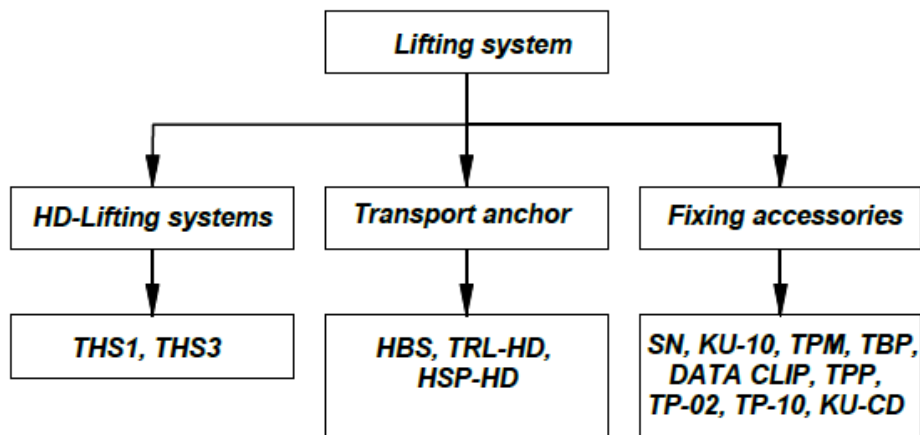
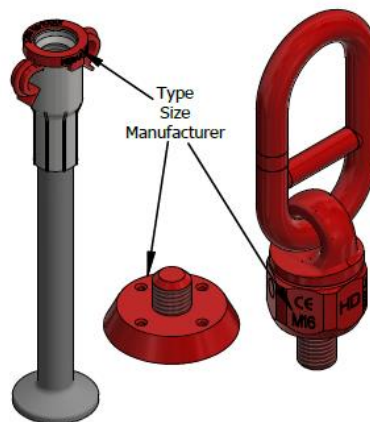
CE MARKING

CE marking means that a product is manufactured and inspected in accordance with a harmonised European standard (hEN) or a European Technical Approval (ETA). ETA can be used as the basis for CE marking for cases in which there is no harmonised EN standard. However, ETA is voluntary and not required by EU directives or legislation. Manufacturers may use the CE marking to declare that their construction products meet harmonised European standards or have been granted ETA Approvals. These documents define properties the products must have to be granted the right to use the CE marking and describe how the manufacture of these products is supervised and tested. EU Construction Products Regulation takes full effect on 1 July 2013. There are no harmonised EN standards for detailed building parts, such as connections used in concrete constructions, excluding lifting items and devices, which are covered by the EU Machinery Directive. For steel constructions, CE marking will become mandatory as of 1 July 2014, as covered by the EU Construction Products Directive.

PRODUCT RANGE

HD LIFTING SYSTEMS

- **RE-USABLE THREADED LIFTING SYSTEM**
Terwa offers various types of threaded lifting keys suitable for lifting, transporting and installing precast concrete elements.
- **TRANSPORT ANCHORS**
T-tail and rebar anchors with pressed sockets designed for lifting and transporting various precast concrete elements with a load range between 1.3 and 15 tonnes and lifting sockets with footplate suitable for thin panels or top slabs.
- **RECESS FORMERS AND MOUNTING ACCESSORIES**
Mounting accessories for fixing the anchors to the formwork during the production of the precast element.



TECHNICAL INFORMATION – CHOOSING THE TYPE OF ANCHOR

Terwa has 3 types of lifting systems:

- 1D threaded lifting system
- 2D strip anchor lifting system
- 3D T-slot anchor lifting system

The method for choosing the anchor is identical for all these types and depends on the lifting method and/or experience.

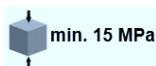
The 1D threaded lifting system is mainly used when the hoisting angles are limited, while the 2D strip anchor lifting system and the 3D T-slot anchor lifting system can be used for all hoisting angles, with minor limitations for the 2D strip anchor lifting system. The difference between the 2D strip anchor lifting system and the 3D T-slot anchor lifting system lies principally in the experience one has in using one or the other system.

Terwa also has software for making the anchor calculations.



SAFETY RULES

The lifting system consists of a threaded anchor embedded in concrete and a threaded lifting device. The threaded lifting loop is connected to the anchor only when required for lifting. **Ensure that the concrete has reached MPa strength of at least 15 before beginning lifting.**



These lifting systems are not suitable for **intensive** re-use. Please see chapter **Checking the lifting system** for inspection requirements.

In designing the lifting system, the safety factors for the failure mode steel rupture derived from the Machinery Directive 2006/42/EC are:

- **for steel component (solid sections)** $\gamma = 3$
- **for steel wires** $\gamma = 4$

For this, the load-side dynamic working coefficient $\psi_{dyn} = 1.3$

For the determination of the characteristic resistances based on method A in accordance with DIN EN 1990 - Annex D for the concrete break-out, splitting, blow-out and pull-out failure modes, the safety factor is $\gamma = 2.5$

The safety concept requires that the action E does not exceed the admissible value for the resistance R_{adm} :

$$E \leq R_{adm} \quad \text{Where: } E - \text{action, } R_{adm} - \text{admissible load (resistance)}$$

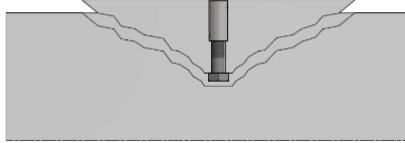
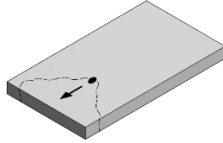
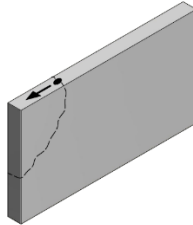
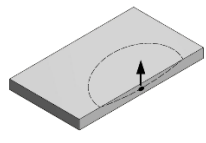
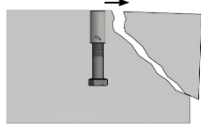
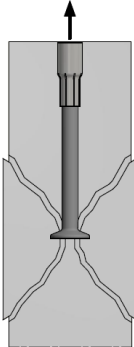
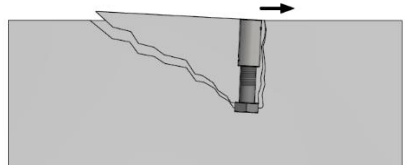
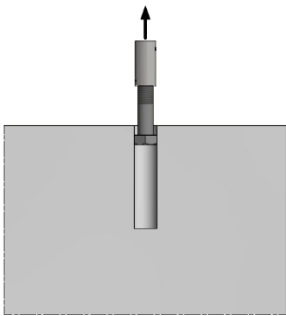

The admissible load (resistance) of lifting anchor and lifting device is obtained as follows:

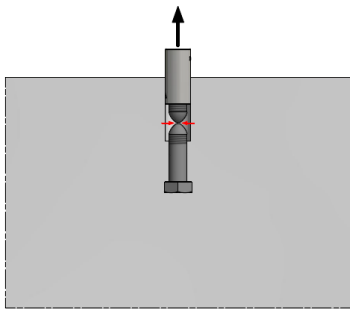
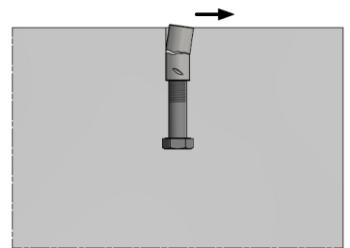
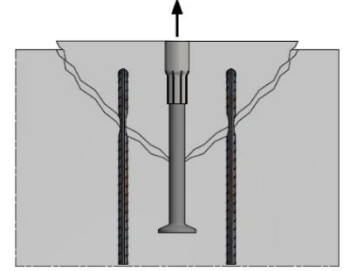
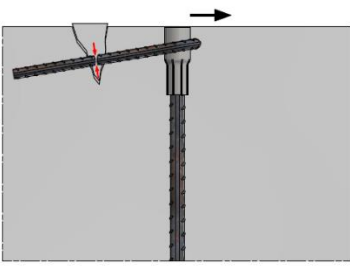
$$R_{adm} = \frac{R_k}{\gamma} \quad \text{Where: } R_k - \text{characteristic resistance of the anchoring of a lifting anchor or lifting device, } \gamma - \text{global safety factor}$$

Notice: The lifting anchors must always be installed above the centre of gravity. Otherwise, the element can tip over during transport.

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

POSSIBLE TYPES OF FAILURE OF A LIFTING ANCHOR

Failure type	Fracture pattern: tensile force	Fracture pattern: transverse shear force	
Concrete break-out Failure mode, characterised by a wedge or cone shaped concrete break-out body, which was separated from the anchor ground and is initiated by the lifting anchor		 	 
Local concrete break-out (blow-out) Concrete spalling at the side of the component that contains the anchor, at the level of the form-fitting load application by the lifting anchor into the concrete break-out at the concrete surface.			
Pry-out (rear breakout of concrete) Failure mode characterised by the concrete breaking out opposite the direction of load, on lifting anchors with shear load.			
Pull-out Failure mode, where the lifting anchor under tension load is pulled out of the concrete with large displacements and a small concrete break-out.			
Splitting of the component A concrete failure in which the concrete fractures along a plane passing through the axis of the lifting anchor.			

Failure type	Fracture pattern: tensile force	Fracture pattern: transverse shear force
Steel failure Failure mode characterised by fracture of the steel lifting anchor parts.		
Steel failure of additional reinforcement Steel failure of the supplementary reinforcement loaded directly or indirectly by the lifting anchor		

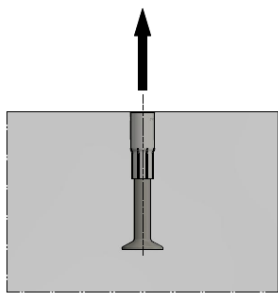
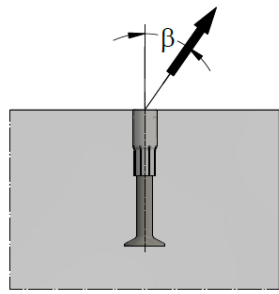
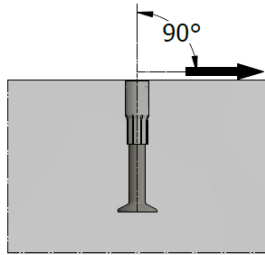
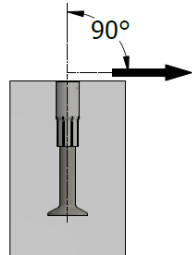
DIMENSIONING OF LIFTING ANCHOR SYSTEM

For the safe dimensioning of lifting anchor systems for precast concrete elements, the following points must be made clear at the start:

- The type of the structural element and the geometry
- Weight and location of centre of gravity of the structural element
- Directions of the loads on the anchor during the entire transport process, with all loading cases that occur.
- The static system of taking on the loads.

To determine the correct size of the lifting anchor, the stresses in the direction of the wire rope sling must be determined for all load classes. These stresses must then be compared with the applicable resistance values for the type of loading case.

Stress ≤ Resistance always applies

Direction of stress			
Axial tension		Parallel shear pull	
Load or load component action in the direction of the longitudinal axis of the lifting anchor.		Load or load component action at an angle β to the longitudinal axis of the lifting anchor in the plane of the precast component.	
Transverse shear pull parallel to the structural element plane		Transverse shear pull perpendicular to the structural element plane	
Load or load component parallel to the surface of structural element and to the plane of the element, acting at an angle β perpendicular to the longitudinal axis of the lifting anchor.		Load or load component parallel to the building component surface and perpendicular to the surface of the component.	

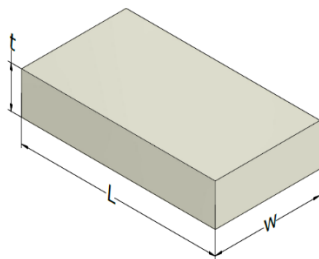
LOAD CAPACITY

The loading and capacity of the anchors depend on multiple factors such as:

- The deadweight of the precast concrete element " F_G "
- Adhesion to the formwork
- The load direction, angle of pull
- Number of load-bearing anchors
- The edge distance and spacing of the anchors
- The strength of the concrete when operating, lifting or transporting
- The embedded depth of the anchor
- Dynamic forces
- The reinforcement arrangement

WEIGHT OF PRECAST UNIT

The total self-weight " F_G " of the precast reinforced concrete element is determined using a specific weight of: $\rho = 25 \text{ kN/m}^3$. For prefabricated elements composed of reinforcing elements with a higher concentration, this will be taken into consideration when calculating the weight.



$$F_G = \rho \times V$$

$$V = L \times w \times h$$

Where:

V - volume of precast unit in m^3

L - length in m

w - width in m

h - thickness in m

ADHESION TO FORMWORK COEFFICIENT

When a precast element is lifted from the formwork, adhesion force between element and formwork develops. This force must be taken into consideration for the calculation of the anchor load and depends on the total area in contact with the formwork, the shape of the precast element and the material of the formwork. The value " F_{adh} " of adhesion to the formwork is calculated using the following equation:

$$F_{adh} = q_{adh} \times A_f \text{ [kN]}$$

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

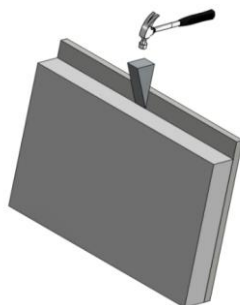
q_{adh} - the adhesion to formwork and form friction factor corresponding to the material of the formwork

A_f - the area of contact between the formwork and the concrete element when starting the lift

Adhesion to the formwork	q_{adh} in kN/m^2
Oiled steel formwork, oiled plastic-coated plywood	≥ 1
Varnished timber formwork with panel boards	≥ 2
Rough timber formwork	≥ 3

In some cases, such as π - panel or other specially shaped elements, an increased adhesion coefficient must be taken into consideration.

Adhesion to the formwork	
Double-T beams	$F_{adh} = 2 \times F_G \text{ [kN]}$
Ribbed elements	$F_{adh} = 3 \times F_G \text{ [kN]}$
Waffled panel	$F_{adh} = 4 \times F_G \text{ [kN]}$



Adhesion to the formwork should be minimised 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, brief vibration for detachment, using wedges).

DYNAMIC LOADS COEFFICIENT

During lifting and handling of the precast elements, the lifting devices are subject to dynamic actions. The value of the dynamic actions depends on the type of lifting machinery. Dynamic effect shall be considered by the dynamic factor Ψ_{dyn} .

Lifting equipment	Dynamic factor Ψ_{dyn}
Tower crane, portal crane and mobile crane	1.3 *)
Lifting and moving on flat terrain	2.5
Lifting and moving on rough terrain	≥ 4.0
*) lower values may be appropriate in precast plants if special arrangements are made.	

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

LIFTING OF PRECAST CONCRETE ELEMENT UNDER COMBINED TENSION AND SHEAR LOADING

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 β is determined by the length of the suspension chain. We recommend that, if possible, β should be kept to $\beta \leq 30^\circ$. The tensile force on the anchor will be increased by a cable angle coefficient "z".

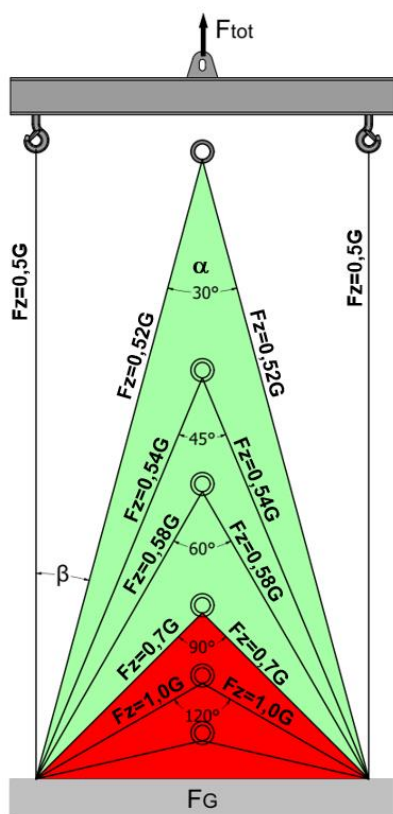
$$z = 1/\cos\beta$$

$$F = \frac{F_{tot} \times z}{n}$$

Where:

z - cable angle coefficient

n - number of load-bearing anchors



Cable angle β	Spread angle α	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 option $\beta \leq 30^\circ$

Note: If no lifting beam is used during transport, the anchor must be installed symmetrical to the centre of gravity of the load.

ASYMMETRIC DISTRIBUTION OF THE LOAD

For asymmetrical elements, calculate the loads based on the centre of gravity before installing the anchors.

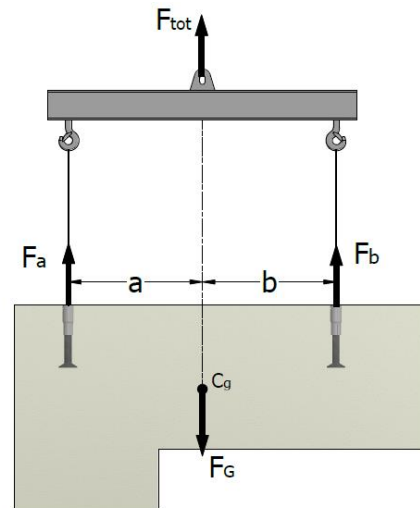
The load of each anchor depends on the embedded position of the anchor in the precast unit and on the transport mode:

- If the arrangement of the anchors is asymmetrical in relation to the centre of gravity, the individual anchors support different loads. For the load distribution in asymmetrically installed anchors when a spreader beam is used, the forces on each anchor are calculated using the following equation:

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

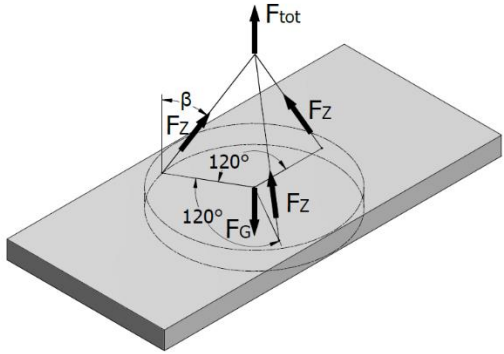
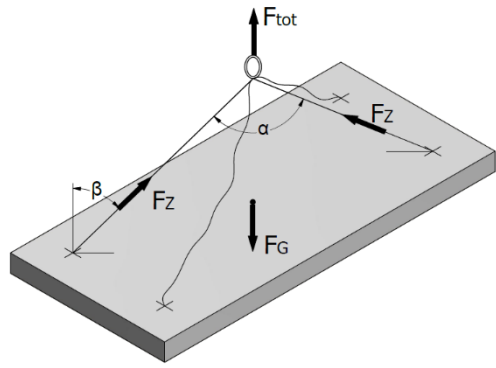
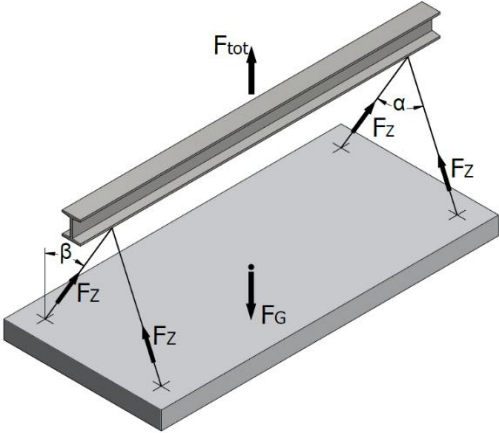
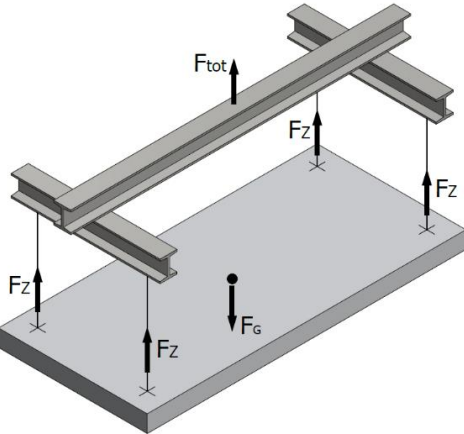
$$F_b = F_{tot} \times a / (a + b)$$

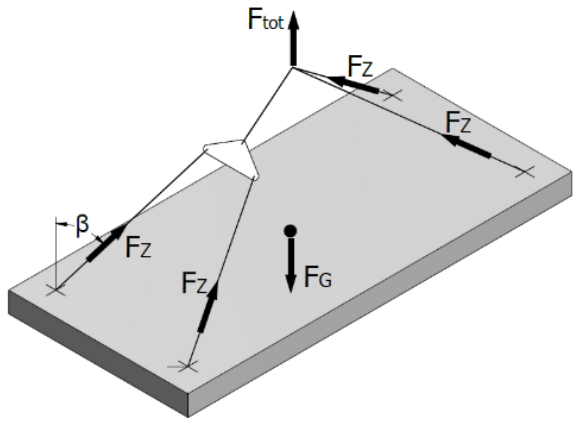
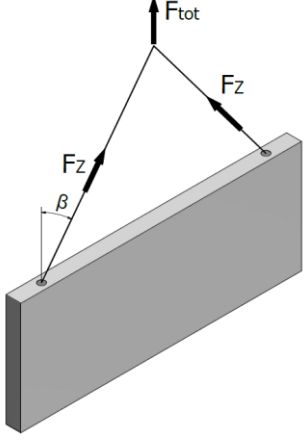
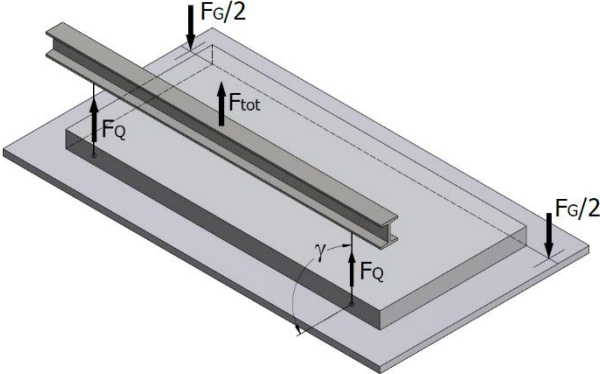
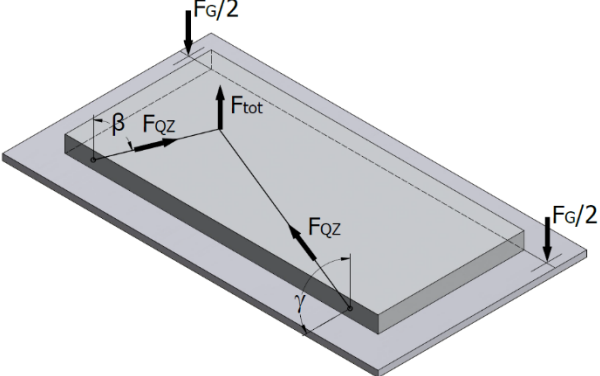
Note: To avoid tilting the element during transport, the load should be suspended from the lifting beam in such a way that its centre of gravity (C_g) is directly under the crane hook.



- For transporting without a lifting beam, the load on the anchor depends on the cable angle (β).

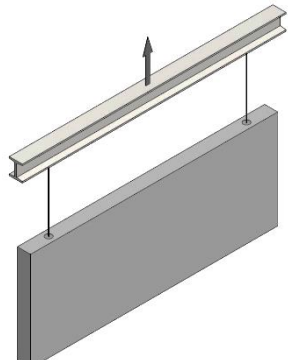
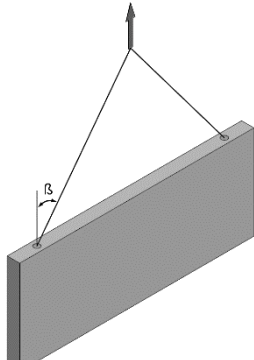
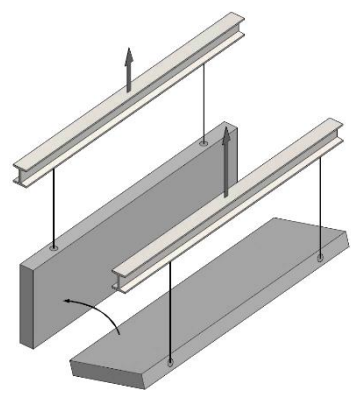
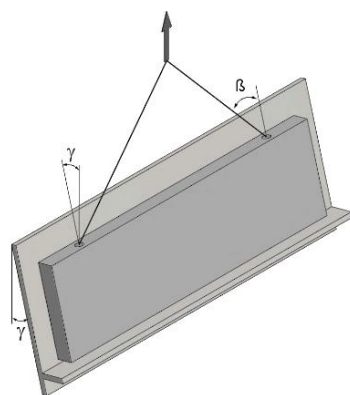
ANCHORS LIFTING CONDITIONS

<p>Using three anchors spaced the same distance apart from each other as in the figure, three load bearing anchors can be assumed.</p> <p>Load bearing anchors: n=3</p> <p>Load type – lifting of formwork</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor <p>Load type – transport</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor 	
<p>Using four anchors lifted without a spreader beam, only two load bearing anchors can be assumed. The load distribution is randomly based</p> <p>Load bearing anchors: n=2</p> <p>Load type – lifting of formwork</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor <p>Load type – transport</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor 	
<p>Perfect force distribution is assumed using a spreader beam</p> <p>Load bearing anchors: n=4</p> <p>Load type – lifting of formwork</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor <p>Load type – transport</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor 	
<p>Perfect static weight distribution can be obtained using a lifting beam and two pairs of anchors symmetrically placed.</p> <p>Load bearing anchors: n=4</p> <p>Load type – lifting of formwork</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor <p>Load type – transport</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor 	

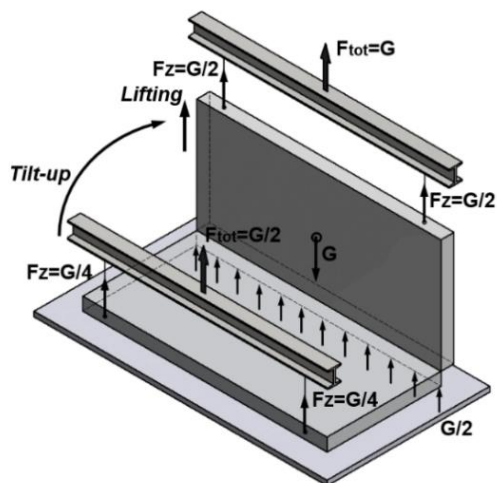
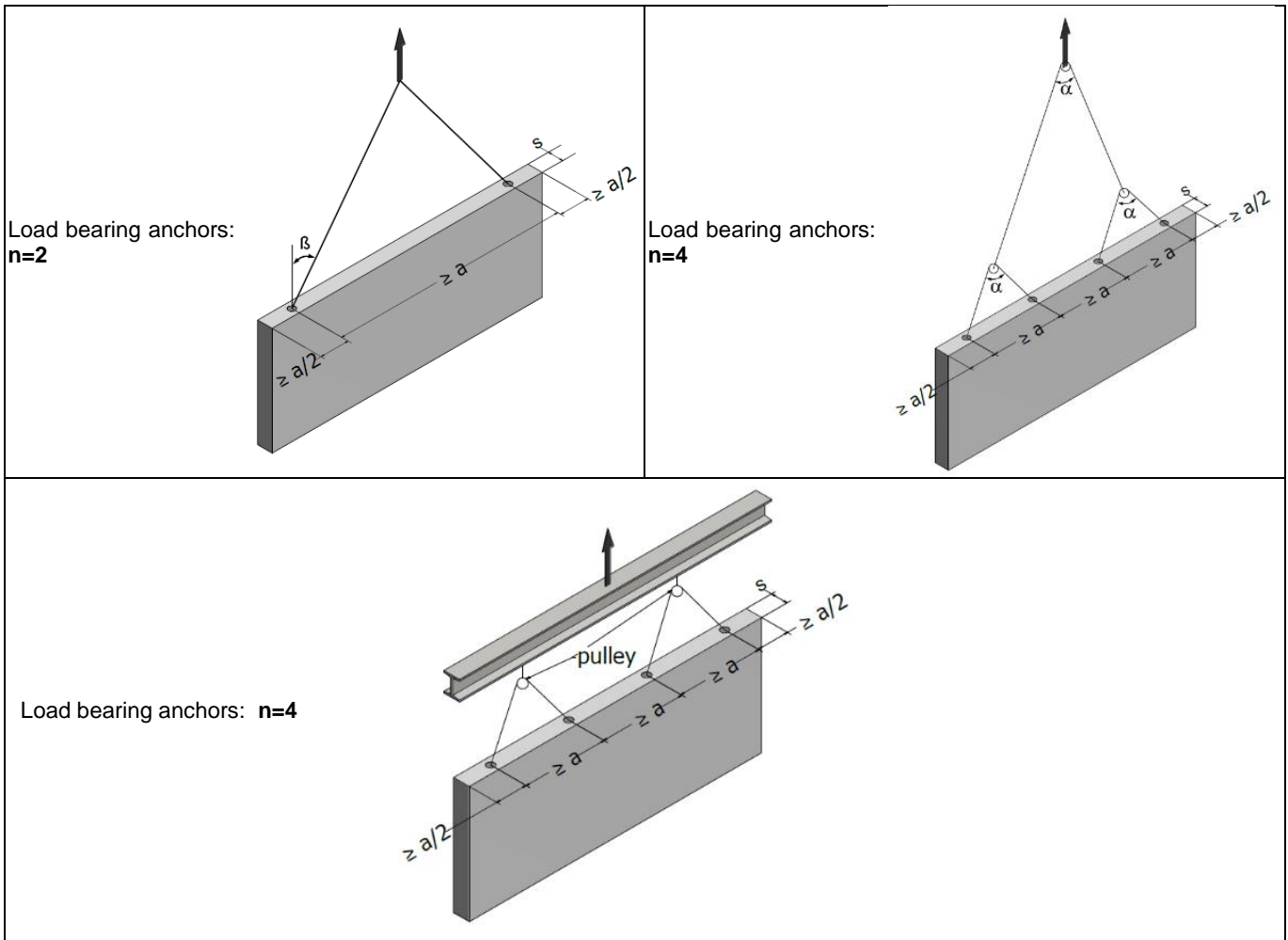
<p>The compensating lifting slings ensure equal force distribution.</p> <p>Load bearing anchors: n=4</p> <p>Load type – lifting of formwork</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor <p>Load type – transport</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor 	
<p>Lifting of wall elements parallel to the axis of concrete element</p> <p>Load bearing anchors: n=2</p> <p>Load type – transport</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor 	
<p>When the element is lifted without a lifting table at a straight angle and contact with the ground is maintained. Additional shear reinforcement is required.</p> <p>Load bearing anchors: n=2</p> <p>Load type – lifting of formwork</p> <ul style="list-style-type: none"> -shear pull factor $z = 1$ -formwork adhesion -no dynamic factor <p>Load type – transport</p> <ul style="list-style-type: none"> -shear pull factor $z = 1$ -no formwork adhesion -dynamic factor 	
<p>When the element is lifted without a lifting table at a straight angle and contact with the ground is maintained. Additional shear reinforcement is required. $\beta \leq 30^\circ$</p> <p>Load bearing anchors: n=2</p> <p>Load type – lifting of formwork</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor <p>Load type – transport</p> <ul style="list-style-type: none"> -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor 	

LOAD DIRECTIONS

Various scenarios may occur during transport and lifting, such as tilt-up, rotation, hoisting and, of course, installation. The lifting anchors and clutches must have the capacity for all these cases and combinations of them. Therefore, the load direction is a very important factor for proper anchor selection.

<p>Axial load $\beta = 0^\circ$ to 10°</p> 	<p>Diagonal load $\beta = 10^\circ$ to 45°</p> <p><i>Note: $\beta \leq 30^\circ$ is recommended</i></p> 
<p>Tilting $g = 90^\circ$</p> <p>Additional shear reinforcement steel must be used.</p> 	<p>When a tilting table is used, the anchors can be used without additional shear reinforcement steel, not to angle $g < 15^\circ$</p> 

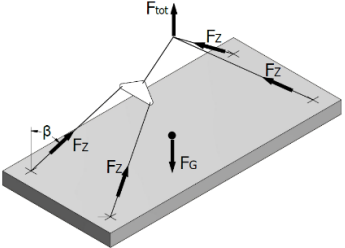
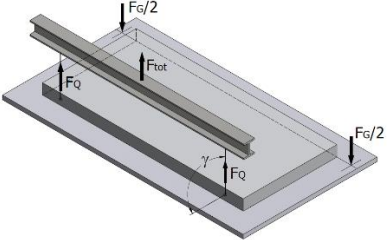
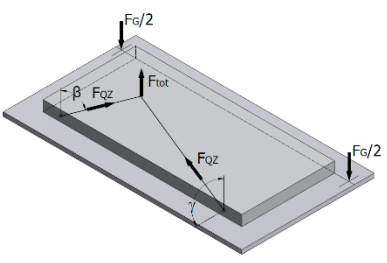
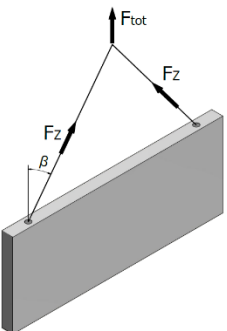
POSITIONING THE ANCHORS IN WALLS



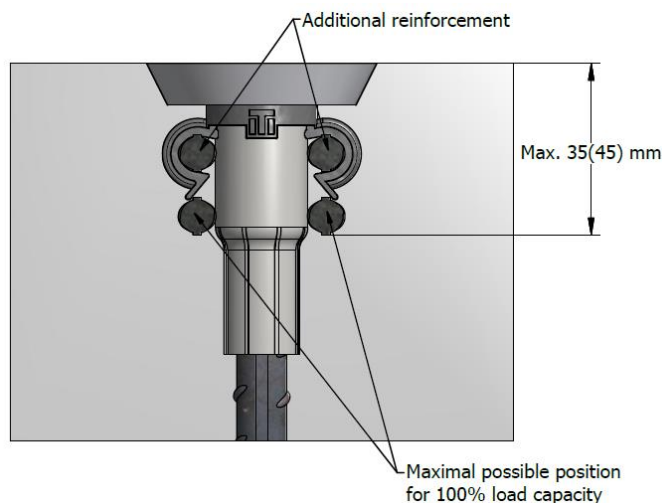
Lifting the walls from horizontal to vertical position without tilt-up table.

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

DETERMINATION OF ANCHOR LOAD

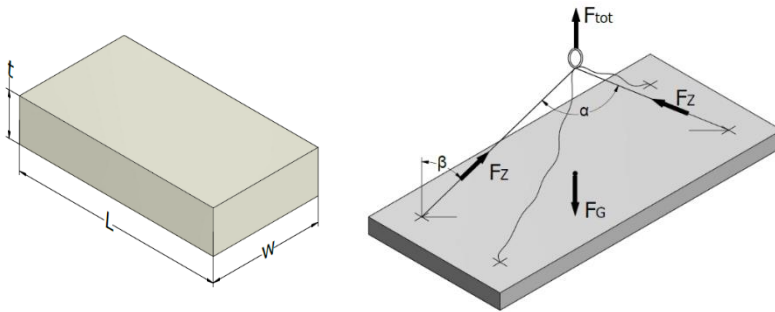
Load type	Calculation	Verification
<i>Lifting with formwork adhesion</i> 	$F_Z = \frac{(F_G + F_{adh}) \times z}{n}$ <p>F_Z – Load acting on the lifting anchor in kN</p>	$F_Z \leq N_{R,adm}$ <p>$N_{R,adm}$ – admissible normal load</p>
<i>Erecting</i> 	$F_Q = \frac{(F_G/2) \times \psi_{dyn}}{n}$ <p>F_Q – Shear load acting on the lifting anchor directed perpendicular to the longitudinal axis of the concrete element when lifting from horizontal position with a beam in kN</p>	$F_Q \leq V_{R,adm}$ <p>$V_{R,adm}$ – admissible shear load</p>
	 $F_{QZ} = \frac{(F_G/2) \times \psi_{dyn} \times z}{n}$ <p>F_{QZ} – Shear load acting on the lifting anchor inclined and perpendicular to the longitudinal axis of the concrete element when lifting from horizontal position with a beam in kN</p>	$F_{QZ} \leq V_{R,adm}$ <p>$V_{R,adm}$ – admissible shear load</p>
<i>Transport</i> 	$F_Z = \frac{F_G \times \psi_{dyn} \times z}{n}$ <p>F_Z – Load acting on the lifting anchor in kN</p>	$F_Z \leq N_{R,adm}$ <p>$N_{R,adm}$ – admissible normal load</p>

INSTALLATION TOLERANCES FOR ALL TERWA LIFTING SOCKET ANCHORS



CALCULATION EXAMPLE

Example 1: SLAB UNIT



The slab unit has the following dimensions:

$$L = 5 \text{ m}$$

$$W = 2 \text{ m}$$

$$t = 0.2 \text{ m}$$

$$\text{Weight } F_G = \rho \times V = 25 \times (5 \times 2 \times 0.2) = 50 \text{ kN}$$

$$\text{Formwork area } A_f = L \times W = 5 \times 2 = 10 \text{ m}^2$$

$$\text{Anchor number } n = 2$$

General data:	Symbol	De-mould	Transport	Mount
Concrete strength at de-mould [MPa]		15	15	
Concrete strength on site [MPa]				35
Element weight [kN]	F_G	50		
Element area in contact with formwork [m ²]	A_f	10		
Cable angle factor at de-mould ($\beta = 15.0^\circ$)	z	1.04	1.04	
Cable angle factor on site ($\beta = 30.0^\circ$)	z			1.16
Dynamic coefficient at transport	ψ_{dyn}		1.3	
Dynamic coefficient on site	ψ_{dyn}			1.3
Adhesion to formwork factor for varnished timber formwork [kN/m ²]	q_{adh}	2		
Anchor number for de-mould	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:

$$q_{adh} = 2 \text{ kN/m}^2$$

Cable angle factor:

$$z = 1.04 (\beta = 15.0^\circ)$$

Concrete strength:

$$15 \text{ MPa}$$

$$F_Z = \frac{[(F_G + q_{adh} \times A_f) \times z]}{n} = \frac{[(50 + 2 \times 10) \times 1.04]}{2} = 36.4 \text{ kN}$$

TRANSPORT AT THE PLANT:

Dynamic coefficient:

$$\psi_{dyn} = 1.3$$

Cable angle factor:

$$z = 1.04 (\beta = 15.0^\circ)$$

Concrete strength:

$$15 \text{ MPa}$$

$$F_Z = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{50 \times 1.3 \times 1.04}{2} = 33.80 \text{ kN}$$

TRANSPORT ON SITE:

Dynamic coefficient:

$$\psi_{dyn} = 1.3$$

Cable angle factor:

$$z = 1.16 (\beta = 30.0^\circ)$$

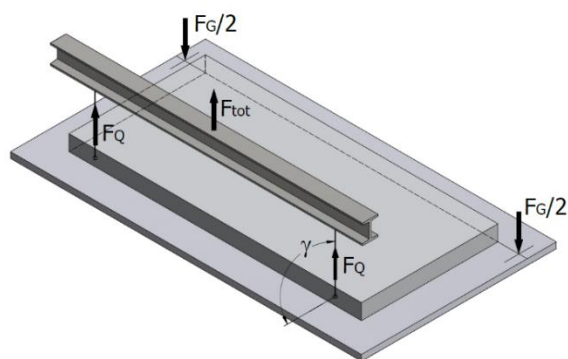
Concrete strength:

$$35 \text{ MPa}$$

$$F_Z = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{50 \times 1.3 \times 1.16}{2} = 37.70 \text{ kN}$$

An anchor in the **40 kN** range is required.

Example 2: WALL PANEL



The slab unit has the following dimensions:

$$L = 7.5 \text{ m}$$

$$w = 2 \text{ m}$$

$$t = 0.18 \text{ m}$$

$$\text{Weight } F_G = \rho \times V = 25 \times (7.5 \times 2 \times 0.18) = 67.5 \text{ kN}$$

$$\text{Formwork area } A_f = L \times w = 7.5 \times 2 = 15 \text{ m}^2$$

$$\text{Anchor number } n = 2$$

General data:	Symbol	De-mould	Tilting	Mount
Concrete strength at de-mould [MPa]		15	15	
Concrete strength on site [MPa]				35
Element weight [kN]	F_G	67.5		
Element area in contact with formwork [m²]	A_f	15		
Cable angle factor at de-mould ($\beta = 0.0^\circ$)	z	1.0		
Cable angle factor at tilting ($\beta = 0.0^\circ$)	z		1.0	
Cable angle factor on site ($\beta = 30^\circ$)	z			1.16
Dynamic coefficient at tilting	ψ_{dyn}		1.3	
Dynamic coefficient on site	ψ_{dyn}			1.3
Adhesion factor for oiled steel formwork [kN/m²]	q_{adh}	1.0		
Anchor number for de-mould	n	2		
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: $q_{adh} = 1 \text{ kN/m}^2$
Cable angle factor: $z = 1 \text{ } (\beta = 0^\circ)$
Concrete strength: 15 MPa

$$F_Q = \frac{[(F_G/2 + q_{adh} \times A_f) \times z]}{n} = \frac{[(67.5/2 + 1 \times 15) \times 1]}{2} = 24.38 \text{ kN}$$

TRANSPORT AT THE PLANT:

Dynamic coefficient: $\psi_{dyn} = 1.3$
Cable angle factor: $z = 1 \text{ } (\beta = 0^\circ)$
Concrete strength: 15 MPa

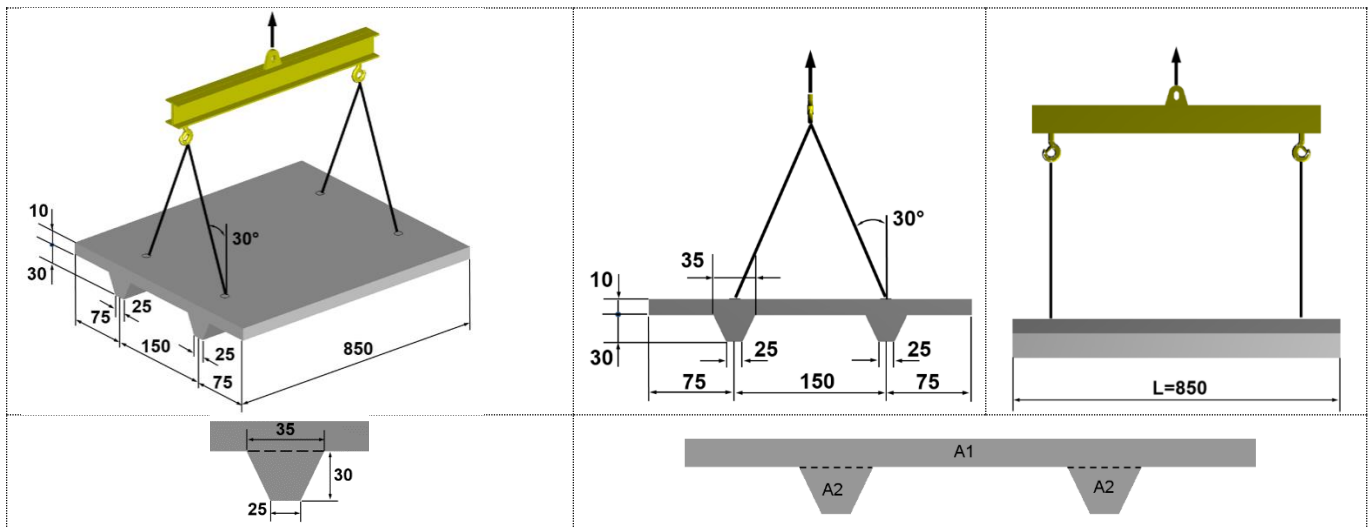
$$F_Q = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{67.5 \times 1.3 \times 1}{2} = 43.87 \text{ kN}$$

TRANSPORT ON SITE:

Dynamic coefficient: $\psi_{dyn} = 1.3$
Cable angle factor: $z = 1.16 \text{ } (\beta = 30.0^\circ)$
Concrete strength: 35 MPa

$$F_Q = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{67.5 \times 1.3 \times 1.16}{2} = 50.89 \text{ kN} = 51 \text{ kN}$$

For embedding on the lateral side, two anchors in the 75kN range are required.
Tail and tilting reinforcement are usually added for this type of anchor reinforcement.

Example 3: DOUBLE-T BEAM


NOTE: Dimensions are in cm

General data:	Symbol	De-mould	Transport
Concrete strength at de-mould and transport [MPa]		25	25
Element weight [kN]	F_G	102	
Formwork area [m ²]	A_f	35.8	
Cable angle factor at de-mould ($\beta = 30.0^\circ$)	z	1.16	
Cable angle factor on site ($\beta = 30.0^\circ$)	z		1.16
Dynamic coefficient at transport	ψ_{dyn}		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	$z = 1.16$ ($\beta = 30.0^\circ$)
Dynamic coefficient	$\psi_{dyn} = 1.3$
Anchor number	$n = 4$

$$F_G = V \times \rho = (A \times L) \times \rho = (A1 + A2 \times 2) \times L \times \rho = (0.1 \times 3 + 0.09 \times 2) \times 8.5 \times 25 = 102 \text{ kN}$$

$$L = 8.5 \text{ m}$$

$$A1 = 0.1 \times 3 \text{ (m}^2\text{)}$$

$$A2 = \frac{[(0.35 + 0.25) \times 0.3]}{2} = \frac{(0.6 \times 0.3)}{2} = 0.09 \text{ (m}^2\text{)}$$

Weight:

$$F_G = 102 \text{ kN}$$

Adhesion to mould

$$F_{adh} = 2 \times F_G = 204 \text{ kN}$$

Total load

$$F_{tot} = F_G + F_{adh} = 102 + 204 = 306 \text{ kN}$$

LOAD PER ANCHOR WHEN DE-MOULD:

$$F = \frac{F_{tot} \times z}{n} = \frac{(F_G + F_{adh}) \times z}{n} = \frac{306 \times 1.16}{4} = 88.74 \text{ kN}$$

LOAD PER ANCHOR WHEN TRANSPORTING:

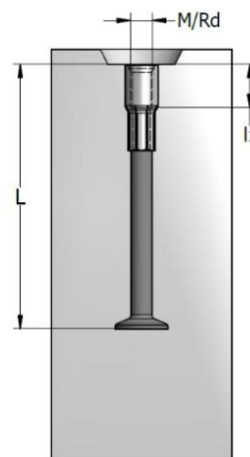
$$F = \frac{F_{tot} \times \psi_{dyn} \times z}{n} = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{102 \times 1.3 \times 1.16}{4} = 38.46 \text{ kN}$$

Four anchors in the 100 kN range are required (> 88.74 kN)

HD – LIFTING ANCHORS

LIFTING SOCKET ANCHOR – HBS-LONG

Terwa HBS anchors are designed for lifting and transporting various types of precast concrete elements with a load range between 1.3 and 15 tonnes. The anchor consists of a slot that has a steel base which ensures that it is embedded in the concrete and a threaded socket pressed in at the top. The lifting anchors are available with a metric thread and round thread.



The HBS anchors are manufactured in three versions:

- Socket - steel S355J0 zinc-plated, foot - steel S355J2
- Socket - steel S355J0 zinc-plated, foot - steel S355J2 zinc plated
- Socket - stainless steel– W 1.4571 [SS4], foot - steel S355J2
- Socket - stainless steel– W 1.4571 [SS4], foot - steel S355J2 zinc-plated

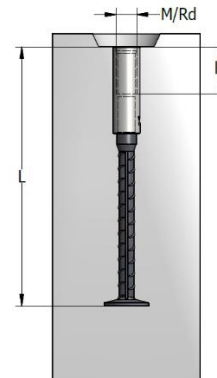
HBS-Rd	Zinc galvanising socket	Zinc galvanising socket and foot	Stainless steel SS4 socket	Stainless steel SS4 socket and foot	Load group	Thread	Overall length	l ₁
	Product no.	Product no.	Product no.	Product no.	f _{cu} > 15 MPa		L	
					[t]		[mm]	
HBS-Rd12-130	43562	64088	45719	64089	1.3	12	130	22
HBS-Rd16-100	49745	-	49746	-	2.5	16	100	30
HBS-Rd16-140	47432	-	47433	-	2.5	16	140	30
HBS-Rd16-175	43563	-	45721	-	2.5	16	175	30
HBS-Rd16-200	43564	64093	45722	64095	2.5	16	200	30
HBS-Rd20-135	49748	-	49749	-	4.0	20	135	35
HBS-Rd20-175	60172	-	60562	-	4.0	20	175	35
HBS-Rd20-258	43565	64097	45725	64237	4.0	20	258	35
HBS-Rd24-155	49751	-	49752	-	5.0	24	155	41
HBS-Rd24-275	43567	-	45727	-	5.0	24	275	41
HBS-Rd24-325	43568	64101	45728	64254	5.0	24	325	41
HBS-Rd30-215	49754	-	49755	-	7.5	30	215	55
HBS-Rd30-325	43569	-	45729	-	7.5	30	325	55
HBS-Rd30-400	43570	64105	45730	64256	7.5	30	400	55
HBS-Rd36-285	49757	-	49758	-	10.0	36	285	65
HBS-Rd36-375	43650	64107	45731	64109	10.0	36	375	65
HBS-Rd36-475	43651	64108	45732	64257	10.0	36	475	65
HBS-Rd42-425	43652	64111	45733	64113	12.5	42	425	70
HBS-Rd42-550	43653	64112	45734	64258	12.5	42	550	70
HBS-Rd52-575	43654	-	45735	-	15.0	52	575	100

The loads indicated in the table above are available for axial pull. Taking a reduced load into consideration is essential for angled lift $\beta > 30^\circ$. The anchor capacity for turning is approximately 50% of admissible load at axial pull.

HBS-M	Zinc galvanising socket	Stainless steel SS4 socket	Load group	Thread	Overall length	I ₁
	Product no.	Product no.	f _{cu} > 15 MPa		L	
			[t]		[mm]	
HBS-M12-130	61043	61044	1.3	12	130	22
HBS-M16-100	61052	61053	2.5	16	100	30
HBS-M16-140	61055	61056	2.5	16	140	30
HBS-M16-175	61058	61059	2.5	16	175	30
HBS-M16-200	61060	61061	2.5	16	200	30
HBS-M20-135	61073	61074	4.0	20	135	35
HBS-M20-175	61076	63133	4.0	20	175	35
HBS-M20-258	61067	61068	4.0	20	258	35
HBS-M24-155	61080	61081	5.0	24	155	41
HBS-M24-275	61083	61084	5.0	24	275	41
HBS-M24-325	61085	61086	5.0	24	325	41
HBS-M30-215	61091	61092	7.5	30	215	55
HBS-M30-325	61094	61095	7.5	30	325	55
HBS-M30-400	61096	61097	7.5	30	400	55
HBS-M36-285	61099	61100	10.0	36	285	65
HBS-M36-375	61102	61103	10.0	36	375	65
HBS-M36-475	61104	61105	10.0	36	475	65
HBS-M42-425	61107	61108	12.5	42	425	70
HBS-M42-550	61109	61110	12.5	42	550	70
HBS-M52-575	61112	61196	15.0	52	575	100

The loads indicated in the table above are available for axial pull. Taking a reduced load into consideration is essential for angled lift $\beta > 30^\circ$. The anchor capacity for turning is approximately 50% of admissible load at axial pull.

LIFTING SOCKET ANCHOR – HBS WITH BARRIER



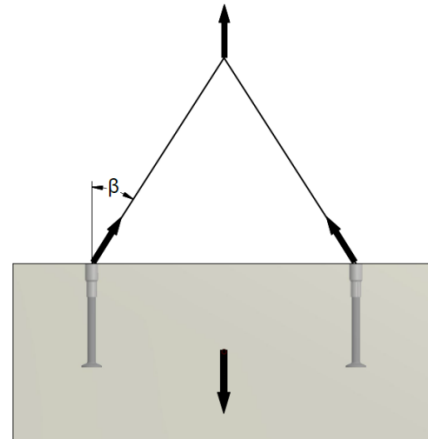
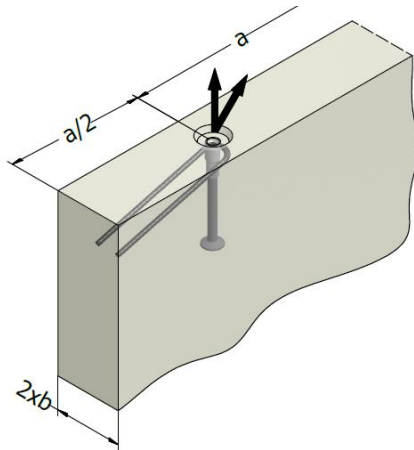
The HBS with barrier consists of a Terwa bush made of stainless steel (SS) and an HBS foot made of reinforcement steel. The bush is machined on both sides, thereby creating a barrier in the middle, which prevents infiltration of water and other corrosive agents.

HBS – With Barrier	Product no.	Load group	Thread	Overall length	I ₁
		$f_{cu} > 15 \text{ MPa}$		L	
		[t]		[mm]	
HBS-with barrier Rd24-325	60451	5.0	24	325	46
HBS-with barrier Rd30-400	60452	7.5	30	400	56

For axial pull, the loads indicated in the table above are available. Taking a reduced load into consideration is essential for angled lift $\beta > 30^\circ$. The anchor capacity for turning/tilting is approximately 50% of admissible load at axial pull.

LIFTING AND TRANSPORT – HBS LONG ANCHORS

Edge distance and spacing for lifting sockets.

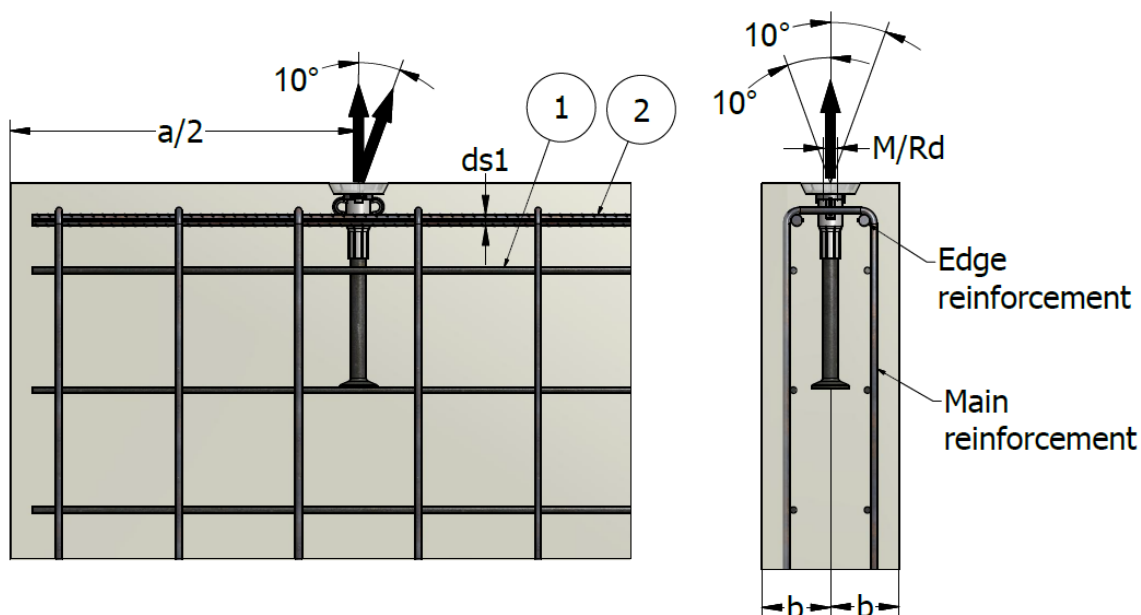



HBS- SS2/SS4	Load group	Thread	a min	Minimum element thickness 2 x b	Axial load and diagonal load ≤ 30°			Axial load and diagonal load ≤ 45°			Transverse load		
	$f_{cu} > 15$ MPa				15 MPa	25 MPa	35 MPa	15 MPa	25 MPa	35 MPa	15 MPa	25 MPa	35 MPa
	[t]				[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
HBS- M(Rd)12- 130	1.3	12	440	80	13.0	13.0	13.0	10.4	13.0	13.0	5.9	7.5	7.5
				100	13.0	13.0	13.0	10.5	13.0	13.0	7.5	7.5	7.5
				120	13.0	13.0	13.0	10.5	13.0	13.0	7.5	7.5	7.5
HBS- M(Rd)16- 140	2.5	16	450	100	13.5	17.4	20.6	10.8	17.4	20.6	6.8	8.8	10.4
				120	15.5	20.0	23.7	12.4	20.0	23.7	9.9	12.7	14.0
				140	17.4	22.4	25.0	13.9	22.4	25.0	11.6	14.0	14.0
HBS- M(Rd)16- 200	2.5	16	640	80	18.7	24.1	25.0	15.0	24.1	25.0	4.2	5.4	6.4
				100	22.7	25.0	25.0	18.2	25.0	25.0	6.8	8.8	10.4
				120	25.0	25.0	25.0	18.9	25.0	25.0	9.9	12.7	14.0
HBS- M(Rd)20- 258	4.0	20	800	120	33.1	40.0	40.0	29.8	40.0	40.0	8.9	11.5	13.6
				140	36.0	40.0	40.0	31.8	40.0	40.0	12.9	16.6	19.6
				160	39.0	40.0	40.0	31.8	40.0	40.0	17.5	22.6	23.0
HBS- M(Rd)24- 325	5.0	24	1000	120	40.0	50.0	50.0	40.0	50.0	50.0	13.1	16.9	20.0
				140	45.6	50.0	50.0	42.1	50.0	50.0	14.7	19.0	22.5
				160	49.0	50.0	50.0	42.1	50.0	50.0	20.0	25.8	28.0
HBS- M(Rd)30- 400	7.5	30	1240	160	66.8	75.0	75.0	66.8	75.0	75.0	24.2	31.2	36.9
				180	71.8	75.0	75.0	67.7	75.0	75.0	31.1	40.1	42.5
				200	75.0	75.0	75.0	67.7	75.0	75.0	39.1	42.5	42.5
HBS- M(Rd)36- 475	10.0	36	1460	180	90.7	100.0	100.0	90.7	100.0	100.0	30.5	39.4	46.6
				200	98.3	100.0	100.0	92.6	100.0	100.0	38.1	49.1	57.0
				220	100.0	100.0	100.0	92.6	100.0	100.0	46.2	57.0	57.0
HBS- M(Rd)42- 550	12.5	42	1700	200	125.0	125.0	125.0	120.2	125.0	125.0	40.1	51.7	61.1
				220	125.0	125.0	125.0	120.2	125.0	125.0	48.4	62.4	71.0
				240	125.0	125.0	125.0	120.2	125.0	125.0	57.9	71.0	71.0
HBS- M(Rd)52- 575	15.0	52	1760	200	126.8	150.0	150.0	126.8	150.0	150.0	36.2	46.7	55.2
				220	139.5	150.0	150.0	139.5	150.0	150.0	44.3	57.2	66.7
				240	150.0	150.0	150.0	144.8	150.0	150.0	53.0	68.5	81.0
				280	150.0	150.0	150.0	144.8	150.0	150.0	72.5	85.5	85.5

For using a cage or two layers of mesh, the dimensions indicated in the table above are available.

REINFORCEMENT AND LOAD CAPACITY – DIAGONAL LOAD UP TO 10°

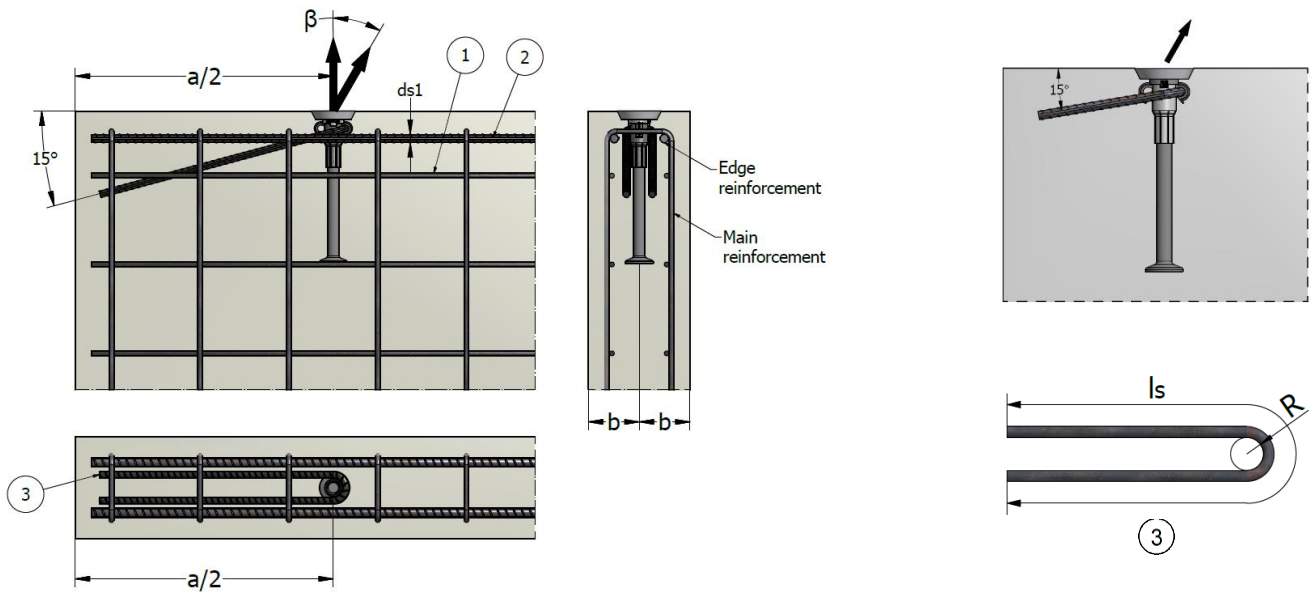
- No diagonal reinforcement is required
- 100% load capacity




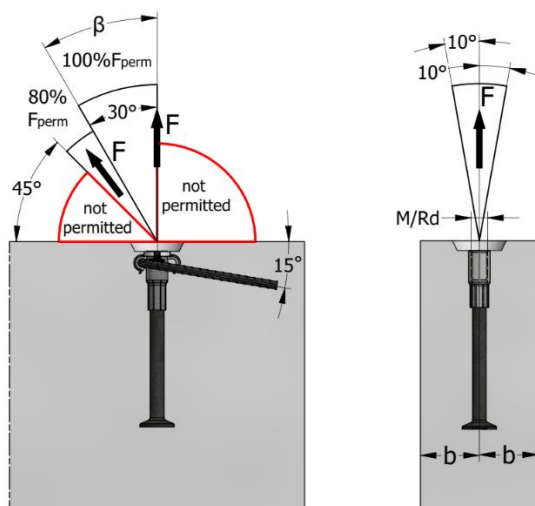
HBS-M(Rd)	Load group	Minimum unit thickness	Axial spacing	Mesh reinforcement ①	Edge reinforcement ②	Load capacity	
		2 x b	a		ds1		
	[t]	[mm]	[mm]		[mm]	f _{cu} > 15 MPa	f _{cu} > 25 MPa
M(Rd)12-130	1.3	80/100/120	440	2 x 188	-	13	13
M(Rd)16-140	2.5	100/120/140	450	2 x 188	-	25	25
M(Rd)16-200	2.5	80/100/120	640	2 x 188	-	25	25
M(Rd)20-258	4.0	120/140/160	800	2 x 188	-	40	40
M(Rd)24-325	5.0	120/140/160	1000	2 x 188	-	50	50
M(Rd)30-400	7.5	160/180/200	1240	2 x 188	2 x Ø12	75	75
M(Rd)36-475	10.0	180/200/220	1460	2 x 188	2 x Ø14	100	100
M(Rd)42-550	12.5	200/220/240	1700	2 x 188	2 x Ø14	125	125
M(Rd)52-575	15.0	200/220/240/280	1760	2 x 188	2 x Ø14	150	150

REINFORCEMENT AND LOAD CAPACITY – DIAGONAL LOAD UP TO 45°

- **Diagonal reinforcement is always required**
- **Approx. 80% load capacity in 15 MPa**
- **100% load capacity from 25 MPa**



HBS-M(Rd)	Load group	Minimum unit thickness	Axial spacing	Mesh reinforcement ①	Edge reinforcement ②	Diagonal reinforcement $\beta \leq 30^\circ$ ③		Diagonal reinforcement $\beta \leq 45^\circ$ ③		Load capacity 
		2 x b	a		d _{s1}	d _s	L _s	d _s	L _s	f _{cu} > 25 MPa
	[t]	[mm]	[mm]	[mm ² /m]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]
M(Rd)12-130	1.3	80/100/120	440	2 x 188	-	Ø8	850	Ø8	1000	13
M(Rd)16-140	2.5	100/120/140	450	2 x 188	-	Ø10	1200	Ø10	1400	25
M(Rd)16-200	2.5	80/100/120	640	2 x 188	-	Ø8	1000	Ø10	1200	25
M(Rd)20-258	4.0	120/140/160	800	2 x 188	-	Ø10	1200	Ø12	1750	40
M(Rd)24-325	5.0	120/140/160	1000	2 x 188	-	Ø12	1750	Ø14	2000	50
M(Rd)30-400	7.5	160/180/200	1240	2 x 188	2 x Ø12	Ø14	1750	Ø16	2000	75
M(Rd)36-475	10.0	180/200/220	1460	2 x 188	2 x Ø14	Ø16	2000	Ø20	2050	100
M(Rd)42-550	12.5	200/220/240	1700	2 x 188	2 x Ø14	Ø20	2050	Ø20	2200	125
M(Rd)52-575	15.0	200/220/240/280	1760	2 x 188	2 x Ø14	Ø20	2200	Ø25	2200	150

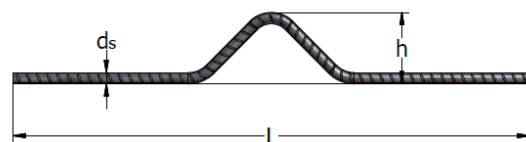
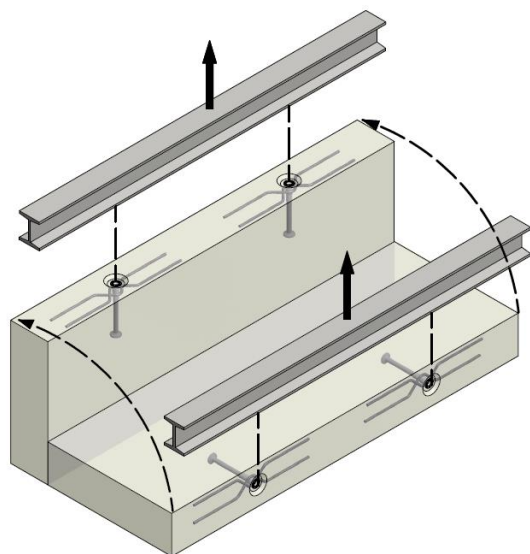


Note: The bend radius R will be determined according to EN 1992.

Diagonal reinforcement must be placed in direct contact with the socket anchor. Always install diagonal reinforcement opposite the load direction. The dimensions in the illustrations are in [mm].

REINFORCEMENT AND LOAD CAPACITY – DIAGONAL LOAD AND TILTING UP TO 90°

For tilting and diagonal pull, additional reinforcements must be installed in the anchor zone. Make certain that the placement of the anchors ensures load transfer. When turning and lifting at an angle, tilt reinforcement is sufficient and there is no need for angle lift reinforcement.



Tilt reinforcement

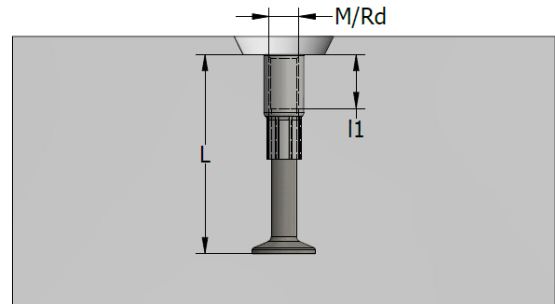
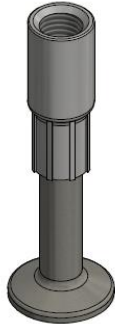
Note: Tilt reinforcement must be placed in direct contact with the socket anchor.

There must be two layers of mesh reinforcement.

HBS-SS2/SS4	Load group	Thread	Overall length	Minimum element thickness	Mesh reinforcement	Transverse reinforcement		
	$f_{cu} > 15 \text{ MPa}$					Dia. d_s	High h	Length before bending
	[t]	M(Rd)	[mm]	[mm]	[mm ² /m]	[mm]	[mm]	[mm]
HBS-M(Rd)12-130	1.3	12	130	80	2 x 188	Ø8	33	550
				100	2 x 188	Ø8	43	550
				120	2 x 188	Ø8	53	550
HBS- M(Rd)16-140	2.5	16	140	100	2 x 188	Ø 12	47	750
				120	2 x 188	Ø 12	57	750
				140	2 x 188	Ø 12	67	750
HBS- M(Rd)16-200	2.5	16	200	80	2 x 188	Ø 12	37	750
				100	2 x 188	Ø 12	47	750
				120	2 x 188	Ø 12	57	750
HBS- M(Rd)20-258	4.0	20	258	120	2 x 188	Ø 16	62	900
				140	2 x 188	Ø 16	72	900
				160	2 x 188	Ø 16	82	900
HBS- M(Rd)24-325	5.0	24	325	120	2 x 188	Ø 16	66	1100
				140	2 x 188	Ø 16	76	1100
				160	2 x 188	Ø 16	86	1100
HBS- M(Rd)30-400	7.5	30	400	160	2 x 188	Ø 20	94	1300
				180	2 x 188	Ø 20	104	1300
				200	2 x 188	Ø 20	114	1300
HBS- M(Rd)36-475	10.0	36	475	180	2 x 188	Ø 20	108	1700
				200	2 x 188	Ø 20	118	1700
				220	2 x 188	Ø 20	128	1700
HBS- M(Rd)42-550	12.5	42	550	200	2 x 188	Ø 25	127	1650
				220	2 x 188	Ø 25	137	1650
				240	2 x 188	Ø 25	147	1650
HBS- M(Rd)52-575	15.0	52	575	200	2 x 188	Ø 25	133	1950
				220	2 x 188	Ø 25	143	1950
				240	2 x 188	Ø 25	153	1950
				280	2 x 188	Ø 25	173	1950

LIFTING SOCKET ANCHOR – HBS-SHORT

Terwa HBS SHORT anchors are designed for lifting and transporting slabs of precast concrete elements with a load range between 1.3 and 7.5 tonnes. The anchor consists of a slot that has a steel base which ensures that it is embedded in the concrete and a threaded socket pressed in at the top. The lifting anchors are available with a metric thread and round thread.



The HBS anchors are manufactured in different versions:

- Socket - steel S355J0 zinc-plated, foot - steel S355J2
- Socket - steel S355J0 zinc-plated, foot - steel S355J2 zinc plated
- Socket - stainless steel– W 1.4571 [SS4], foot - steel S355J2
- Socket - stainless steel– W 1.4571 [SS4], foot - steel S355J2 zinc-plated

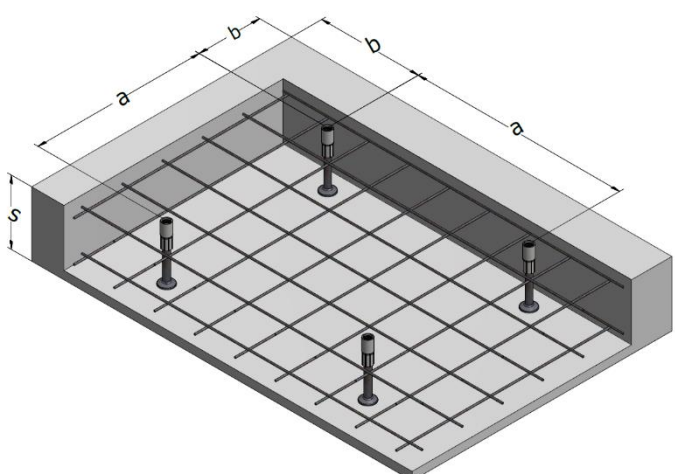
HBS-Rd-SHORT	Zinc galvanizing socket	Zinc galvanizing socket and foot	Stainless steel SS4 socket	Stainless steel SS4 socket and foot	Load group	Thread	Overall length	l_1
	Product no.	Product no.	Product no.	Product no.	$f_{cu} > 15 \text{ MPa}$		L	
					[t]		[mm]	
HBS-Rd12-70	47337	64091	47338	64251	1.3	12	70	22
HBS-Rd16-90	46637	64092	47340	64252	2.5	16	90	30
HBS-Rd20-125	46638	64096	47339	64236	4.0	20	125	35
HBS-Rd24-140	46639	64100	47342	64253	5.0	24	140	41
HBS-Rd30-185	46640	64104	47466	64255	7.5	30	185	55

HBS-M-SHORT	Zinc galvanizing socket	Stainless steel SS4 socket	Load group	Thread	Overall length	l_1
	Product no.	Product no.	$f_{cu} > 15 \text{ MPa}$		L	
			[t]		[mm]	
HBS-M12-70	61046	61047	1.3	12	70	22
HBS-M16-90	61049	61050	2.5	16	90	30
HBS-M20-125	61070	61071	4.0	20	125	35
HBS-M24-140	61077	61078	5.0	24	140	41
HBS-M30-185	61088	61089	7.5	30	185	55

The loads indicated in the table above are available for axial pull. Taking a reduced load into consideration is essential for angled lift $\beta > 30^\circ$. The anchor capacity for turning is approximately 50% of admissible load at axial pull.

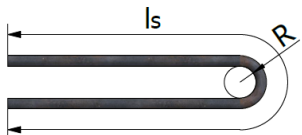
LIFTING AND TRANSPORT – HBS SHORT ANCHORS

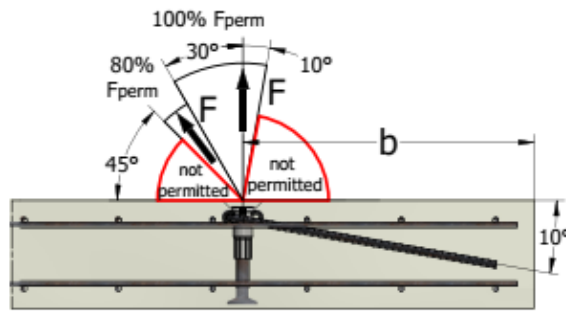
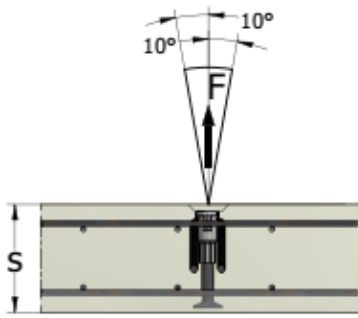
Edge distance and spacing for lifting sockets.

HBS-M(Rd)	s minimum	a minimum	b minimum	
	[mm]	[mm]	[mm]	
M(Rd)12-70	120	220	140	
M(Rd)16-90	160	280	180	
M(Rd)20-125	220	400	250	
M(Rd)24-140	280	450	300	
M(Rd)30-185	360	560	370	

The HBS short anchors are used for lifting flat elements such as floor slabs. The lifting angle must be $\leq 45^\circ$. For a lifting angle between 10° and 45° , additional reinforcement is required.

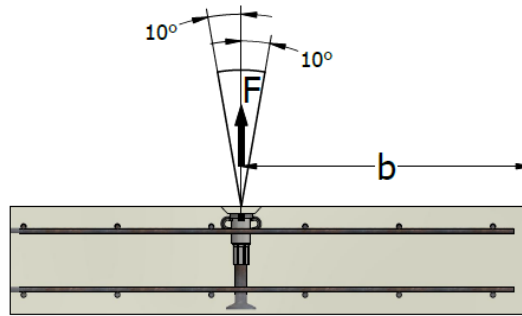
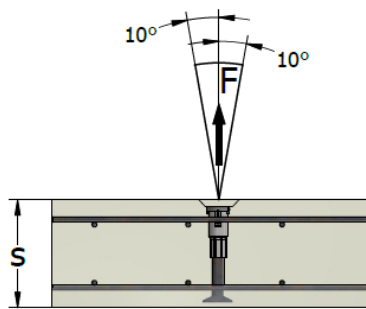
HBS-M(Rd)	Load group	Thread	Overall length	Element thickness	Axial load and diagonal load $\leq 45^\circ$		
	$f_{cu} > 15 \text{ MPa}$				15 MPa	25 MPa	35 MPa
	[t]				[kN]	[kN]	[kN]
HBS-M(Rd)12-70	1.3	12	70	120	13.0	13.0	13.0
HBS-M(Rd)16-90	2.5	16	90	130	16.5	21.3	25.0
				160	19.5	25.0	25.0
HBS-M(Rd)20-125	4.0	20	125	160	25.3	32.6	38.6
				220	31.2	40.0	40.0
HBS-M(Rd)24-140	5.0	24	140	180	29.1	37.5	44.4
				280	39.3	50.0	50.0
HBS-M(Rd)30-185	7.5	30	185	240	44.9	57.9	68.5
				360	59.4	75.0	75.0

HBS-M(Rd) short	Thread	Two layers of mesh	Diagonal reinforcement				
			Diameter d	Length before bending			
				15 MPa	25 MPa	35 MPa	
	M(Rd)	mm²/m	[mm]	[mm]	[mm]	[mm]	
HBS –M(Rd)12-70	12	2 x 188	Ø10	800	700	600	Note: The bend radius <i>R</i> will be determined according to EN 1992. There must be two layers of mesh reinforcement. Diagonal reinforcement must be placed in direct contact with the socket anchor. Always install diagonal reinforcement opposite the load direction.
HBS –M(Rd)16-90	16	2 x 188	Ø 12	900	850	750	
HBS –M(Rd)20-125	20	2 x 188	Ø 14	1020	850	750	
HBS –M(Rd)24-140	24	2 x 188	Ø 14	1650	1400	1200	
HBS –M(Rd)30-185	30	2 x 188	Ø 16	2000	1600	1400	



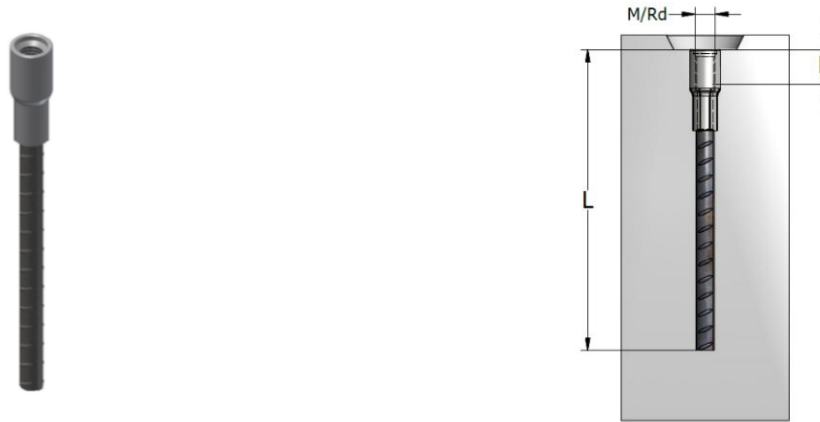
Note: The bend radius R will be determined according to EN 1992.

Diagonal reinforcement must be placed in direct contact with the socket anchor. Always install diagonal reinforcement opposite the load direction. The dimensions in the illustrations are in [mm].



LIFTING SOCKET – STRAIGHT END REINFORCING STEEL – TRL-HD

Terwa TRL-HD anchors are designed for lifting and transporting various precast concrete thin elements with a load range between 1.3 and 15 tonnes. The anchor consists of a reinforcing bar and a threaded socket pressed at the top. The lifting anchors are available with a metric thread and round thread.



The TRL-HD anchors are manufactured in two versions:

- Socket - steel S355J0 zinc-plated, foot – reinforcing bar B500B without coating.
- Socket - stainless steel– W 1.4571 [SS4], foot – reinforcing bar B500B without coating.

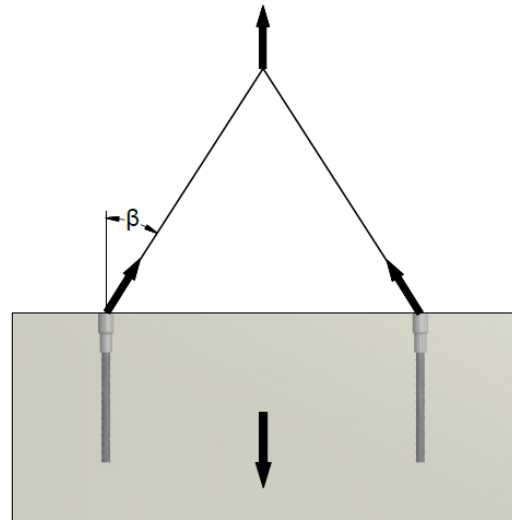
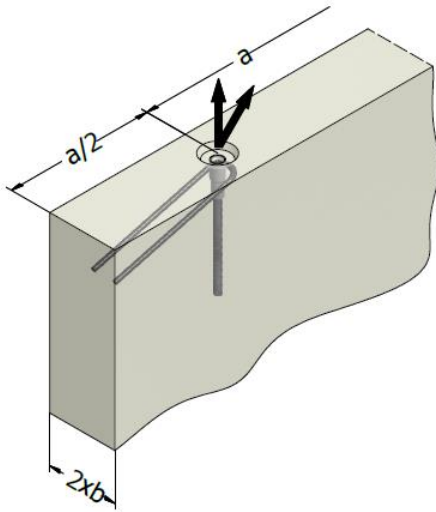
TRL-HD - Rd	Zinc galvanizing	Stainless steel SS4	Load group	Thread	Bar diam.	Overall length	I ₁
	Product no.	Product no.	f _{cu} > 15 MPa			L	
			[t]			[mm]	
TRL HD-Rd12-300	63815	63817	1.3	12	10	300	22
TRL HD-Rd16-400	63818	63820	2.5	16	14	400	30
TRL HD-Rd20-520	63821	63823	4.0	20	18	520	35
TRL HD-Rd24-540	63824	63826	5.0	24	20	540	41
TRL HD-Rd30-700	63827	63829	7.5	30	25	700	55
TRL HD-Rd36-800	63830	63832	10.0	36	28	800	65
TRL HD-Rd42-920	63833	63835	12.5	42	32	920	70
TRL HD-Rd52-1100	63836	63838	15.0	52	36	1100	100

The loads indicated in the table above are available for axial pull. Taking a reduced load into consideration is essential for angled lift $\beta > 30^\circ$. The anchor capacity for turning is approximately 50% of admissible load at axial pull.

TRL-HD - M	Zinc galvanizing	Stainless steel SS4	Load group	Thread	Bar diam.	Overall length	I ₁
	Product no.	Product no.	f _{cu} > 15 MPa			L	
			[t]			[mm]	
TRL HD-M12-300	63724	63750	1.3	12	10	300	22
TRL HD-M16-400	63751	63753	2.5	16	14	400	30
TRL HD-M20-520	63754	63756	4.0	20	18	520	35
TRL HD-M24-540	63757	63759	5.0	24	20	540	41
TRL HD-M30-700	63760	63762	7.5	30	25	700	55
TRL HD-M36-800	63763	63765	10.0	36	28	800	65
TRL HD-M42-920	63766	63768	12.5	42	32	920	70
TRL HD-M52-1100	63769	63771	15.0	52	36	1100	100

LIFTING AND TRANSPORT – TRL-HD ANCHORS

Edge distance and spacing for TRL-HD anchors.

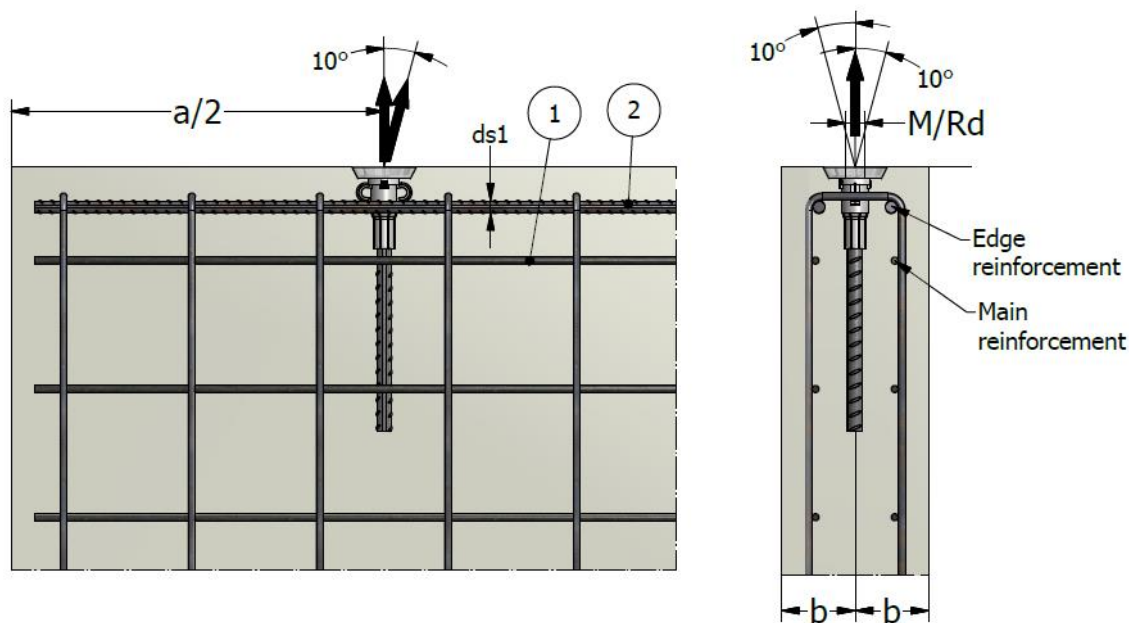


TRL HD	Load group	Thread	a min	Minimum element thickness 2 x b	Axial load and diagonal load ≤30°			Axial load and diagonal load ≤ 45°			Transverse Load 90°		
	$f_{cu} > 15$ MPa				15 MPa	25 MPa	35 MPa	15 MPa	25 MPa	35 MPa	15 MPa	25 MPa	35 MPa
	[t]				[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
TRL HD-M(Rd)12-300	1.3	12	620	60	13.0	13.0	13.0	10.5	13.0	13.0	3.5	4.5	5.3
				80	13.0	13.0	13.0	10.5	13.0	13.0	5.9	7.5	7.5
				100	13.0	13.0	13.0	10.5	13.0	13.0	7.5	7.5	7.5
TRL HD-M(Rd)16-400	2.5	16	820	80	25.0	25.0	25.0	18.9	25.0	25.0	4.2	5.4	6.3
				100	25.0	25.0	25.0	18.9	25.0	25.0	6.8	8.8	10.4
				120	25.0	25.0	25.0	18.9	25.0	25.0	9.9	12.7	14.0
TRL HD-M(Rd)20-520	4.0	20	980	120	38.2	40.0	40.0	31.8	40.0	40.0	8.9	11.5	13.6
				140	40.0	40.0	40.0	31.8	40.0	40.0	12.9	16.6	19.6
				160	40.0	40.0	40.0	31.8	40.0	40.0	17.5	22.5	23.0
TRL HD-M(Rd)24-540	5.0	24	1100	120	44.2	50.0	50.0	42.1	50.0	50.0	13.1	16.9	20.0
				140	47.1	50.0	50.0	42.1	50.0	50.0	14.7	19.0	22.5
				160	50.0	50.0	50.0	42.1	50.0	50.0	20.0	25.8	28.0
TRL HD-M(Rd)30-700	7.5	30	1420	140	70.0	75.0	75.0	67.7	75.0	75.0	18.1	23.4	27.7
				160	75.0	75.0	75.0	67.7	75.0	75.0	24.4	31.2	36.9
				180	75.0	75.0	75.0	67.7	75.0	75.0	31.1	40.1	42.5
TRL HD-M(Rd)36-800	10.0	36	1620	160	100.0	100.0	100.0	92.6	100.0	100.0	24.0	30.9	36.5
				180	100.0	100.0	100.0	92.6	100.0	100.0	30.5	39.4	46.6
				200	100.0	100.0	100.0	92.6	100.0	100.0	38.1	49.1	57.0
TRL HD-M(Rd)42-920	12.5	42	1870	160	125.0	125.0	125.0	120.2	125.0	125.0	26.3	33.9	40.1
				180	125.0	125.0	125.0	120.2	125.0	125.0	33.2	42.8	50.6
				200	125.0	125.0	125.0	120.2	125.0	125.0	40.1	51.7	61.2
TRL HD-M(Rd)52-1100	15.0	52	2230	200	150.0	150.0	150.0	144.8	150.0	150.0	36.2	46.7	55.2
				220	150.0	150.0	150.0	144.8	150.0	150.0	44.3	57.2	67.7
				240	150.0	150.0	150.0	144.8	150.0	150.0	53.0	68.5	81.0

For using a cage or two layers of mesh, the dimensions indicated in the table above are available.

REINFORCEMENT AND LOAD CAPACITY – AXIAL LOAD UP TO 10°

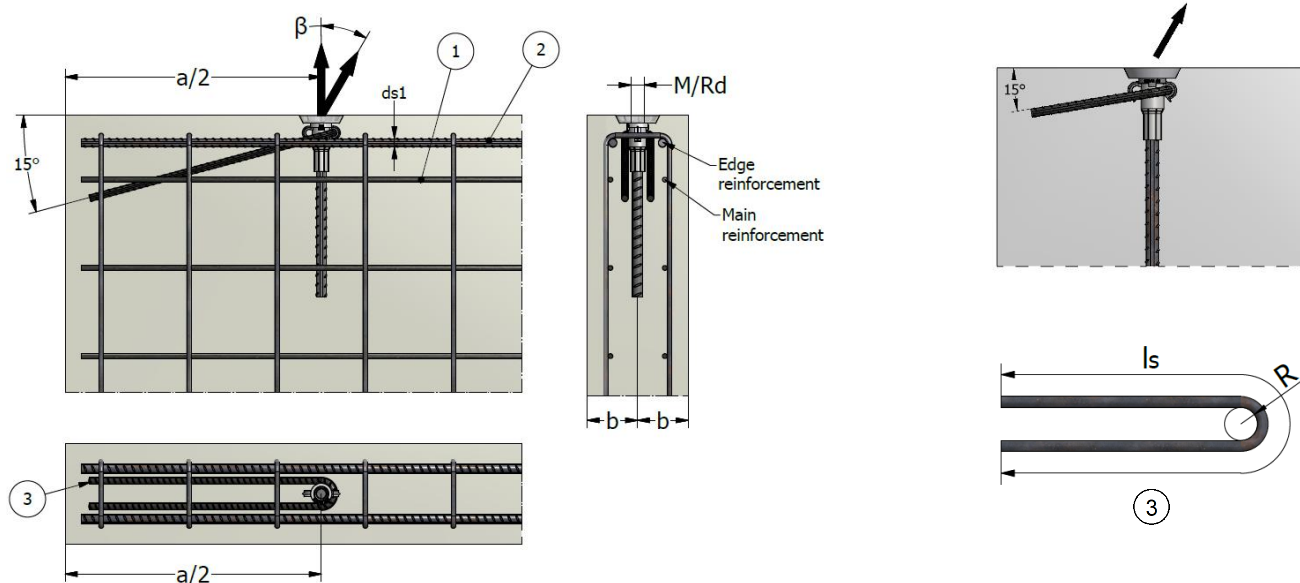
- No diagonal reinforcement is required
- 100% load capacity




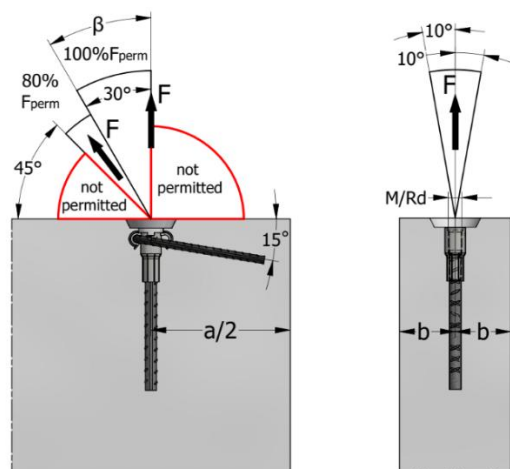
TRL HD-M(Rd)	Load group	Minimum unit thickness	Axial spacing	Mesh reinforcement ①	Edge reinforcement ②	Load capacity	
		2 x b	a		d _{s1}	f _{cu} > 15 MPa	f _{cu} > 25 MPa
	[t]	[mm]	[mm]	[mm ² /m]	[mm]	[kN]	[kN]
M(Rd)12-300	1.3	60/80/100	620	2 x 188	-	13	13
M(Rd)16-400	2.5	80/100/120	820	2 x 188	-	25	25
M(Rd)20-520	4.0	120/140/160	980	2 x 188	2 x Ø12	40	40
M(Rd)24-540	5.0	120/140/160	1100	2 x 188	2 x Ø12	50	50
M(Rd)30-700	7.5	140/160/180	1420	2 x 188	2 x Ø14	75	75
M(Rd)36-800	10.0	160/180/200	1620	2 x 188	2 x Ø14	100	100
M(Rd)42-920	12.5	160/180/200	1870	2 x 188	2 x Ø14	125	125
M(Rd)52-1100	15.0	200/220/240	2230	2 x 188	2 x Ø14	150	150

REINFORCEMENT AND LOAD CAPACITY – DIAGONAL LOAD UP TO 45°

- Diagonal reinforcement is always required
- Approx. 80% load capacity in 15 MPa
- 100% load capacity from 25 MPa



TRL HD-M(Rd)	Load group	Minimum unit thickness	Axial spacing	Mesh reinforcement ①	Edge reinforcement ②	Diagonal reinforcement $\beta \leq 30^\circ$ ③		Diagonal reinforcement $\beta \leq 45^\circ$ ③		Load capacity
		2 x b	a		ds1	ds	LS	ds	LS	
		[mm]	[mm]		[mm]	[mm]	[mm]	[mm]	[mm]	f _{cu} > 25 MPa [kN]
M(Rd)12-300	1.3	60/80/100	620	2 x 188	-	Ø8	850	Ø8	1000	13
M(Rd)16-400	2.5	80/100/120	820	2 x 188	-	Ø8	1000	Ø10	1200	25
M(Rd)20-520	4.0	120/140/160	980	2 x 188	2 x Ø12	Ø10	1200	Ø12	1750	40
M(Rd)24-540	5.0	120/140/160	1100	2 x 188	2 x Ø12	Ø12	1750	Ø14	2000	50
M(Rd)30-700	7.5	140/160/180	1420	2 x 188	2 x Ø14	Ø14	1750	Ø16	2000	75
M(Rd)36-800	10.0	160/180/200	1620	2 x 188	2 x Ø14	Ø16	2000	Ø20	2050	100
M(Rd)42-920	12.5	160/180/200	1870	2 x 188	2 x Ø14	Ø20	2050	Ø20	2200	125
M(Rd)52-1100	15.0	200/220/240	2230	2 x 188	2 x Ø14	Ø20	2200	Ø25	2200	150



Note: The bend radius R will be determined according to EN 1992.

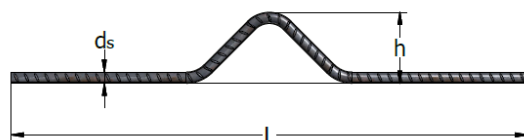
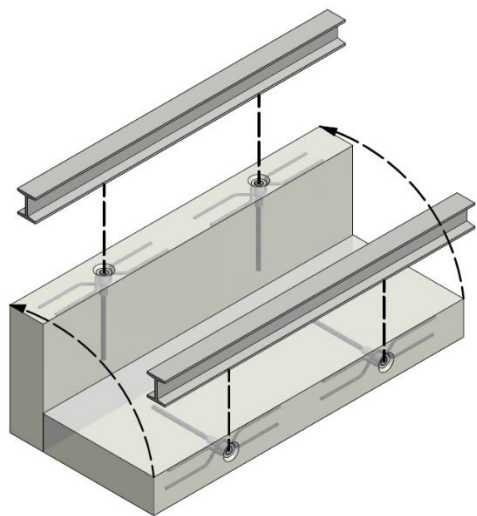
Diagonal reinforcement must be placed in direct contact with the socket anchor.

Always install diagonal reinforcement opposite the load direction.

The dimensions in the illustrations are in [mm].

REINFORCEMENT AND LOAD CAPACITY – DIAGONAL LOAD AND TILTING UP TO 90°

For tilting and diagonal pull, additional reinforcements must be installed in the anchor zone. Make certain that the placement of the anchors ensures load transfer. When turning and lifting at an angle, tilt reinforcement is sufficient and there is no need for angle lift reinforcement.



Tilt reinforcement

Note: Tilt reinforcement must be placed in direct contact with the socket anchor.

There must be two layers of mesh reinforcement.

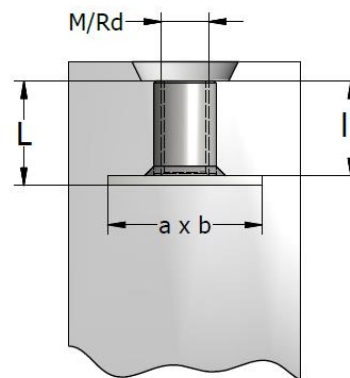
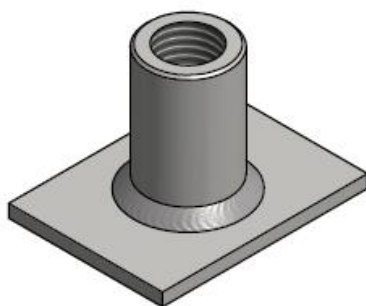
TRL HD-M(Rd)	Load group	Thread	Overall length	Minimum element thickness	Mesh reinforcement	Transverse reinforcement		
	$f_{cu} > 15 \text{ MPa}$					Dia. d_s	High h	Length before bending
	[t]		[mm]	[mm]	[mm ² /m]	[mm]	[mm]	[mm]
TRL HD-M(Rd)12-300	1.3	12	300	60	2 x 188	Ø8	23	550
				80	2 x 188	Ø8	33	550
				100	2 x 188	Ø8	43	550
TRL HD- M(Rd)16-400	2.5	16	400	80	2 x 188	Ø 12	37	750
				100	2 x 188	Ø 12	47	750
				120	2 x 188	Ø 12	57	750
TRL HD- M(Rd)20-520	4.0	20	520	120	2 x 188	Ø 16	62	910
				140	2 x 188	Ø 16	72	910
				160	2 x 188	Ø 16	82	910
TRL HD- M(Rd)24-540	5.0	24	540	120	2 x 188	Ø 16	66	1100
				140	2 x 188	Ø 16	76	1100
				160	2 x 188	Ø 16	86	1100
TRL HD- M(Rd)30-700	7.5	30	700	140	2 x 188	Ø 20	84	1300
				160	2 x 188	Ø 20	94	1300
				180	2 x 188	Ø 20	104	1300
TRL HD- M(Rd)36-800	10.0	36	800	160	2 x 188	Ø 20	98	1700
				180	2 x 188	Ø 20	108	1700
				200	2 x 188	Ø 20	118	1700
TRL HD- M(Rd)42-920	12.5	42	920	160	2 x 188	Ø 25	107	1650
				180	2 x 188	Ø 25	117	1650
				200	2 x 188	Ø 25	127	1650
TRL HD- M(Rd)52-1100	15.0	52	1100	200	2 x 188	Ø 25	133	1950
				220	2 x 188	Ø 25	143	1950
				240	2 x 188	Ø 25	153	1950


LIFTING SOCKET WITH FOOTPLATE – HSP-HD


The low-profile lifting socket with footplate is suitable for the face of thin panels or top slabs, which are lifted perpendicular to their largest surface. The footplate and the socket are fully welded, so the insert is effectively sealed. The threaded bush is made of S355J0 steel and the plate is manufactured from steel sheet. On special request, the product can be produced from stainless steel.

The preferred lift angle is $\beta \leq 30^\circ$.

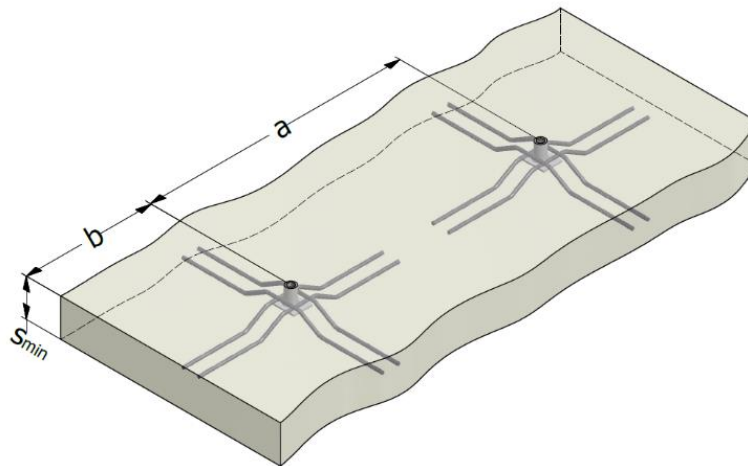
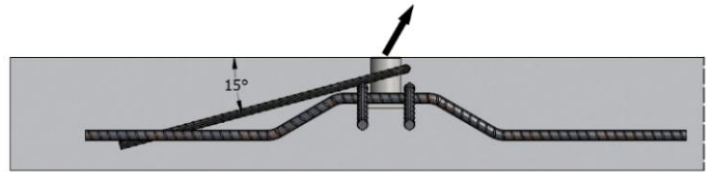
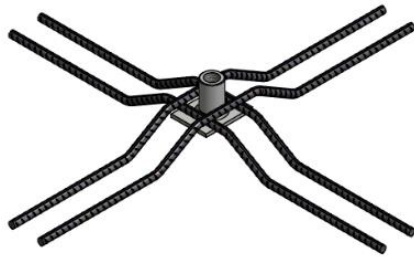
The safe working loads presented are after the application of a safety factor on test loads of 2 for 15MPa concrete and 3 for steel.

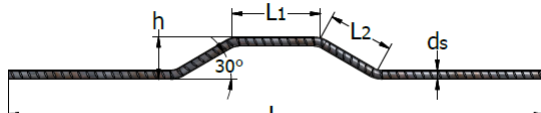
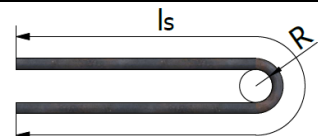


HSP-HD M	Product no.	Thread	Load group $f_{cu} > 15 \text{ MPa}$	Overall length L	a	b
						
	Zinc galvanizing	M	[t]	[mm]	[mm]	[mm]
HSP-HD M12	61608	12	1.3	46	50	50
HSP-HD M16	61609	16	2.5	54	60	80
HSP-HD M20	61610	20	4.0	72	80	100
HSP-HD M24	61611	24	5.0	83	100	130
HSP-HD M30	61612	30	7.5	98	130	130

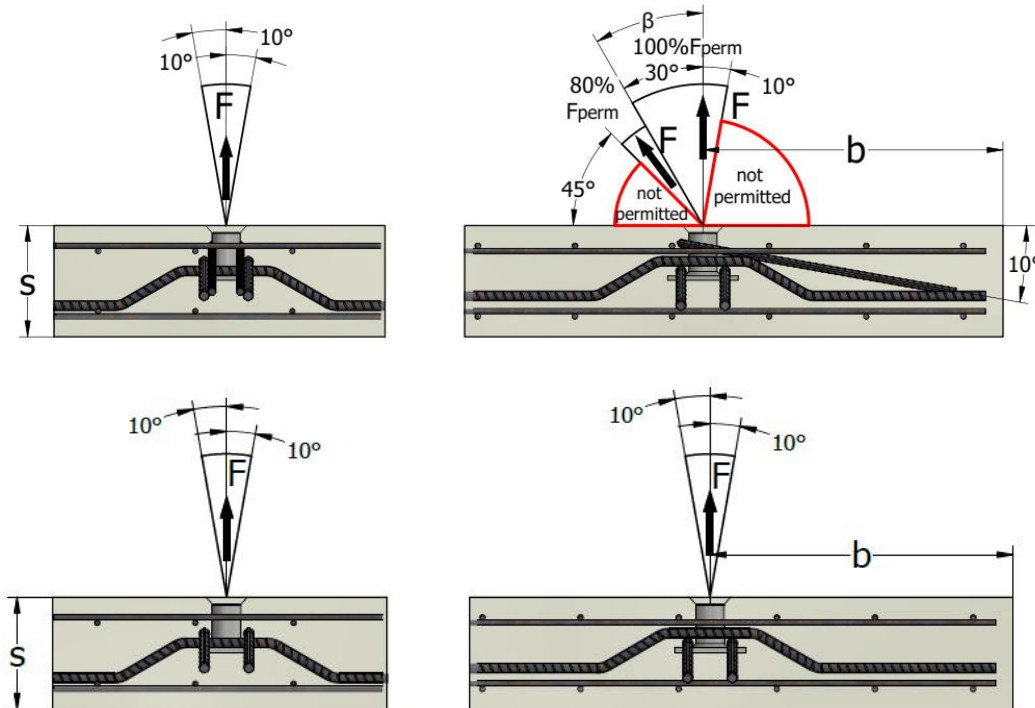
HSP-HD Rd	Product no.	Thread	Load group $f_{cu} > 15 \text{ MPa}$	Overall length L	a	b
						
	Zinc galvanizing	Rd	[t]	[mm]	[mm]	[mm]
HSP-HD Rd12	61666	12	1.3	46	50	50
HSP-HD Rd16	61667	16	2.5	54	60	80
HSP-HD Rd20	61668	20	4.0	72	80	100
HSP-HD Rd24	61669	24	5.0	83	100	130
HSP-HD Rd30	61670	30	7.5	98	130	130

LIFTING SOCKETS HSP – INSTALLATION AND REINFORCEMENTS



HSP-HD M(Rd)	Load group	Minimum unit thickness	Anchor spacing	Edge distance	Mesh reinforcement	
		Smin	a	b		
	[t]	[mm]	[mm]	[mm]	[mm ² /m]	
12	1.3	100	500	250	2 x 188	 Note: The bend radius R will be determined according to EN 1992. Additional reinforcement must be placed and secured on top of the plate anchor and in direct contact with the plate. There must be two layers of mesh reinforcement. Additional reinforcement must be placed crosswise in pairs.
16	2.5	120	820	410	2 x 188	
20	4.0	150	1020	510	2 x 188	
24	5.0	160	1300	650	2 x 188	
30	7.5	200	1300	650	2 x 260	

HSP-HD M(Rd)	Additional reinforcement						Axial load $\beta \leq 10^\circ$	Diagonal load $10^\circ \leq \beta \leq 45^\circ$	
							Load capacity $f_{cu} > 15\text{MPa}$	Load capacity $f_{cu} > 15\text{MPa}$	Angled pull reinforcement $\varnothing \times l_s$
	number [pcs]	d_s [mm]	L_1 [mm]	L_2 [mm]	h [mm]	L [mm]	[kN]	[kN]	[mm]
12	4	8	60	80	40	400	13	10.4	$\varnothing 10 \times 750$
16	4	10	90	110	55	620	25	20.0	$\varnothing 12 \times 1300$
20	4	12	110	110	55	800	40	32.0	$\varnothing 12 \times 1400$
24	4	16	140	120	60	1120	50	40.0	$\varnothing 16 \times 1500$
30	4	16	140	120	60	1220	75	60.0	$\varnothing 16 \times 1750$



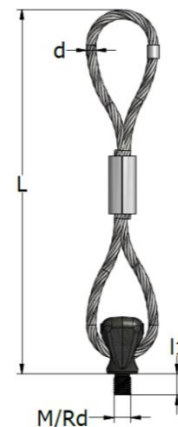
Note: The bend radius R will be determined according to EN 1992.

Diagonal reinforcement must be placed in direct contact with the socket anchor.
Always install diagonal reinforcement opposite the load direction.
The dimensions in the illustrations are in [mm].

LIFTING SYSTEMS

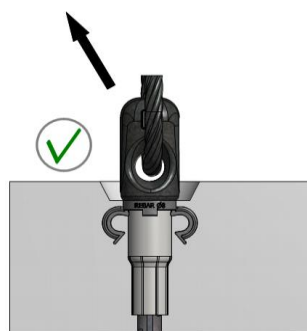
LIFTING SLING - THS1

The threaded lifting sling is made of high-grade steel wire rope according EN 12385-4, swaged in a ferrule made of AlMg1.8 and a steel bolt made of high-strength steel. It is zinc-plated for protection against corrosion. Every lifting system is individually tested at 3 times the working load and comes with its own unique certificate. Each threaded lifting loop has a label marked with the admissible load, the thread type and the code number of the testing. Before use, you must check that the wires are in good condition. Lifting loops with broken strands or other signs of damage, kinking, bird caging, corrosion that require discarding according EN 13414-1 must not be used for further lifting. Ensure that the thread is fully bottomed out in the socket before lifting. A back rotation up to a maximum 90° is allowed to adjust the loop direction towards the load. The threaded lifting sling should only be attached to the concrete unit and only used after the concrete strength has reached 15MPa.

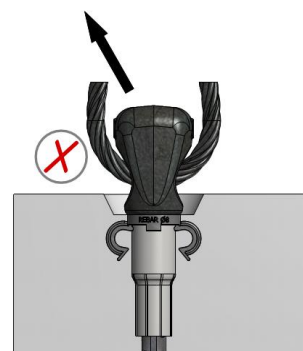


THS1-M	Product no.	Thread	THS1-Rd	Product no.	Thread	Load group	Axial load	L	d	l ₁	Wire length
		M			Rd						
THS1-M12	45890	12	THS1-Rd12	46378	12	1.3	13	310	8	20	700
THS1-M16	45891	16	THS1-Rd16	46379	16	2.5	25	400	12	20	950
THS1-M20	45892	20	THS1-Rd20	46380	20	4.0	40	440	14	25	1035
THS1-M24	45893	24	THS1-Rd24	46381	24	5.0	50	480	16	30	1130
THS1-M30	45894	30	THS1-Rd30	46382	30	7.5	75	640	20	37	1480
THS1-M36	46339	36	THS1-Rd36	46383	36	10.0	100	735	22	44	1725
THS1-M42	46340	42	THS1-Rd42	46384	42	12.5	125	745	26	51	1765
THS1-M52	46341	52	THS1-Rd52	46385	52	15.0	150	745	26	62	1765

The lifting slings can be used with all types of anchors and threaded sockets. They are suitable for most lifting situations, particularly site operations. They can be reused, but only after inspection. If kept in storage for reuse, they must be inspected every six months and retested every year. For inspection procedures and requirements, see chapter **Checking the lifting system**. These lifting systems are not recommended for intensive reuse conditions.



Optimum load transfer is ensured if the eye bolt is oriented in load direction.



Diagonal or shear load is not permitted in this case.

THS1 – APPLICATIONS

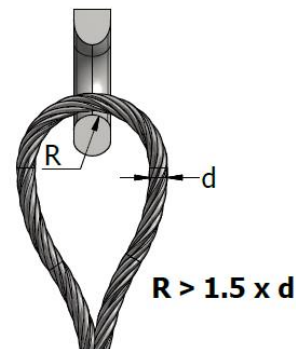
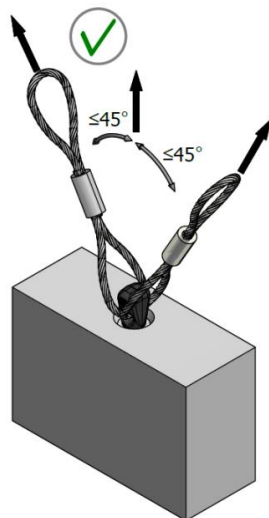
SCREWING DETAILS

Ensure that the thread is fully bottomed out in the socket before lifting. A back rotation up to a maximum 90° is allowed to adjust the loop direction towards the load. **No gaps are permitted between the concrete element and the body of the lifting system: the thread must be fully threaded inside the socket.**

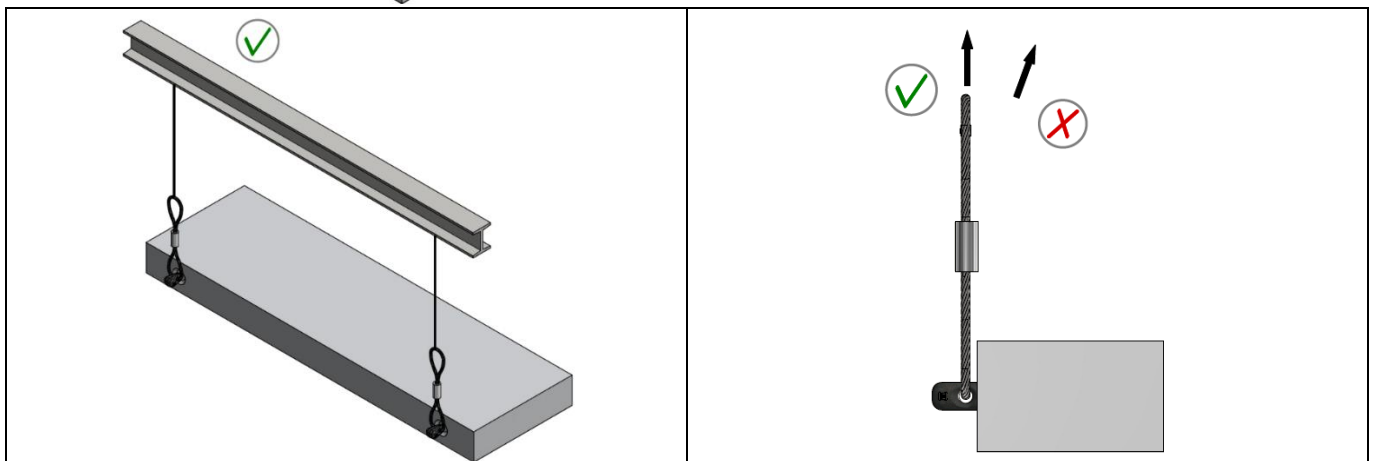




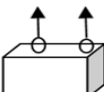
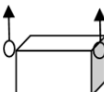
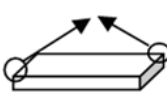
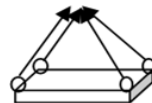
The preferred option is the vertical lift. Normally the angle of lift (β) should not be greater than 30°. Pulling back towards the unit is not permitted.

ADMISSIBLE LOAD DIRECTION



Note: Minimum radius of the crane hook for the wire loop must be $R > 1.5 \times d$



Number of pieces	1	1	2	2	2	2	3 or 4	3 or 4
Type of attachment								
Angle of inclination	0 °	90 °	0 °	90 °	0 ° - 45 °	45 ° - 60 °	0 ° - 45 °	45 ° - 60 °
THS1-M/Rd	WLL group	Axial load	Load group	Axial load	Load group	Axial load	Load group	Axial load
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
THS1-M/Rd12	13	6.5	26	13	9.1	6.5	13	9.1
THS1-M/Rd16	25	12.5	50	25	17.5	12.5	25	17.5
THS1-M/Rd20	40	20.0	80	40	28.0	20.0	40	28.0
THS1-M/Rd24	50	25.0	100	50	35.0	25.0	50	35.0
THS1-M/Rd30	75	37.5	150	75	52.5	37.5	75	52.5
THS1-M/Rd36	100	50.0	200	100	70.0	50.0	100	70.0
THS1-M/Rd42	125	62.5	250	125	84.0	62.5	125	84.0
THS1-M/Rd52	150	75.0	300	150	105.0	75.0	150	105.0

GENERAL GUIDANCE FOR LIFTING SLING THS1

Ensure that the concrete has MPa strength of at least 15 before beginning lifting.

For positioning the inserts, always check the permitted edge distances and spacing between inserts.

We recommend restricting the lift angle to a maximum of 30° when angled lifting is necessary.

To choose the proper lifting system, take into consideration how frequently the precast unit is going to be lifted.

The cast-in threaded elements (anchors or fixing inserts) can be flush or recessed for corrosion protection.

This recess is filled with fine concrete after use.

All the HD lifting systems are tested before delivery under a test load three times the working load (individual test for THS1).

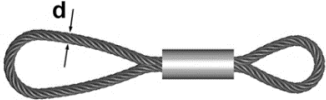
CHECKING THE LIFTING SYSTEM THS1

The lifting devices THS1 must be examined by the authorised specialist before using them for the first time, at least twice a year and after special events.

- **Any deformation to the wire rope (see the type of damages mentioned on the following page), thread, or metal structural elements causes a weakening of the lifting device with the risk of falling of the precast element. Do not perform any repair work. The lifting device must be discarded. Lifting loops with broken strands or other signs of damage, kinking, bird caging, corrosion that require discarding according EN 13414-1 must not be used for any further lifting.**
- **Damage, distortions, cracks, and extensive corrosion can reduce the load-carrying capacity and lead to failure. This causes a hazard to life and limb. If necessary, any affected parts must be taken out of service immediately.**

The lifting bolt thread must be regularly checked for signs of damage. Re-cutting the thread is not permitted. Cables must not come into contact with acids, caustic solutions, or other aggressive substances.







Combining products from different companies is not recommended.

	Cable type	Number of visible broken wires over a length of		
		3d	6d	10d
	Stranded rope	4	6	16

d = cable diameter

Wire cables should be inspected and discarded according EN 13414-1 when the following flaws occur:

- Kinking
- One strand is broken
- Separation of the outer layer of braids
- Crushed strands
- 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
- Signs of corrosion
- Damage to or severe wear of the closing bush.
- Signs of slipping between the cable and the closing bush
- A cable with several broken wires mentioned in the table above must be taken out of use

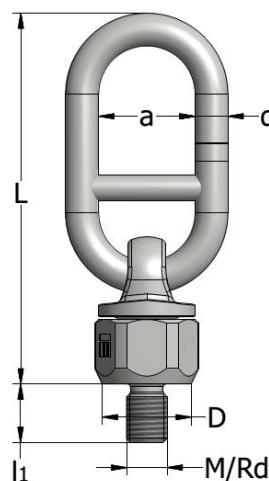
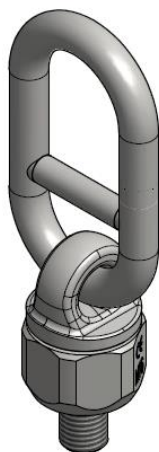
Wire rope dimensions		
		
Kinking	Severe wear	Bird caging
		
Broken wire	Corrosion	Closing bush damage

THREADED SWIVEL EYE – THS3

The threaded swivel eye can be used for anchors with threaded sockets and are suitable for most lifting situations, particularly for turning and tilting. They are more suitable for turning and tilting than the lifting systems manufactured from steel wire and can be reused provided they are inspected regularly. If kept in storage for reuse, they must be inspected in accordance with local requirements. The threaded swivel eye THS3 anchors are made of high-quality steel and are designed with a safety factor of 5. Every lifting system is individually tested at 3 times the working load and comes with its own unique certificate.

The threaded swivel eye should only be attached to the concrete unit and used after the concrete strength has reached 15 MPa. It is usually removed after the concrete elements have been installed. This lifting system is suitable for use with threaded socket cast that is flush with the surface of the unit or recessed using (KU-10, TPM) recess formers.

Ensure that the thread is engaged all the way to the bottom of the socket before lifting.



THS3-M	Product no.	Thread	Load group	Axial load	L	a	d	D	l ₁
		M	[t]	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]
THS3-HD-M12	61703	12	1.3	13	124	34	11	30	17
THS3-HD-M16	61704	16	2.5	25	145	38	13	35	23
THS3-HD-M20	61705	20	4.0	40	169	45	15	44	28.5
THS3-HD-M24	62748	24	5.0	50	198	49	17	44	33.5
THS3-HD-M30	62749	30	7.5	75	230	60	20	59	44.5
THS3-HD-M36	62750	36	10.0	100	264	64	24	59	53.5
THS3-HD-M42	62751	42	12.5	125	285	68	26	75	57.5
THS3-HD-M52	60828	52	15.0	150	307	72	31	84	67.5

THS3-Rd	Product no.	Thread	Load group	Axial load	L	a	d	D	l ₁
		Rd	[t]	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]
THS3-HD-Rd12	61706	12	1.3	13	124	34	11	30	17
THS3-HD-Rd16	61707	16	2.5	25	145	38	13	35	23
THS3-HD-Rd20	61708	20	4.0	40	169	45	15	44	28.5
THS3-HD-Rd24	62752	24	5.0	50	198	49	17	44	33.5
THS3-HD-Rd30	62753	30	7.5	75	230	60	20	59	44.5
THS3-HD-Rd36	62754	36	10.0	100	264	64	24	59	53.5
THS3-HD-Rd42	62755	42	12.5	125	285	68	26	75	57.5
THS3-HD-Rd52	60829	52	15.0	150	307	72	31	84	67.5

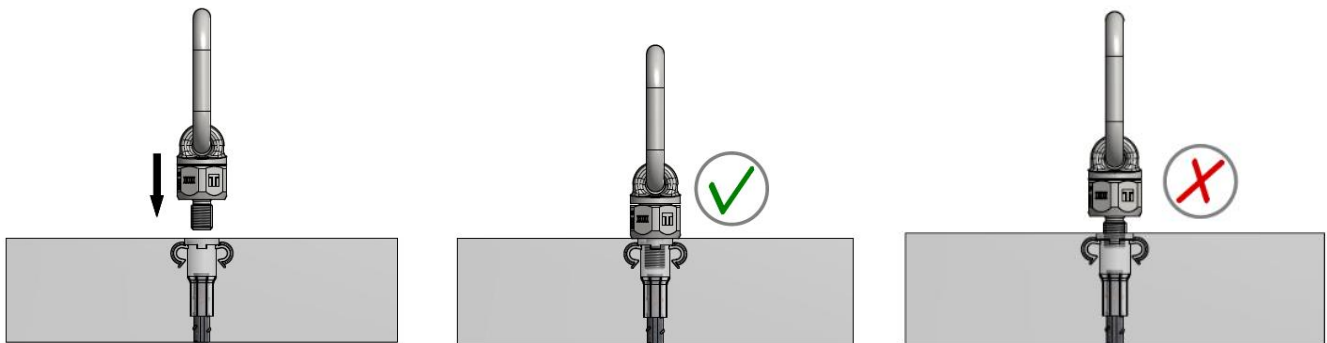
THS3 – APPLICATIONS

SCREWING DETAILS

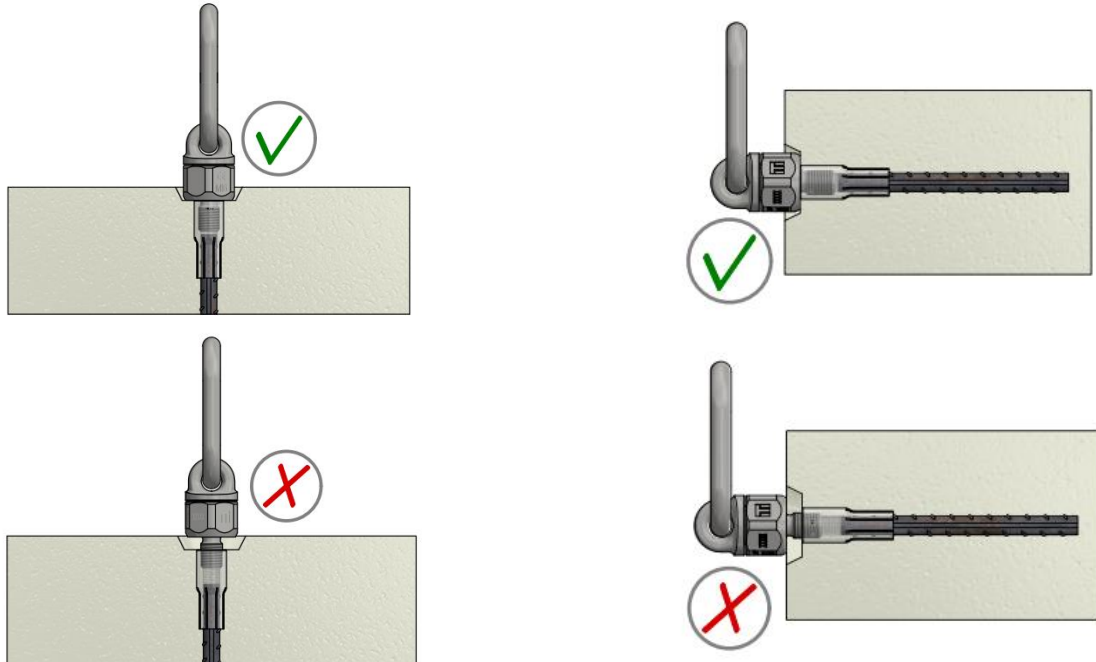
Ensure that the concrete has MPa strength of at least 15 before beginning lifting.

For installation, it is sufficient to tighten the swivel manually with a suitable tool (e.g., open-ended spanner according to DIN 895 or DIN 894). Do not use extensions. Tighten the screw-on swivel so that it is completely in contact with the support surface. Then check whether the upper part rotates freely and easily. The rotating system should be able to turn freely the full 360 degrees without any noticeable obstructions or resistance. Note the load capacity information depending on the angle!

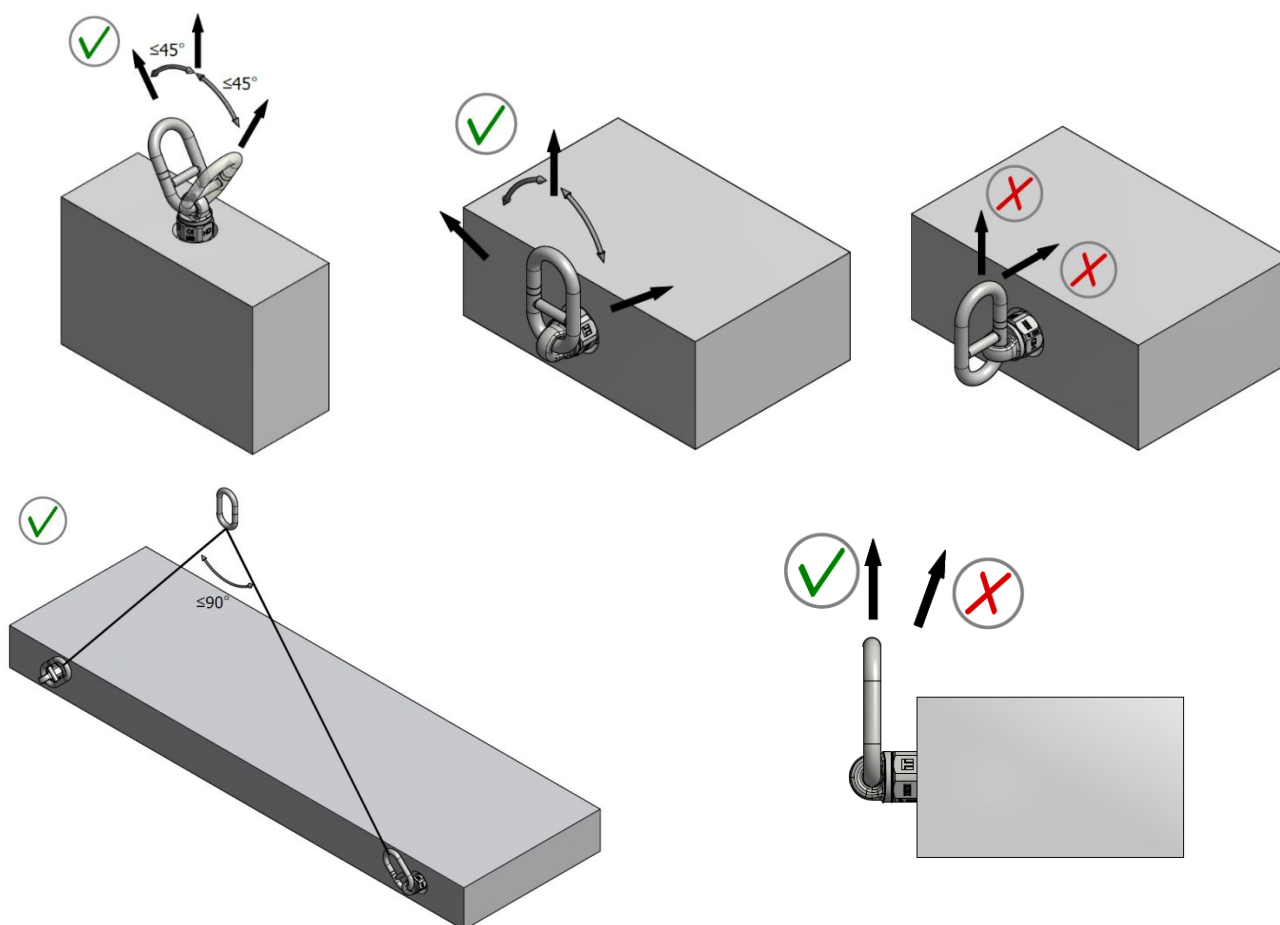
Ensure that the thread is fully bottomed out in the socket before lifting. **No gaps are permitted between the concrete element and the body of the lifting system: the thread must be fully threaded inside the socket.**



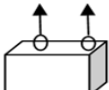
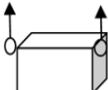

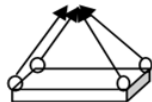


The preferred option is the vertical lift. Normally the angle of lift (β) should not be greater than 30°. Pulling back towards the unit is not permitted. The chain link of the swivel lifting eye must be properly aligned in the direction of the force application and must be freely movable.



ADMISSIBLE LOAD DIRECTION



Number of pieces	1	1	2	2	2	2	3 or 4	3 or 4
Type of attachment								
Angle of inclination	0 °	90 °	0 °	90 °	0 ° - 45 °	45 ° - 60 °	0 ° - 45 °	45 ° - 60 °
THS3-M/Rd	WLL group	Axial load	Load group	Axial load	Load group	Axial load	Load group	Axial load
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
THS3-M/Rd12	13	6.5	26	13	9.1	6.5	13	9.1
THS3-M/Rd16	25	12.5	50	25	17.5	12.5	25	17.5
THS3-M/Rd20	40	20.0	80	40	28.0	20.0	40	28.0
THS3-M/Rd24	50	25.0	100	50	35.0	25.0	50	35.0
THS3-M/Rd30	75	37.5	150	75	52.5	37.5	75	52.5
THS3-M/Rd36	100	50.0	200	100	70.0	50.0	100	70.0
THS3-M/Rd42	125	62.5	250	125	84.0	62.5	125	84.0
THS3-M/Rd52	150	75.0	300	150	105.0	75.0	150	105.0

For an asymmetrical load distribution, the lifting capacities applicable to the 2 and 3 or 4 leg slings are the same as for 1 leg types at 90°.

The preferred option is the vertical lift. Normally, the angle of lift (β) should not be greater than 30°. Pulling back towards the unit is not permitted.

GENERAL GUIDANCE FOR LIFTING SYSTEM THS3

Ensure that the concrete has MPa strength of at least 15 before beginning lifting.

For positioning the inserts, always check the permitted edge distances and spacing between inserts.

We recommend restricting the lift angle to a maximum of 30° when an angled lift is necessary.

To choose the proper lifting system, take into consideration how frequently the precast unit is going to be lifted.

The cast-in threaded elements (anchors or fixing inserts) can be flush or recessed for corrosion protection.

This recess is filled with fine concrete after use.

All the HD lifting systems are tested before delivery under a test load three times the working load (individual test for THS3).

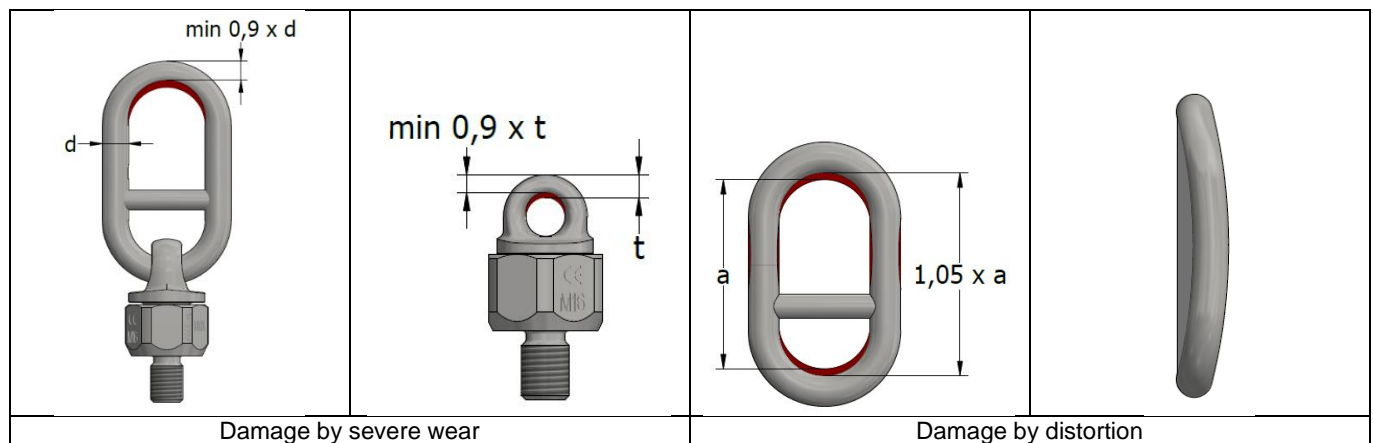
CHECKING THE LIFTING SYSTEM THS3

The lifting devices THS3 must be examined by the authorised specialist before using the first time, at least twice a year and after special events.

- **Any deformation to the oval link, thread, or metal structural elements causes a weakening of the lifting device with the risk of falling of the precast element. Do not perform any repair work. The lifting device must be discarded.**
- **Damage, distortions, cracks, and extensive corrosion can reduce the load-carrying capacity and lead to failure. This causes a hazard to life and limb. If necessary, any affected parts must be taken out of service immediately.**

The lifting bolt thread must be regularly checked for signs of damage. Re-cutting the thread is not permitted.

Combining products from different companies is not recommended.



SAFETY INSTRUCTIONS

Warning: Use only trained personnel. Use the anchor and the lifting device by untrained personnel poses the risk of incorrect use or falling, which may cause injury or death. The lifting systems must be used only for lifting and moving precast concrete elements.

Obligatory instructions for safe working:

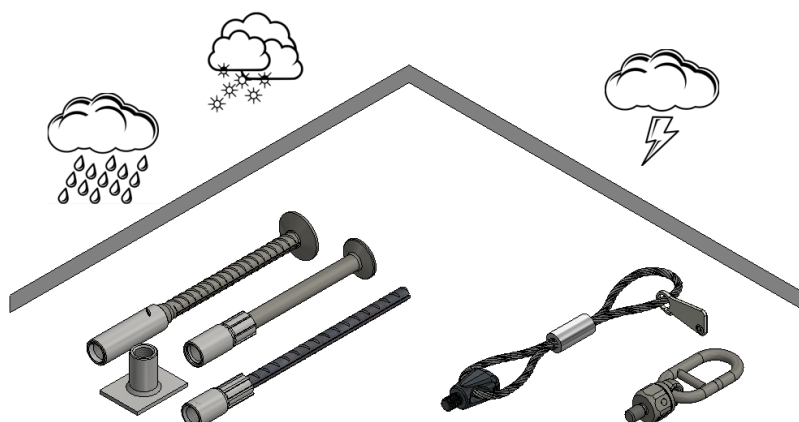
- All lifting anchors and lifting devices must be operated manually
- Visually inspect lifting anchors before use; check and clean all lifting inserts prior to use
- Hook in all lifting systems separately, without using force

Respect local regulations for safe lifting and hoisting at all times.

Incorrect use may result in safety hazards and reduced load-carrying capacity. This may cause the lifted object to fall and pose a hazard to life and limb. Lifting anchor systems must be used only by suitable trained personnel.

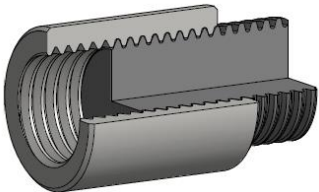
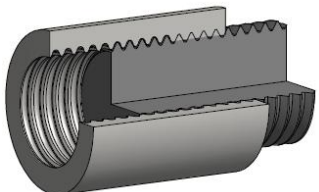
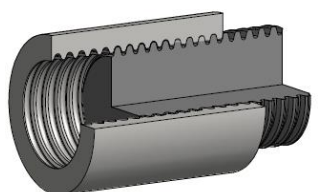
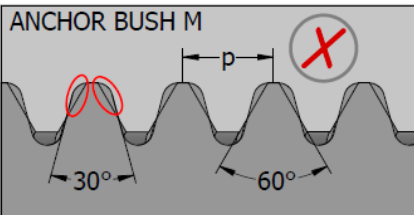
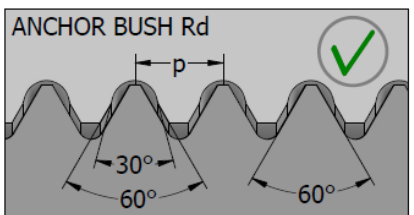
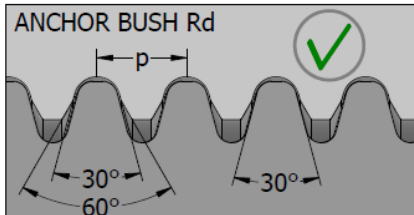
STORAGE REQUIREMENTS

Lifting systems and anchors must be stored and protected in dry conditions, under a roof. Large temperature variations, snow, ice, humidity, or salt and saltwater impact may cause damage to anchor and shorten the service life.



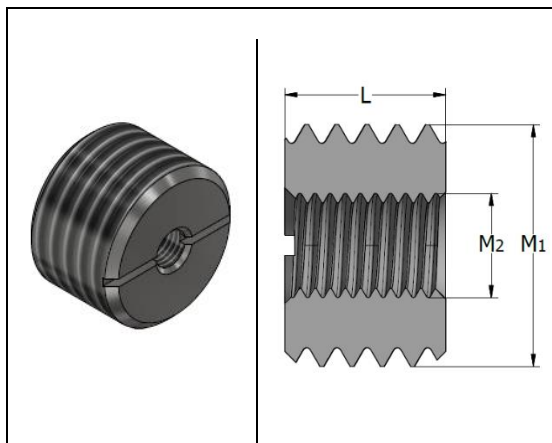
SPECIAL THREAD DESCRIPTION

Terwa special thread Rd is a mix of a standard Rd thread and a metric thread according to DIN 13. It has metric screw pitches and the round thread geometry of thread flanks with a double angle of 60° and 30°. For that reason, an anchor with special Rd thread can be used in combination with both metric and Rd threaded lifting systems.

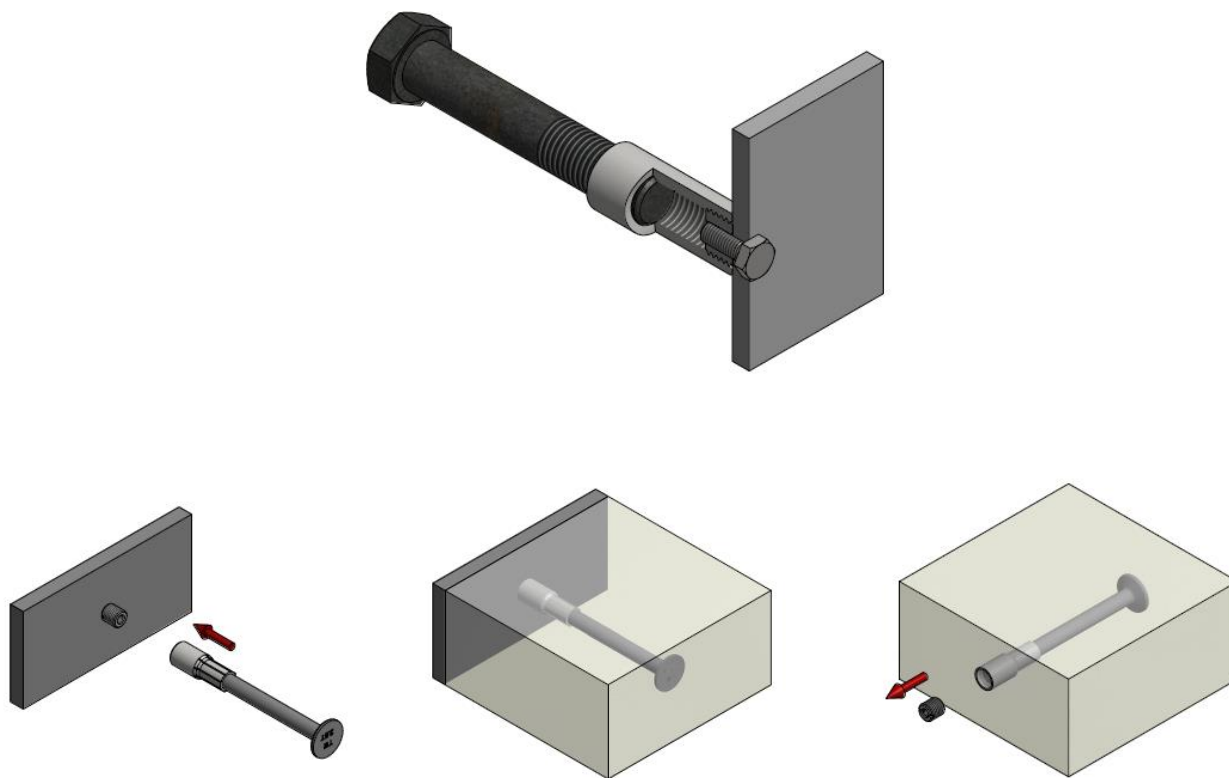
<i>M thread bush and Rd thread bolt</i>	<i>Rd thread bush and metric thread bolt</i>	<i>Rd thread bush and Rd thread bolt</i>
		
<p>ANCHOR BUSH M</p>  <p>LIFTING BOLT Rd</p>	<p>ANCHOR BUSH Rd</p>  <p>LIFTING BOLT M</p>	<p>ANCHOR BUSH Rd</p>  <p>LIFTING BOLT Rd</p>

ACCESSORIES

DOUBLE METRIC MOUNTING PLUG–SN

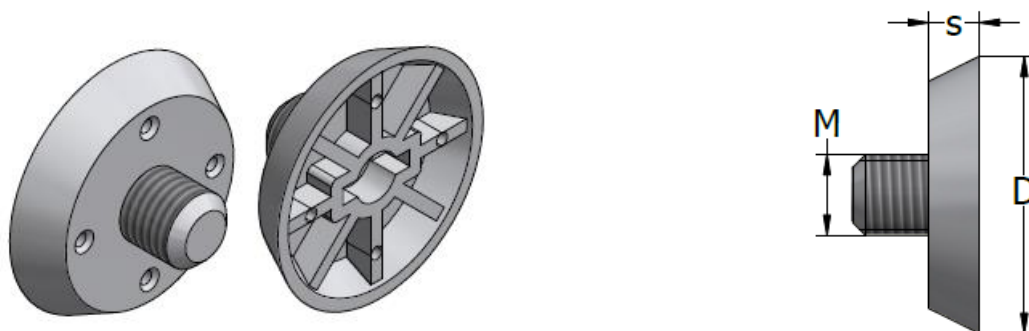
	SN	Product no.	Thread	Thread	L
			M1	M2	[mm]
	SN M12-M6	45214	12	6	16
	SN M16-M8	45215	16	8	16
	SN M20-M8	45216	20	8	16
	SN M24-M8	46303	24	8	16
	SN M24-M10	45217	24	10	16
	SN M30-M10	45218	30	10	16
	SN M30-M8	46079	30	8	16
	SN M36-M10	45219	36	10	25
	SN M42-M10	45220	42	10	30
	SN M48-M10	45464	48	10	36
	SN M48-M12	46525	48	12	36
	SN M48-M16	46524	48	16	36

The double metric mounting plug SN is used for fixing the anchors or the lifting sockets to the formwork with a screw.



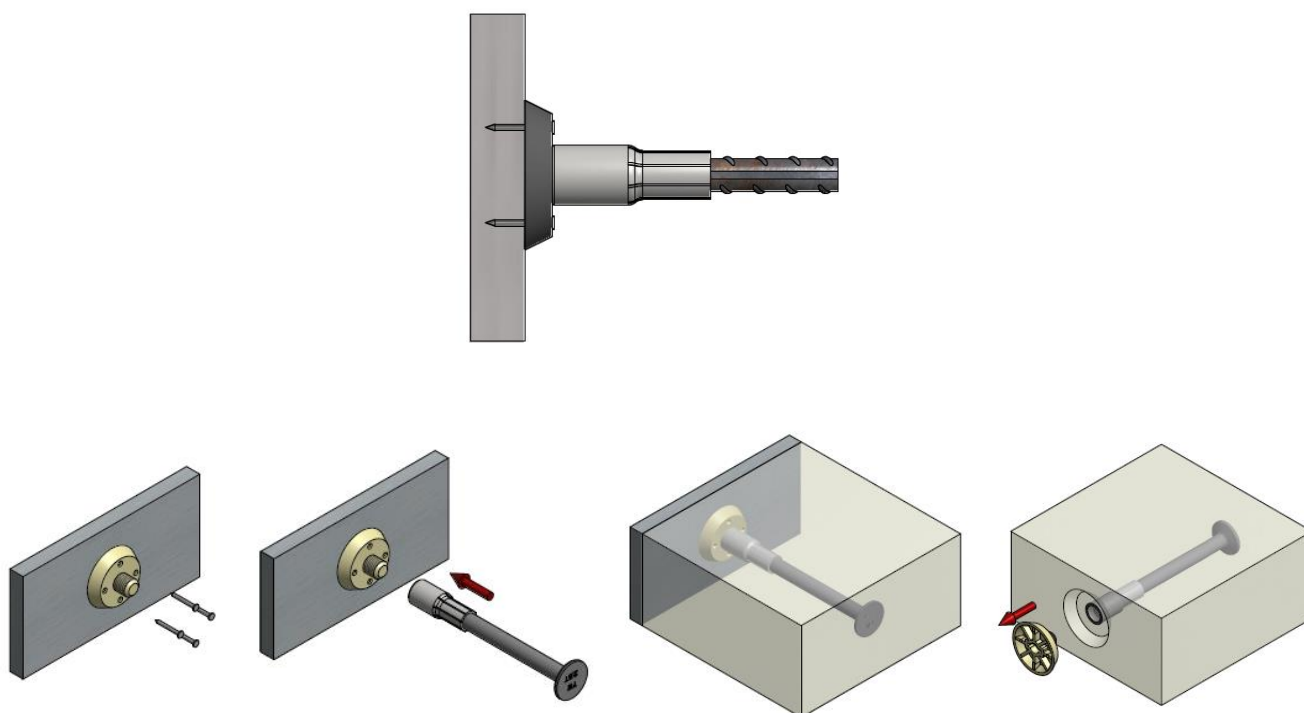
PLASTIC NAILING PLATE KU-10

The nailing plates KU-10 are used for affixing the anchors and the lifting sockets to the formwork with nails. The fixing flange ensures a minimum recess around the head of the anchor. The recess is filled with fine concrete for protection against corrosion.



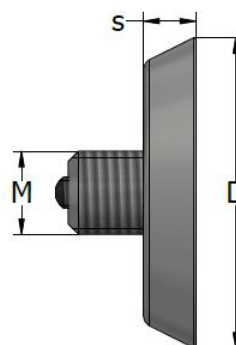
KU-10	Product no.	Thread	Diam. D	s	Colour
		M	[mm]	[mm]	
KU-10-M12	63246	12	47	10	Red RAL 3020
KU-10-M16	63256	16	47	10	Grey RAL 7043
KU-10-M20	63257	20	60	10	Green RAL 6024
KU-10-M24	63258	24	60	10	Blue RAL 5017
KU-10-M30	63259	30	73	10	Light grey RAL 7004
KU-10-M36	63260	36	73	10	Orange RAL 2009
KU-10-M42	63261	42	96	12	Yellow RAL 1023
KU-10-M52	63262	52	96	12	Black RAL 9017

The plastic nailing plates KU-10 are nailed to formwork. Using forming wax on the nailing plate makes it easier to remove and screw on an anchor or fixing insert. The anchor must be fastened to the reinforcement by suitable means, so it does not move when concreting. After stripping, unscrew.



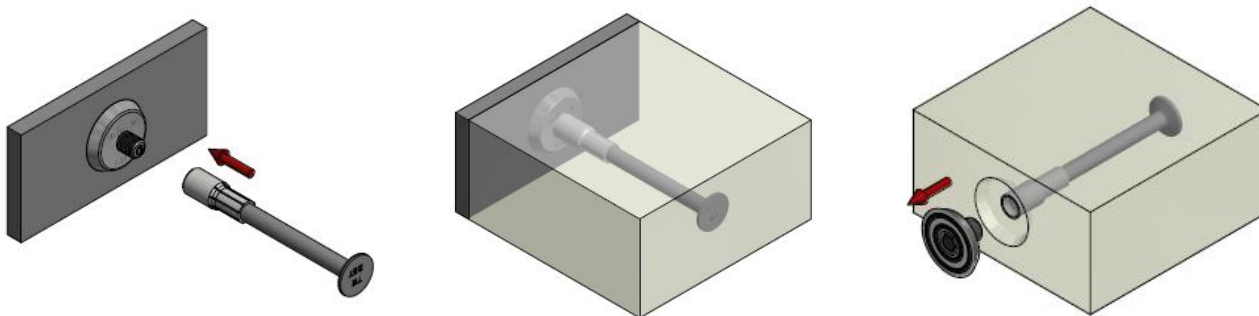
STEEL MAGNETIC PLATE - TPM

The plates with TPM are used for affixing the anchors and the lifting sockets to the steel formwork. The fixing flange ensures a minimum recess around the head of the anchor. When using this magnetic recess former, it is very important that the surface of the formwork is clean. The recess is filled with fine concrete for protection against corrosion.



TPM-10	Product no.	Thread	Diam. D	s
		M	[mm]	[mm]
TPM-10-M12	63867	12	47	10
TPM-10-M16	63868	16	47	10
TPM-10-M20	63869	20	60	10
TPM-10-M24	63870	24	60	10
TPM-10-M30	63871	30	73	10
TPM-10-M36	63872	36	73	10
TPM-10-M42	63873	42	96	12
TPM-10-M52	63874	52	96	12

Note: They are powerful magnets, so please be careful of your hands when mounting them on the steel formwork.





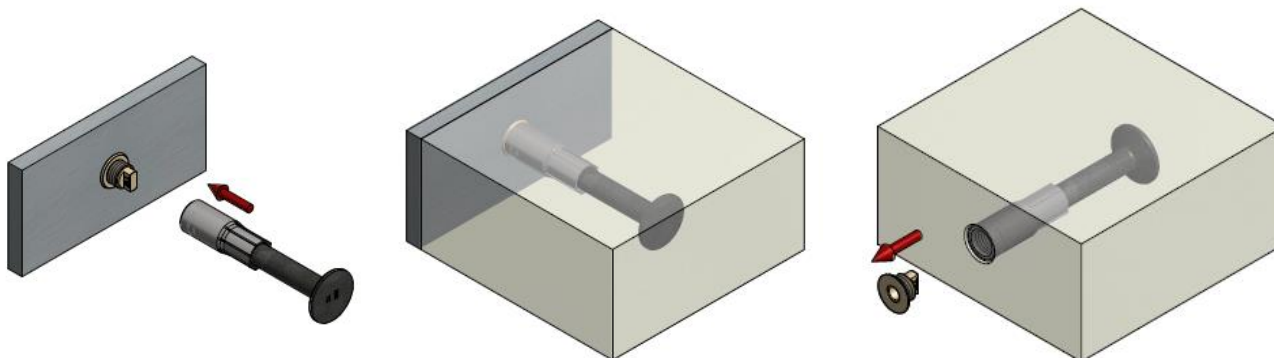
BREAKABLE FIXING PIN – TBP

The breakable fixing pin is used for affixing the anchors or the lifting sockets to the formwork. The breakable fixing pin TBP is made of plastic nylon or polyamide 6.

Working method:

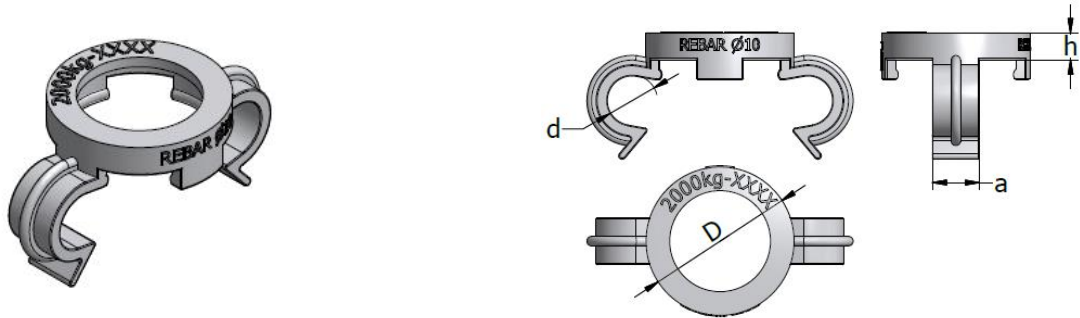
- Insert the breakable fixing pin TBP into the formwork
- Screw the anchor or the fixing insert onto the fixing pin TBP
- Pour concrete
- Remove the formwork; the fixing pin will break off in the formwork
- Remove the remaining part of the fixing pin just before using the thread of the anchor

	TBP	Product no.	Thread	D
			M	[mm]
	TBP-M12	45652	12	11
	TBP-M16	45653	16	17
	TBP-M20	45654	20	17
	TBP-M24	45655	24	17



DATA CLIP

Identifying the lifting anchor embedded in concrete is easy using the Terwa DATA CLIP. The size, the maximum working load, the additional reinforcement steel diameter and the manufacturer are clearly marked on the ring. At the same time, each DATA CLIP has a unique colour code related to the anchor's load group. There are two lateral wings on the product, which permits the additional reinforcement steel on the anchor to be mounted easily in a safe zone, with 100% lifting capacity of the anchor.

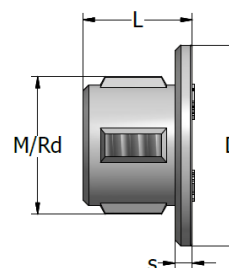
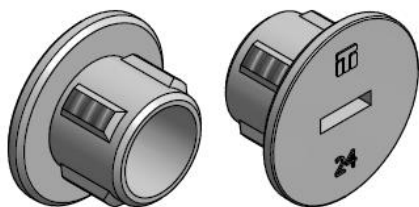


DATA CLIP	Product no.	Thread	D	h	a	d	Colour
		M	[mm]	[mm]	[mm]	[mm]	
DATA CLIP -M12	62651	12	20.5	4	6.5	9	Red RAL 3020
DATA CLIP -M16	62652	16	26.5	5	7.5	11	Dark grey RAL 7043
DATA CLIP -M20	62653	20	31.5	6	10	13	Green RAL 6024
DATA CLIP -M24	62654	24	36.5	6	10	15	Blue RAL 5017
DATA CLIP -M30	62655	30	43.5	6	15	17	Light grey RAL 7004
DATA CLIP -M36	62656	36	52.5	8	18	21	Orange RAL 2009
DATA CLIP -M42	62657	42	60.5	8	19.5	21	Yellow RAL 1023
DATA CLIP -M52	62658	52	73.5	9	22	26	Black RAL 9017

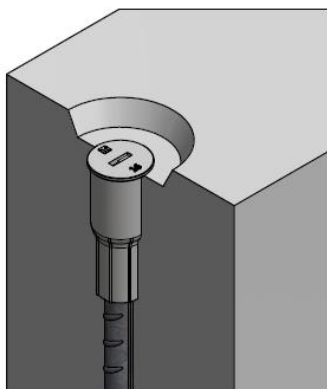
DATA CLIP	Product no.	Thread	D	h	a	d	Colour
		Rd	[mm]	[mm]	[mm]	[mm]	
DATA CLIP -Rd12	62659	12	20.5	4	6.5	9	Red RAL 3020
DATA CLIP -Rd16	62660	16	26.5	5	7.5	11	Dark grey RAL 7043
DATA CLIP -Rd20	62661	20	31.5	6	10	13	Green RAL 6024
DATA CLIP -Rd24	62662	24	36.5	6	10	15	Blue RAL 5017
DATA CLIP -Rd30	62663	30	43.5	6	15	17	Light grey RAL 7004
DATA CLIP -Rd36	62664	36	52.5	8	18	21	Orange RAL 2009
DATA CLIP -Rd42	62665	42	60.5	8	19.5	21	Yellow RAL 1023
DATA CLIP -Rd52	62666	52	73.5	9	22	26	Black RAL 9017

PLASTIC PLUG - TPP

Plastic plugs are used to cover the bushes and to protect the sockets from rust and/or dirt. They are available in light grey (RAL 7035) and red (RAL 3020) and can be left in the concrete element after installation for a finished look or easily spotted to be removed.



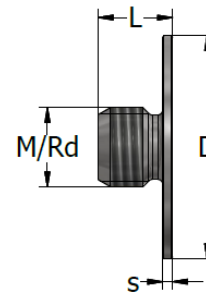
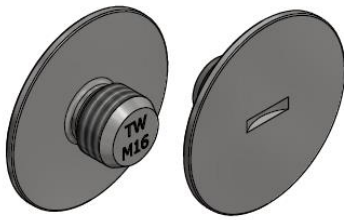
PLASTIC PLUG	Product no. (grey, RAL 7035)	Product no. (red, RAL 3020)	Thread	Diam. D	L	s
			M/Rd	[mm]	[mm]	[mm]
TPP -M/Rd12	62768	65616	12	17.5	10	2
TPP -M/Rd16	62769	65617	16	22	12.5	2
TPP -M/Rd20	62770	65618	20	28	15	3
TPP -M/Rd24	62771	65619	24	34	18	3
TPP -M/Rd30	62772	65620	30	42.5	21	3
TPP -M/Rd36	62773	65621	36	50	23	3
TPP -M/Rd42	62774	65622	42	56	27.5	3
TPP -M/Rd52	62775	65623	52	69	29	3



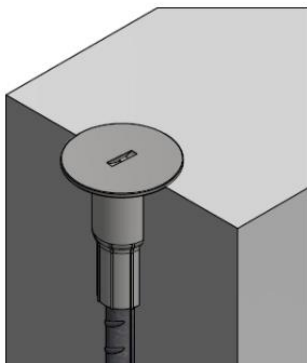
After removing the KU Nailing plate, mount the plastic plug inside the socket.
It can also be used to protect the socket anchor's thread before installation, thereby preventing dirt from getting into the anchor's thread zone.

COVER SEALING CAP TP-02

The cover sealing cap is made of stainless steel. Its purpose is to protect the socket and give the concrete element a finished look.



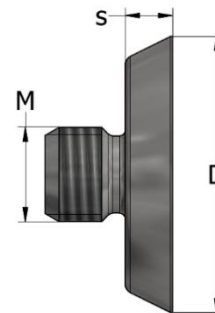
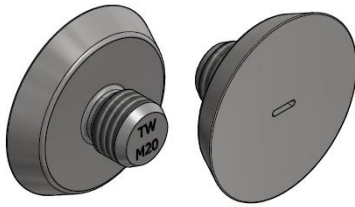
COVER SEALING CAP	Product no.	Thread	Diam. D	L	s
		M/Rd	[mm]	[mm]	[mm]
TP-02 - M/Rd12	61526	12	35	15	2
TP-02 - M/Rd16	61527	16	35	15	2
TP-02 - M/Rd20	61528	20	44	18	2
TP-02 - M/Rd24	61529	24	44	25	2
TP-02 - M/Rd30	61530	30	59	25	2
TP-02 - M/Rd36	61531	36	59	30	2



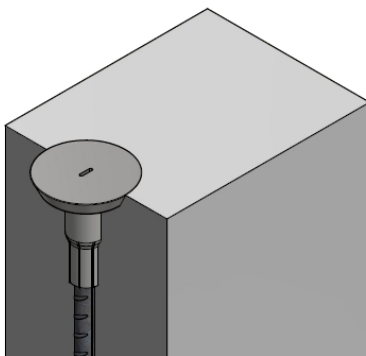
Mount the cap in the socket after removing the nailing plate.

COVER SEALING CAP TP-10

The cover sealing cap is made of stainless steel. Its purpose is to protect the socket and give the concrete element a finished look.



COVER SEALING CAP	Product no.	Thread	Diam. D	s
		M/Rd	[mm]	[mm]
TP-10 - M/Rd12	63115	12	45	10
TP-10 - M/Rd16	63116	16	45	10
TP-10 - M/Rd20	63117	20	58	10
TP-10 - M/Rd24	63118	24	58	10
TP-10 - M/Rd30	63119	30	72	10
TP-10 - M/Rd36	63120	36	72	10
TP-10 - M/Rd42	63121	42	94	12

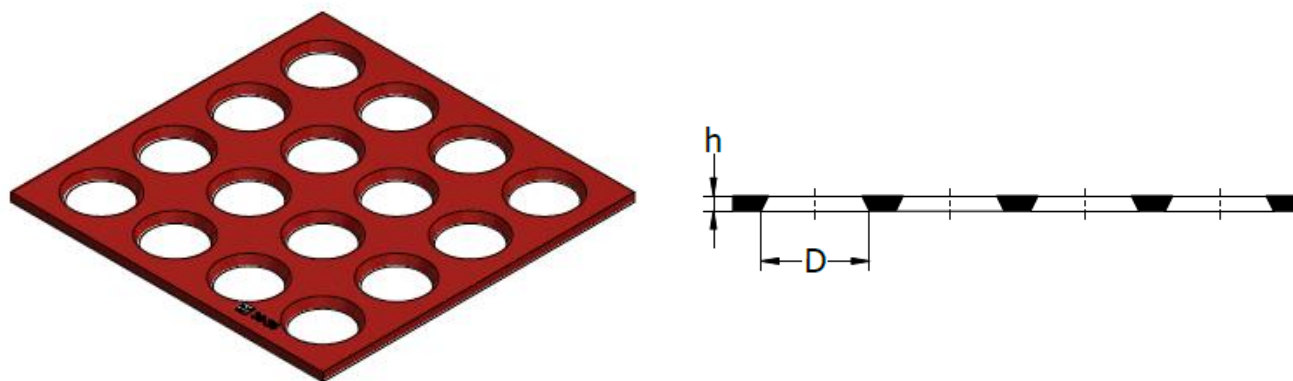


Mount the cap in the socket after removing the nailing plate.

KU CAP DIE

KU CAP DIE is a polyurethane mould used to produce concrete recess sealers. The recess made by the plastic nailing plates KU-10 in precast elements is covered with these concrete recess fillers. The mould KU CAP DIE is reusable. The concrete recess fillers cast with the same material as the main element ensure an aesthetic finish.

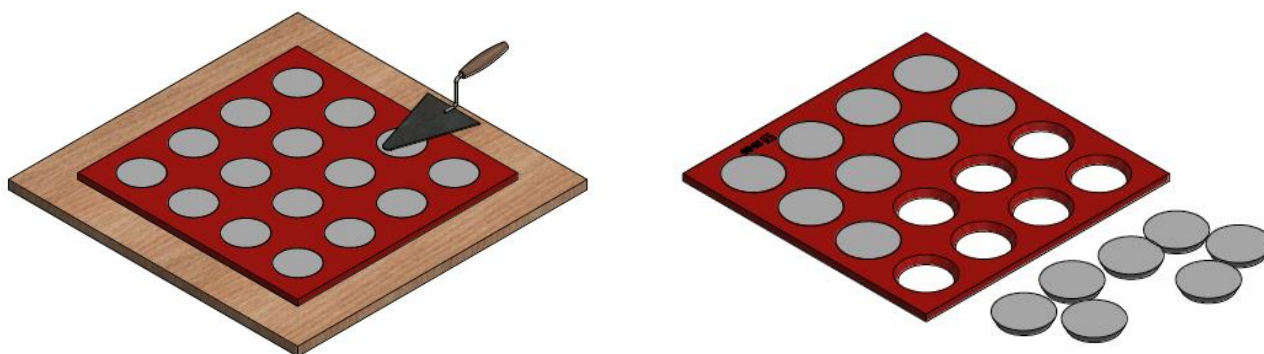
The recess fillers can have same colouring, material and textures as the precast concrete element. Each KU CAP DIE has a lifetime of approximately 100 uses. A releasing agent for concrete casting is recommended. It should provide a clean release and should not interfere with colour or surface detail.



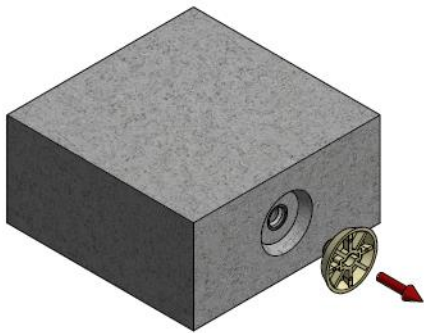
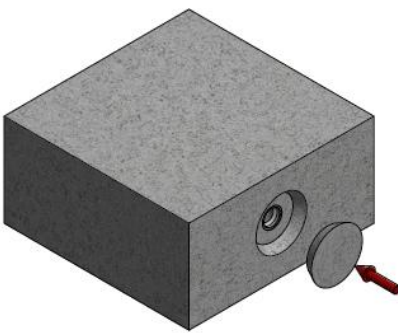
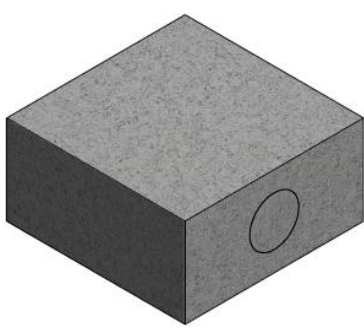
KU CAP DIE	Product number	For socket size	Diam.	h	Numbers of recess fillers
		M/Rd	[mm]	[mm]	pcs
KU CAP DIE M12-M16	63100	12 16	45	9	16
KU CAP DIE M20-M24	64150	20 24	58	9	16
KU CAP DIE M30-M36	63101	30 36	70	8	16
KU CAP DIE M42-M52	63103	42 52	94	10	9

To make recess fillers, the KU CAP DIE must be placed with the larger diameter facing down on the formwork and filled with concrete. Then, the concrete is levelled off with a trowel. After the concrete has hardened, the mould can be removed.





INSTALLING RECESS FILLERS

		
<p>1. Remove the nailing plate (KU or TPM)</p>	<p>2. Cover the recess with the concrete recess fillers made from the same material. For fixing the recess fillers, we recommend quick-set mortar. The moulds are reusable.</p>	

CONTACT



TERWA is the global supplier for precast and construction solutions with multiple offices around the world. With all our staff, partners and agents, we are happy to provide all construction and precast companies who work in the building industry with full service and 100% support.

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