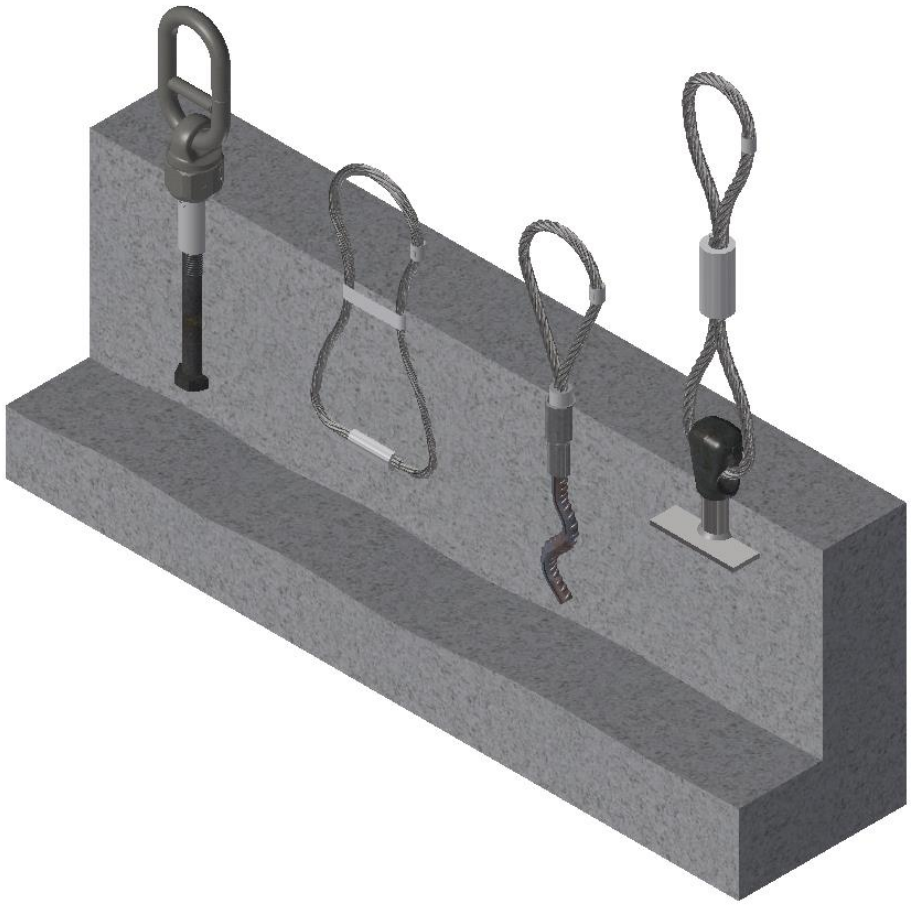
TECHNICAL DOCUMENTATION

LIFTING SYSTEMS | 1D THREADED LIFTING SYSTEM



EN – Original Instructions

OVERVIEW

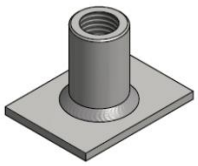
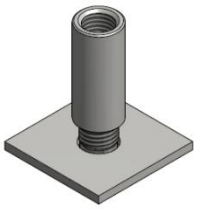
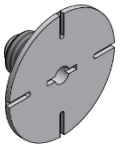
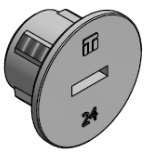
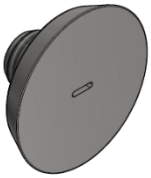
<table>
<tr><th colspan="5">LIFTING SYSTEMS</th></tr>
<tr><td>THL
 
Page 48</td><td>THS1
 
Page 50</td><td>THS3-HD
 
Page 53</td><td>TIL
 
Page 58</td><td>TBL
 
Page 61</td></tr>
<tr><th colspan="5">LIFTING AND TRANSPORT ANCHORS</th></tr>
<tr><td>TGK
 
Page 21</td><td>TGL
 
Page 24</td><td>TRL
 
Page 28</td><td>HBB
 
Page 32</td><td>HSB
 
Page 40</td></tr>
<tr><td colspan="2">HSB – with stopper
 
Page 41</td><td>HSR
 
Page 42</td><td>HSP
 
Page 44</td><td>HBP
 
Page 46</td></tr>
<tr><th colspan="5">FIXING ACCESSORIES</th></tr>
<tr><td>SN
 
Page 66</td><td>KU-10
 
Page 67</td><td>KU-02
 
Page 68</td><td>TPM
 
Page 69</td><td>TBP
 
Page 70</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>DATA CLIP
 
Page 71</td><td>TPP
 
Page 72</td><td>TP-02
 
Page 73</td><td>TP-10
 
Page 74</td><td>KU CAP DIE
 
Page 75</td></tr>
</table>

TABLE OF CONTENTS:

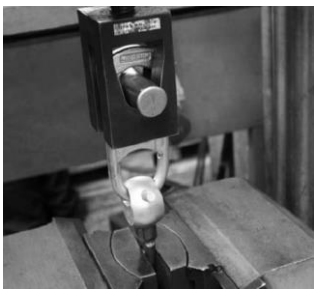
INTRODUCTION

Thread-lifting systems are used in the precast industry and are suitable for lifting, transport, and installation of precast concrete elements on site.
Some of the advantages of this system include:

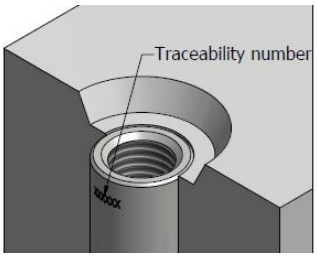
- a wide range of lifting sockets
- threaded lifting loops and cast-in lifting loops,
- capability of establishing a connection in a safe, simple manner
- most of the lifting systems can be re-used
- CE-certified system. All Terwa lifting systems have the CE marking which guarantees conformance with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

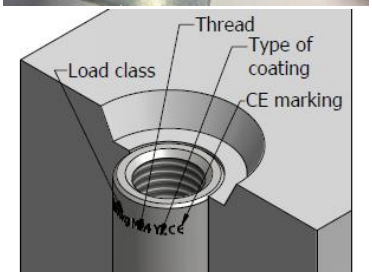
The threaded lifting system combines a lifting anchor embedded in a concrete unit and a lifting device.
The design for Terwa threaded lifting anchors and technical instructions comply with the national German guideline VDI/BV-BS6205 “Lifting inserts and lifting insert for precast concrete elements”. Based on this guideline, the manufacturer must also ensure that the lifting systems have sufficient strength to prevent concrete failure.
A failure of lifting anchors and lifting anchor devices can endanger human lives as well as can lead to significant damage. Therefore, lifting anchors and lifting devices are high-quality products, carefully selected and designed for the intended applications and used by qualified personnel in accordance with the 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.

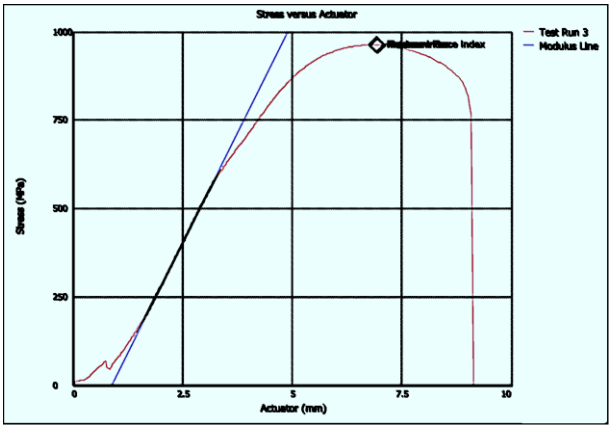


Marking and traceability
All anchors and lifting clutches have the CE marking and all data necessary for traceability, thread type and load class.





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



Application of lifting anchor system

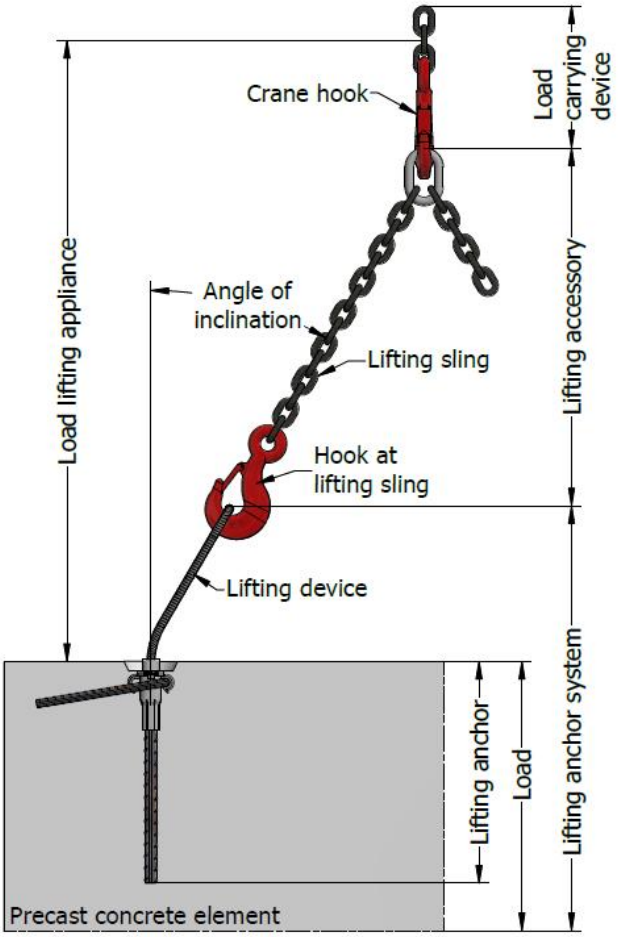
Load carrying devices - are equipment that is permanently connected to the hoist for attaching lifting devices, lifting accessory or loads.

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

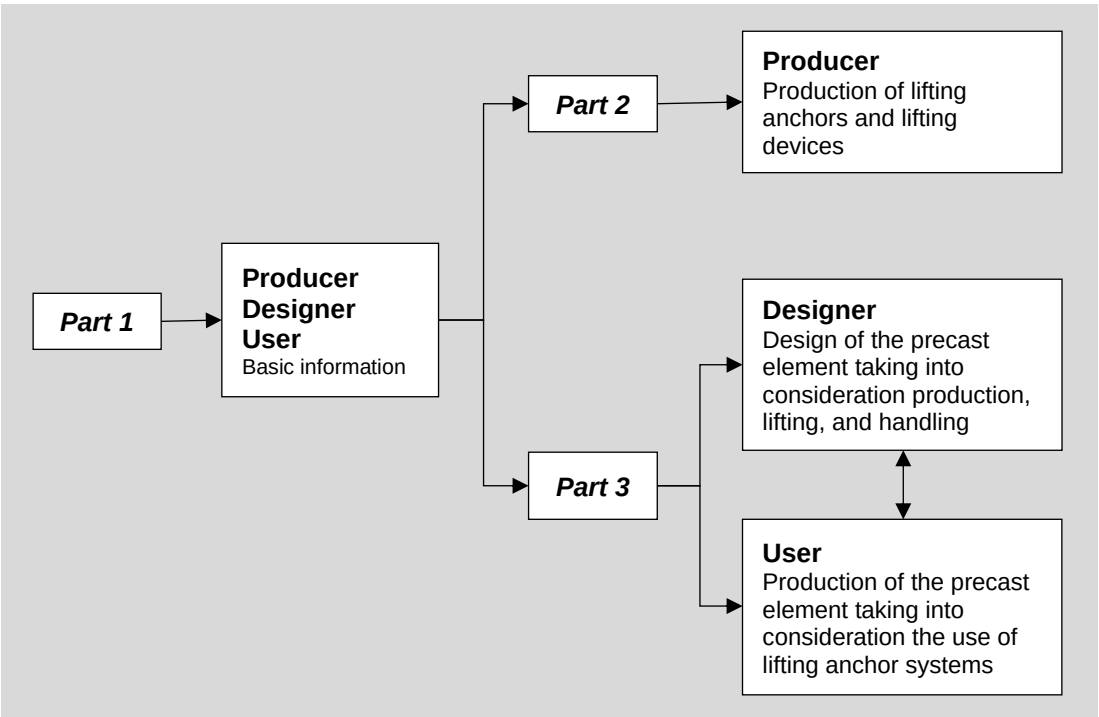
Lifting device (lifting key) – equipment that connects the loads to the load carrying device by means of lifting accessories.

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 hEN. 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

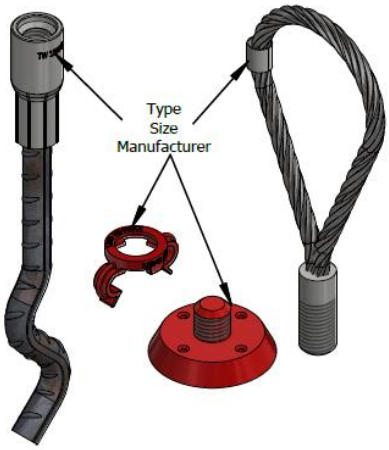
LIFTING SYSTEMS

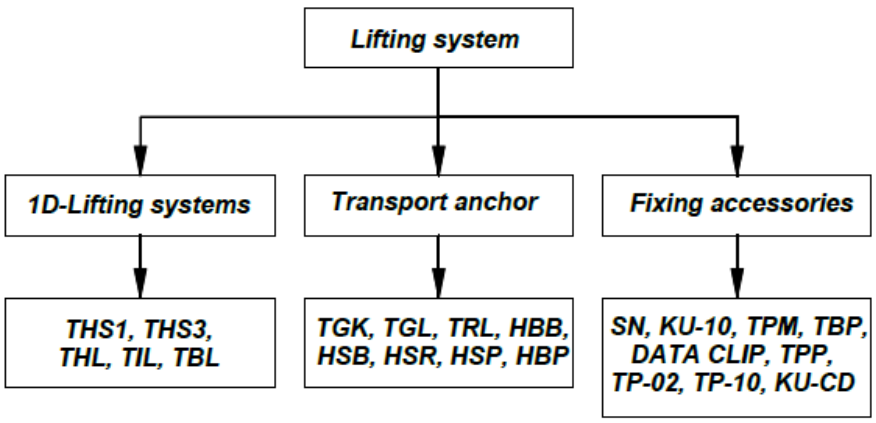
- **REUSABLE THREADED LIFTING SYSTEM**
  Terwa offers various types of threaded lifting keys suitable for lifting, transport, and installation of precast concrete elements.

- **CAST-IN LIFTING SYSTEM**
  Steel wire loops swaged into a ferrule without an additional tail which can be used in combination with a standard crane hook. Can be cut off after use.

- **TRANSPORT ANCHORS**
  Various anchors made from a socket swaged onto wavy reinforcement steel, plain socket lifting inserts, sockets welded to a plate and anchors made from a socket swaged to a standard bolt for thin units.

- **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:

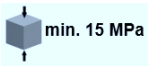
- 1D threaded lifting system
- 2D strip anchor lifting system
- 3D T-slot anchor lifting system

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.
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 ψ_{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 γ **= 2.5**
The safety concept requires that the action E does not exceed the admissible value for the resistance R_{adm}:

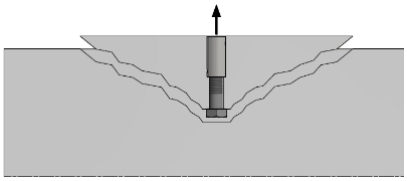
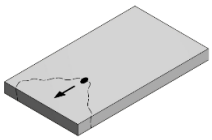
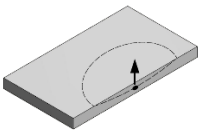
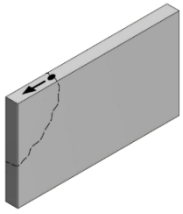
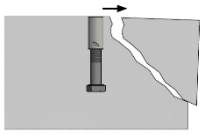
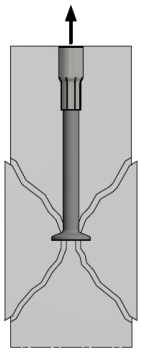
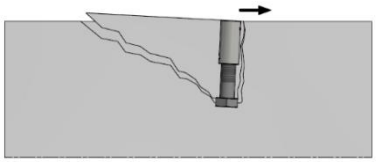
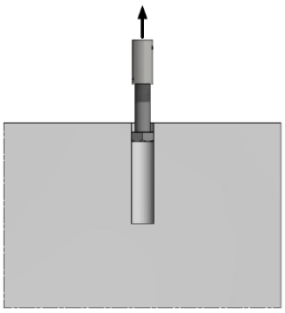
$E \leq R_{adm}$ Where: E - action, R_{adm} - admissible load (resistance)

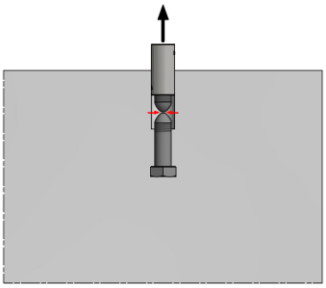
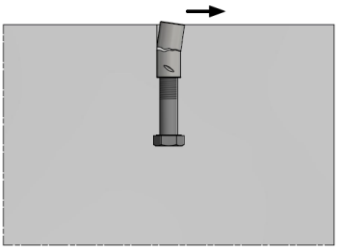
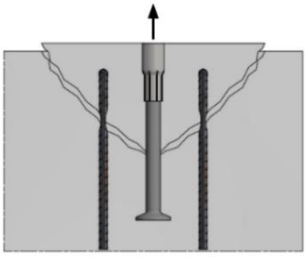
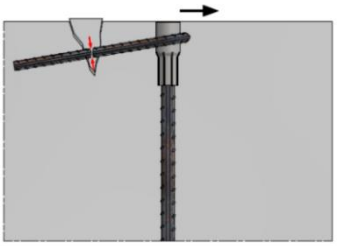
The admissible load (resistance) of lifting anchor and lifting device is obtained as follows:

$R_{adm} = \frac{Rk}{\gamma}$ Where: R_k - characteristic resistance of the anchoring of a lifting anchor or lifting device, γ - 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		

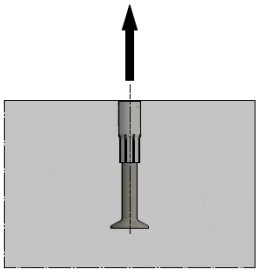
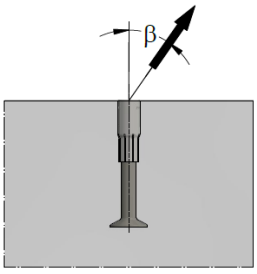
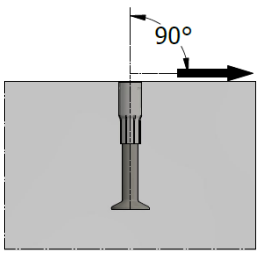
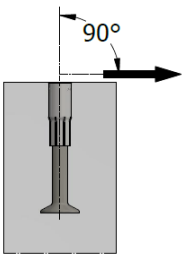
DIMENSIONING OF LIFTING ANCHOR SYSTEM

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 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.	

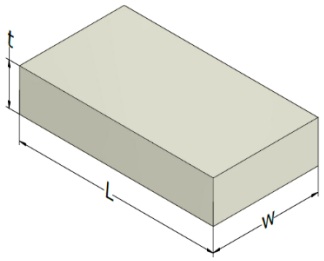
LOAD CAPACITY

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

- The total weight 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: **ρ = 25kN/m³.** For prefabricated elements composed of reinforcing elements with a higher concentration, this will be taken into consideration when calculating the weight.



$$F_G = \rho \times V$$

$$V = L \times w \times t$$

Where:
V - volume of precast unit in [m³]
L – length in [m]
w – width in [m]
t – 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:

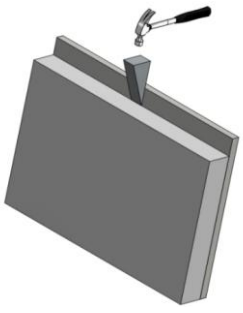
$$F_{adh} = q_{adh} \times A_f \; [kN]$$

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/m²
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.

Increased adhesion to the formwork	
π - panels	$F_{adh} = 2 \times F_G \; [kN]$
Ribbed elements	$F_{adh} = 3 \times F_G \; [kN]$
Waffled panel	$F_{adh} = 4 \times F_G \; [kN]$



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.

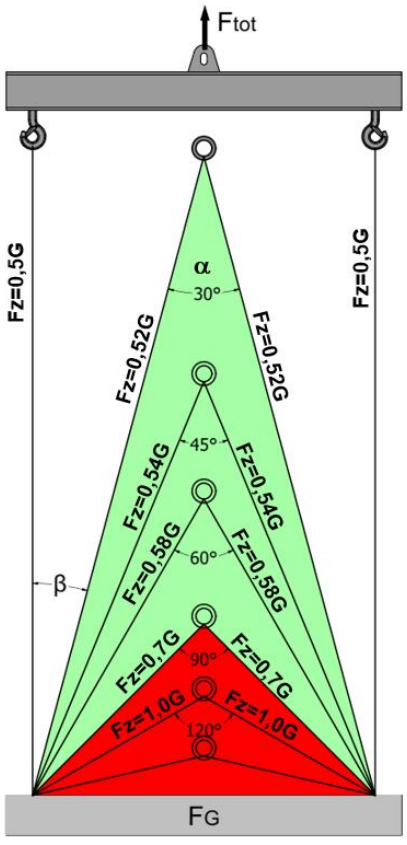
LIFTING OF PRECAST CONCRETE ELEMENT UNDER COMBINED TENSION AND SHEAR LOADING

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 $\beta \leq 30^o$. The tensile force on the anchor will be increased by a cable angle coefficient "**z**".

z = 1/cosβ

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

Where:
z - cable angle coefficient
n - number of load-bearing anchors



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

*** Preferred options ß ≤ 30°**

Note: If no lifting beam is used during transport, the anchor must be installed symmetrical to the load's centre of gravity.
To prevent the prefabricated elements from hanging at an angle when they are moved, the hook in lifting beam must be directly above the centre of gravity.

ASYMMETRIC DISTRIBUTION OF THE LOAD

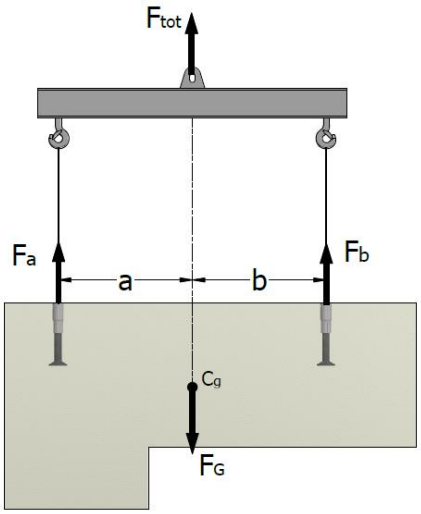
For asymmetrical elements, calculate the loads based on the centre of gravity before installing the anchors.
The load of each anchor depends on the embedded position of the anchor in the precast unit and on the transport mode:

a) 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:

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

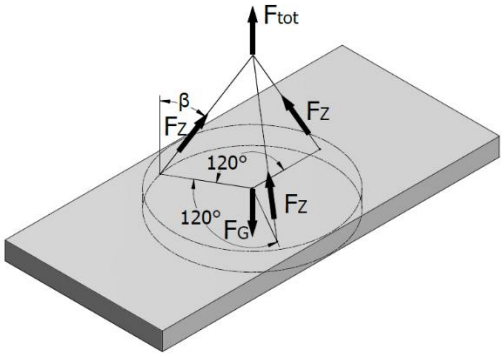
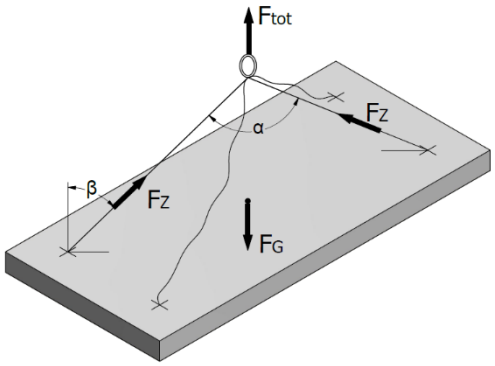
$$F_b = F_{tot} \times \mathbf{a}/(\mathbf{a}+\mathbf{b})$$

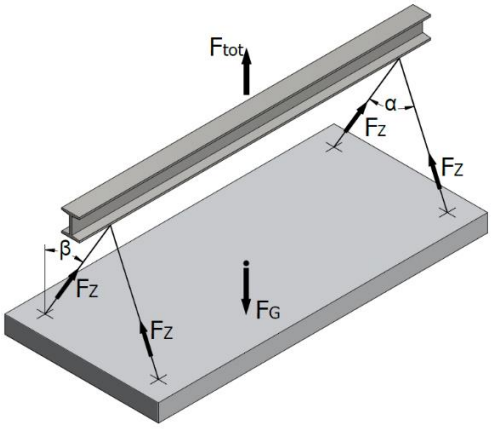
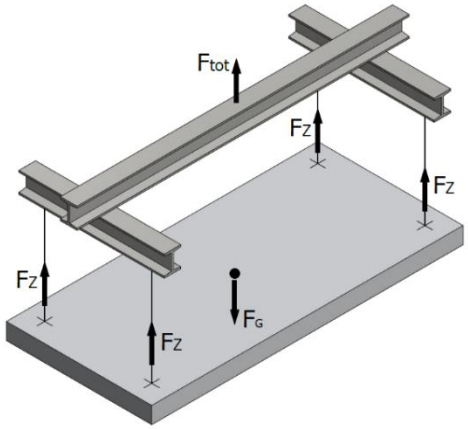
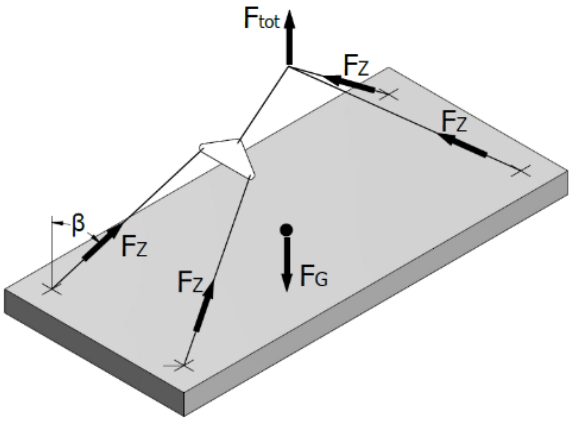
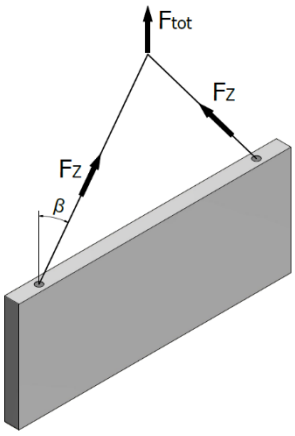
Note: To avoid tilting the element during transport, the load should be suspended from the lifting beam in such a way that its centre of gravity (Cg) is directly under the crane hook.

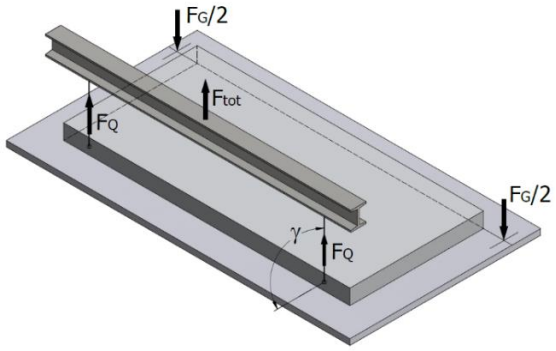
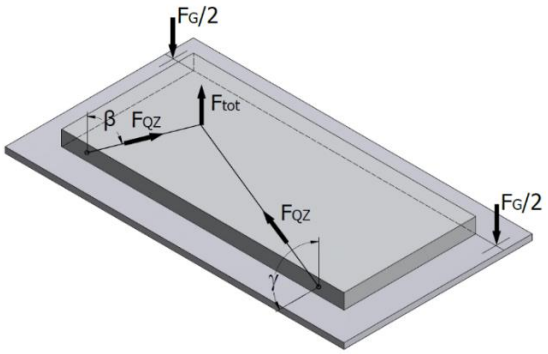


b) For transporting without a lifting beam, the load on the anchor depends on the cable angle (ß).

ANCHORS LIFTING CONDITIONS

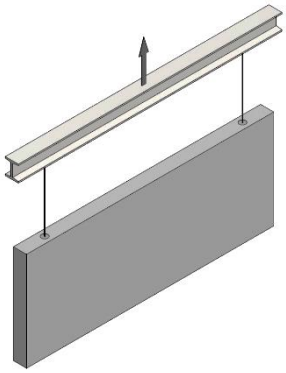
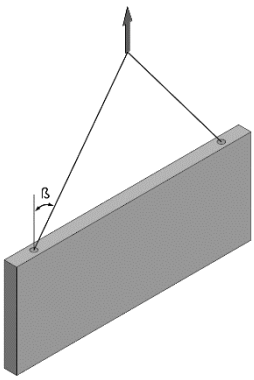
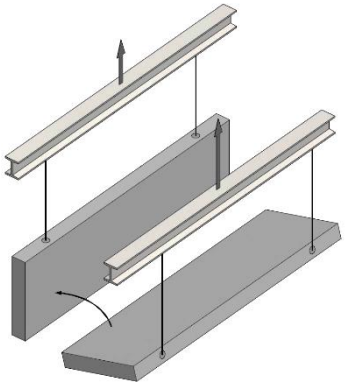
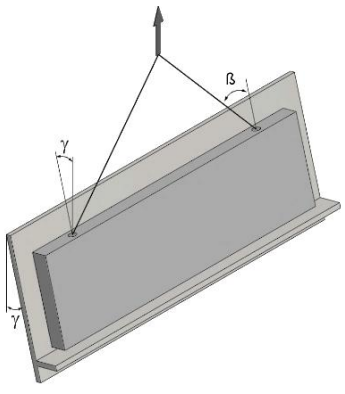
Using three anchors spaced the same distance apart from each other as in the figure, three load bearing anchors can be assumed. Load bearing anchors: **n=3** **Load type – lifting of formwork** -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor **Load type – transport** -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor	
Using four anchors lifted without a spreader beam, only two load bearing anchors can be assumed. The load distribution is randomly based Load bearing anchors: **n=2** **Load type – lifting of formwork** -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor **Load type – transport** -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor	

Perfect force distribution is assumed using a spreader beam Load bearing anchors: **n=4** **Load type – lifting of formwork** -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor **Load type – transport** -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor	
Perfect static weight distribution can be obtained using a lifting beam and two pairs of anchors symmetrically placed. Load bearing anchors: **n=4** **Load type – lifting of formwork** -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor **Load type – transport** -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor	
The compensating lifting slings ensure equal force distribution. Load bearing anchors: **n=4** **Load type – lifting of formwork** -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor **Load type – transport** -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor	
Lifting of wall elements parallel to the axis of concrete element Load bearing anchors: **n=2** **Load type – transport** -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor	

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. Load bearing anchors: **n=2** **Load type – lifting of formwork** -shear pull factor $z = 1$ -formwork adhesion -no dynamic factor **Load type – transport** -shear pull factor $z = 1$ -no formwork adhesion -dynamic factor	
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. ***ß ≤ 30°*** Load bearing anchors: **n=2** **Load type – lifting of formwork** -shear pull factor $z \geq 1$ -formwork adhesion -no dynamic factor **Load type – transport** -shear pull factor $z \geq 1$ -no formwork adhesion -dynamic factor	

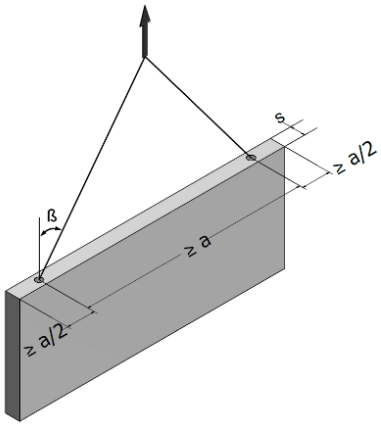
LOAD DIRECTIONS

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.

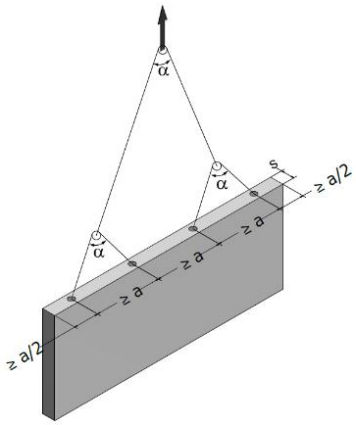
Axial load **ß = 0° to 10°** 	Diagonal load **ß = 10° to 45°** *Note:* ***ß ≤ 30°*** *is recommended* 
Tilting **g = 90°** ***Additional shear reinforcement steel must be used.*** 	When a tilting table is used, the anchors can be used without additional shear reinforcement steel, not to angle ***g < 15°*** 

POSITIONING THE ANCHORS IN WALLS

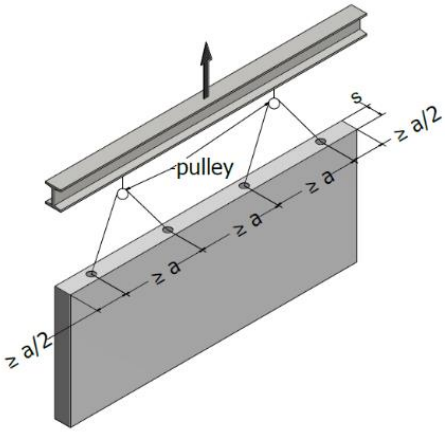
Load bearing anchors:
n=2

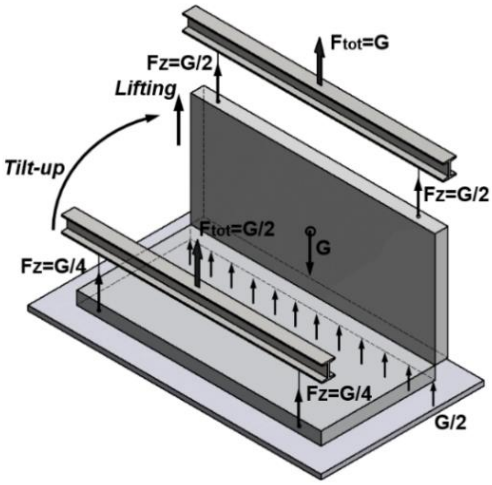


Load bearing anchors:
n=4



Load bearing anchors: **n=4**

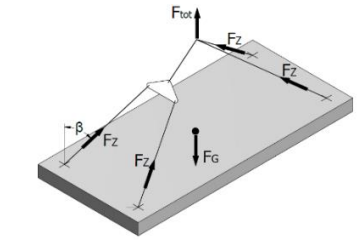
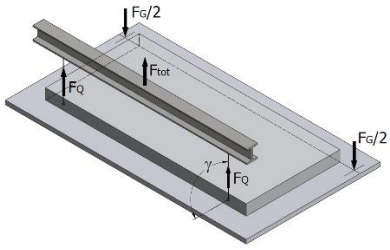
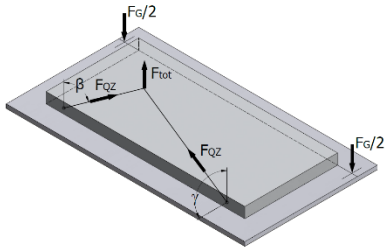
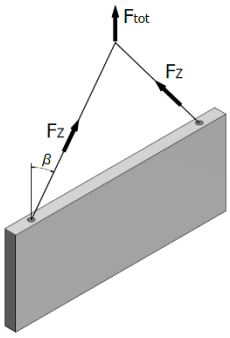




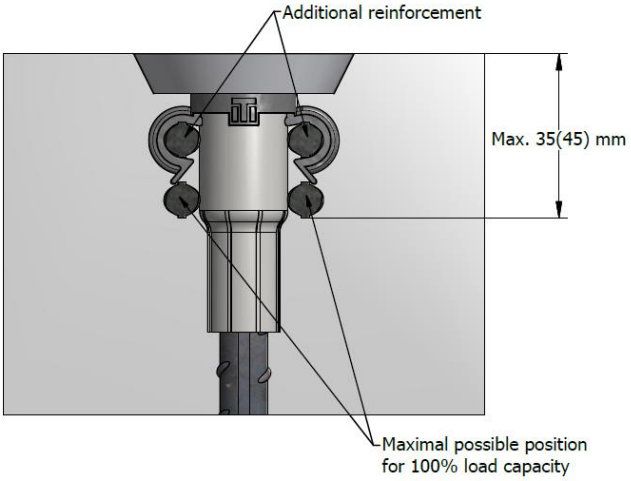
Lifting the walls from horizontal to vertical position without tilt-up table.

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

DETERMINATION OF ANCHOR LOAD

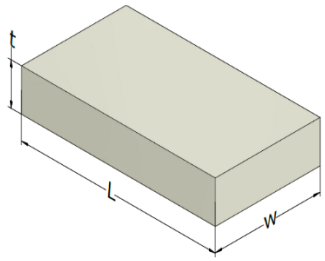
Load type		Calculation	Verification
Lifting with formwork adhesion		$F_Z = \frac{(F_G + F_{adh}) \times z}{n}$ F_Z – Load acting on the lifting anchor in kN	$F_Z \leq N_{R,adm}$ $N_{R,adm}$ – admissible normal load
Erecting		$F_Q = \frac{(F_G/2) \times \psi_{dyn}}{n}$ F_Q – Shear load acting on the lifting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

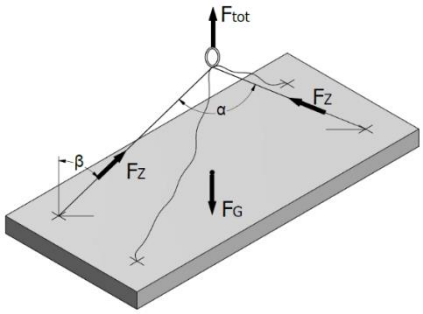
INSTALLATION TOLERANCES FOR ALL TERWA LIFTING SOCKET ANCHORS



CALCULATION EXAMPLE

Example 1: SLAB UNIT





The slab unit has the following dimensions:
$\boldsymbol{L = 5\ m}$
$\boldsymbol{w = 2\ m}$
$\boldsymbol{t = 0.2\ m}$

Weight $\boldsymbol{F_G = \rho \times V = 25 \times (5 \times 2 \times 0.2) = 50kN}$
Formwork area $\boldsymbol{A_f = L \times w = 5 \times 2 = 10\ m^2}$
Load-bearing anchor $\boldsymbol{n = 2}$

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 [m²]	A_f	10		
Cable angle factor at de-mould (β = 15.0°)	z	1.04	1.04	
Cable angle factor on site (β = 30.0°)	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/m²]	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 kN/m²
Cable angle factor: z = 1.04 (β = 15.0°)
Concrete strength: 15 MPa

$$\boldsymbol{F_Z = \frac{[(F_G + q_{adh} \times A_f) \times z]}{n} = \frac{[(50 + 2 \times 10) \times 1.04]}{2} = 36.4\ kN = 3.64\ t}$$

TRANSPORT AT THE PLANT:

Dynamic coefficient: Ψ_{dyn} = 1.3
Cable angle factor: z = 1.04 (β = 15.0°)
Concrete strength: 15 MPa

$$\boldsymbol{F_Z = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{50 \times 1.3 \times 1.04}{2} = 33.80\ kN = 3.38\ t}$$

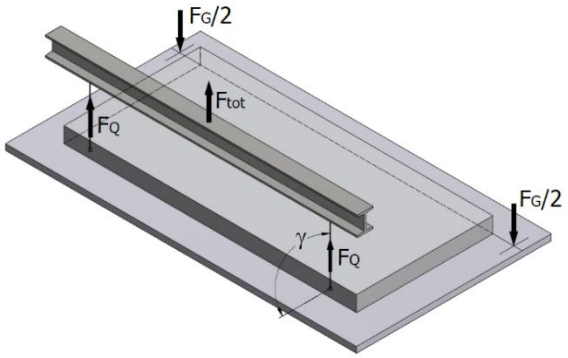
TRANSPORT ON SITE:

Dynamic coefficient: Ψ_{dyn} = 1.3
Cable angle factor: z = 1.16 (β = 30.0°)
Concrete strength: 35 MPa

$$\boldsymbol{F_Z = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{50 \times 1.3 \times 1.16}{2} = 37.70\ kN = 3.77\ t}$$

An anchor in the 4 **t** range is required.

Example 2: WALL PANEL



The slab unit has the following dimensions:
$\boldsymbol{L = 7.5\ m}$
$\boldsymbol{w = 2\ m}$
$\boldsymbol{t = 0.2\ m}$

Weight $\boldsymbol{F_G = \rho \times V = 25 \times (7.5 \times 2 \times 0.2) = 75kN}$
Formwork area $\boldsymbol{A_f = L \times w = 7.5 \times 2 = 15\ m^2}$
Anchor number $\boldsymbol{n = 2}$

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	75		
Element area in contact with formwork [m²]	A_f	15		
Cable angle factor at de-mould (β = 0.0°)	z	1.0		
Cable angle factor at tilting (β = 0.0°)	z		1.0	
Cable angle factor on site (β = 30°)	z			1.16
Dynamic coefficient at 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 kN/m²
Cable angle factor: z = 1 (β = 0°)
Concrete strength: 15 MPa

$$\boldsymbol{F_Q = \frac{[(F_G/2 + q_{adh} \times A_f) \times z]}{n} = \frac{[(75/2 + 1 \times 15) \times 1]}{2} = 26.25\ kN = 2.63\ t}$$

TRANSPORT AT THE PLANT:

Dynamic coefficient: ψ_{dyn} = 1.3
Cable angle factor: z = 1 (β = 0°)
Concrete strength: 15 MPa

$$\boldsymbol{F_Q = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{75 \times 1.3 \times 1}{2} = 48.75\ kN = 4.88\ t}$$

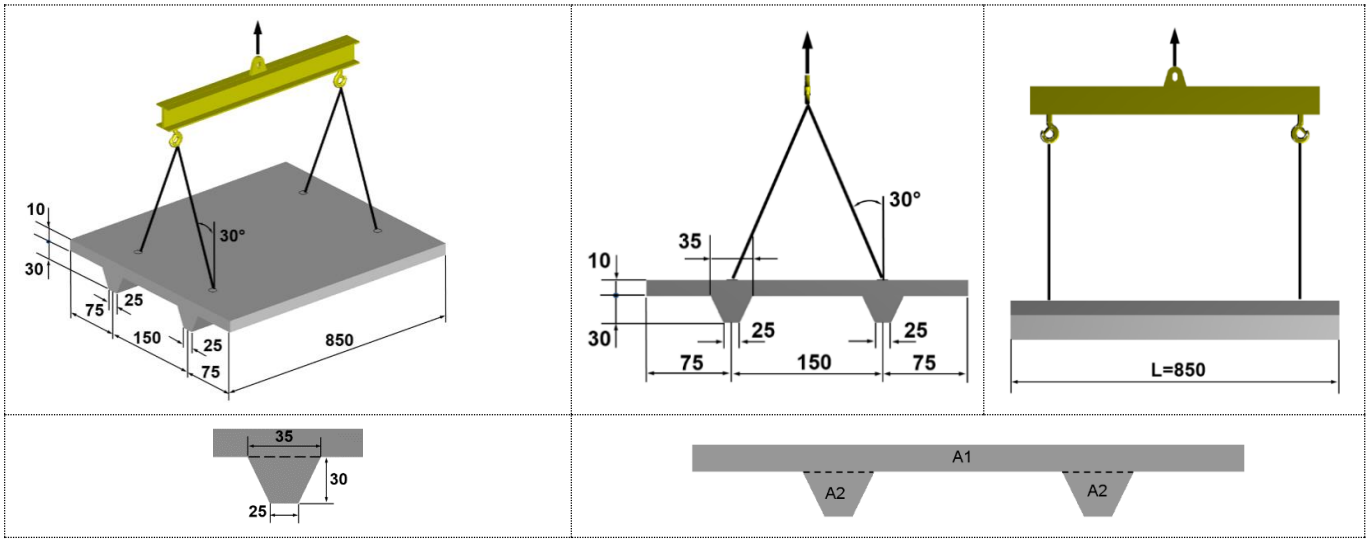
TRANSPORT ON SITE:

Dynamic coefficient: ψ_{dyn} = 1.3
Cable angle factor: z = 1.16 (β = 30.0°)
Concrete strength: 35 MPa

$$\boldsymbol{F_Q = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{75 \times 1.3 \times 1.16}{2} = 56.55\ kN = 5.66\ t}$$

For embedding on the lateral side, two anchors in the 6.3 t 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 [m²]	A_f	35.8	
Cable angle factor at de-mould (ß = 30.0°)	z	1.16	
Cable angle factor on site (ß = 30.0°)	z		1.16
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 (ß = 30.0°)
Dynamic coefficient	ψ_{dyn} = 1.3
Anchor number	n = 4

$F_G = V \times \rho = (A \times L) \times \rho = (A1 + A2 \times 2) \times L \times \rho = (0.1 \times 3 + 0.09 \times 2) \times 8.5 \times 25 = 102\ kN$
$L = 8.5\ m$
$A1 = 0.1 \times 3\ (m^2)$
$A2 = \frac{[(0.35 + 0.25) \times 0.3]}{2} = \frac{(0.6 \times 0.3)}{2} = 0.09\ (m^2)$

Weight:	$F_G = 102\ kN$
Adhesion to mould	$F_{adh} = 2 \times F_G = 204\ kN$
Total load	$F_{tot} = F_G + F_{adh} = 102 + 204 = 306\ kN$

LOAD PER ANCHOR WHEN DE-MOULD:

$$\boldsymbol{F = \frac{F_{tot} \times z}{n} = \frac{[(F_G + F_{adh}) \times z]}{n} = \frac{306 \times 1.16}{4} = 88.74\ kN = 8.87\ t}$$

LOAD PER ANCHOR WHEN TRANSPORTING:

$$\boldsymbol{F = \frac{F_{tot} \times \psi_{dyn} \times z}{n} = \frac{F_G \times \psi_{dyn} \times z}{n} = \frac{102 \times 1.3 \times 1.16}{4} = 38.46\ kN = 3.85\ t}$$

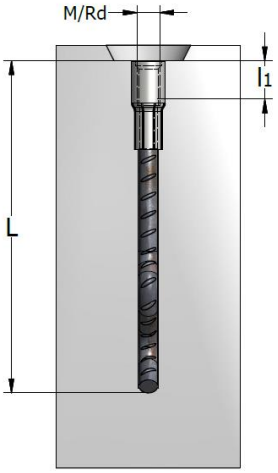
Four anchors in the 10 t range are required (> 8.87 t)

LIFTING SOCKET ANCHORS

LIFTING SOCKET - WAVED END REINFORCING STEEL

Waved lifting sockets are used for lifting moderately thick precast elements. The waved shape provides good force transfer into the concrete. These lifting sockets consist of a steel bush made of S355, stainless steel SS2 or SS4, swaged to a wavy reinforcing bar. The threaded bushes are made with metric thread (M) or round thread (Rd) zinc plated. These lifting sockets are always the preferred option. They ensure the necessary length and edge distance. The preferred lift angle is ß ≤30°.

LIFTING SOCKET – SHORT WAVED END REINFORCING STEEL – TGK



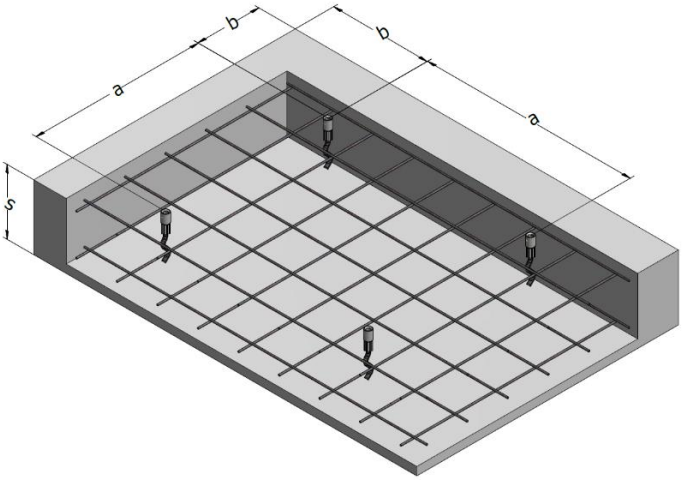
TGK-M	Product number			Load group f_{cu}> 15 MPa	Thread	Bar diam.	Overall length L	l_1
	Zinc galvanizing	Stainless steel SS4	Stainless steel SS2	[t]	M	[mm]	[mm]	[mm]
TGK-M12-108	45248	48463	48464	0.5	12	8	108	22
TGK-M16-167	45249	48465	48466	1.2	16	12	167	30
TGK-M20-187	45250	48467	48468	2.0	20	14	187	35
TGK-M24-240	45251	48469	48470	2.5	24	16	240	41
TGK-M30-300	45252	48471	48472	4.0	30	20	300	55
TGK-M36-380	45850	48473	48474	6.3	36	25	380	65
TGK-M42-450	45254	48475	48476	8.0	42	28	450	70

TGK-Rd	Product number			Load group f_{cu}> 15 MPa	Thread	Bar diam.	Overall length L	l_1
	Zinc galvanizing	Stainless steel SS4	Stainless steel SS2	[t]	Rd	[mm]	[mm]	[mm]
TGK-Rd12-108	45771	48441	48442	0.5	12	8	108	22
TGK-Rd16-167	45772	48443	48444	1.2	16	12	167	30
TGK-Rd20-187	45785	48445	48446	2.0	20	14	187	35
TGK-Rd24-240	45774	48447	48448	2.5	24	16	240	41
TGK-Rd24-360	46537	48453	48454	2.5	24	16	360	41
TGK-Rd30-300	45775	48452	48451	4.0	30	20	300	55
TGK-Rd30-420	45259	48449	48450	4.0	30	20	420	55
TGK-Rd36-380	45776	48455	48456	6.3	36	25	380	65
TGK-Rd42-450	45750	48457	48458	8.0	42	28	450	70
TGK-Rd42-500	45979	48459	48460	8.0	42	28	500	70

LIFTING AND TRANSPORT – TGK ANCHORS

Edge distance and spacing for lifting sockets.

TGK-M(Rd)	s minimum [mm]	a minimum [mm]	b minimum [mm]
M(Rd)12-108	130	200	100
M(Rd)16-167	190	260	130
M(Rd)20-187	210	350	170
M(Rd)24-240	265	440	220
M(Rd)30-300	325	550	275
M(Rd)36-380	405	600	300
M(Rd)42-450	475	800	400

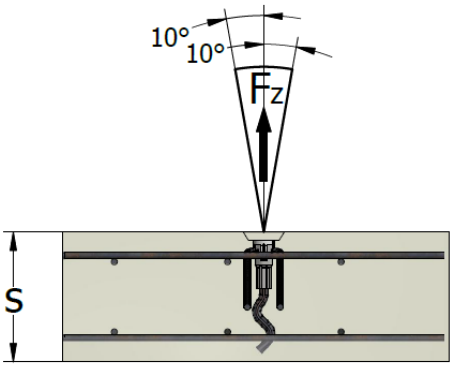


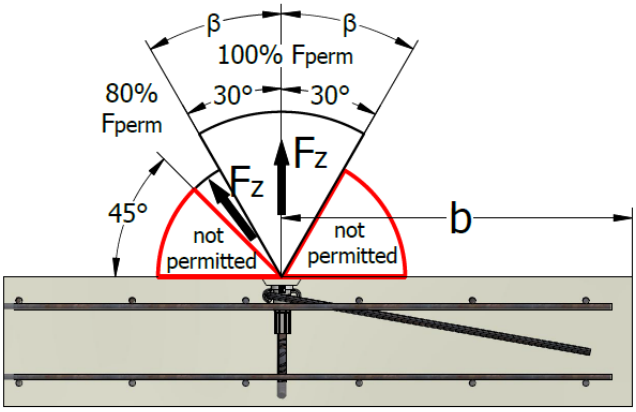
The TGK anchors are used for lifting flat elements such as floor slabs. The lifting angle must be ≤ 45°. For a lifting angle between 10° and 45°, additional reinforcement is required.

TGK-M(Rd)	Load group f_{cu}> 15 MPa [t]	Thread M(Rd)	Overall length [mm]	Element thickness [mm]	Axial load and diagonal load ≤ 45° f_{cu}> 25 MPa [kN]
TGK-M(Rd)12-108	0.5	12	108	130	5
TGK-M(Rd)16-167	1.2	16	167	190	12
TGK-M(Rd)20-187	2.0	20	187	210	20
TGK-M(Rd)24-240	2.5	24	240	265	25
TGK-M(Rd)30-300	4.0	30	300	325	40
TGK -M(Rd)36-380	6.3	36	380	405	63
TGK -M(Rd)42-450	8.0	42	450	475	80

TGK-M(Rd) short	Thread	Two layers of mesh	Diagonal reinforcement		
			Rebar diameter	L	Length before bending
	M(Rd)	mm²/m	[mm]	[mm]	[mm]
TGK –M(Rd)12-108	12	2 x 188	Ø 6	150	310
TGK –M(Rd)16-167	16	2 x 188	Ø 8	200	420
TGK –M(Rd)20-187	20	2 x 188	Ø 8	300	620
TGK –M(Rd)24-240	24	2 x 188	Ø 10	300	620
TGK –M(Rd)30-300	30	2 x 188	Ø 12	400	820
TGK -M(Rd)36-380	36	2 x 188	Ø 14	550	1120
TGK -M(Rd)42-450	42	2 x 188	Ø 16	600	1230

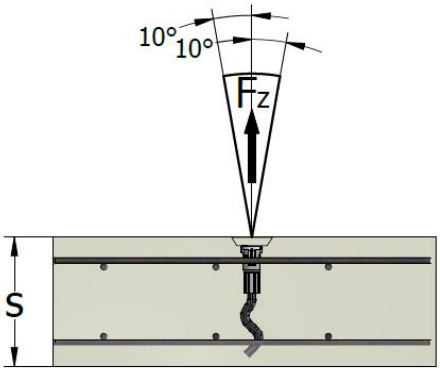
Note:
- The bend diameter D according to EN 1992-1-1 is not mandatory.
- There must be two layers of mesh reinforcement.
- Diagonal reinforcement must be placed in direct contact with the socket anchor.
- Always install diagonal reinforcement opposite the load direction.

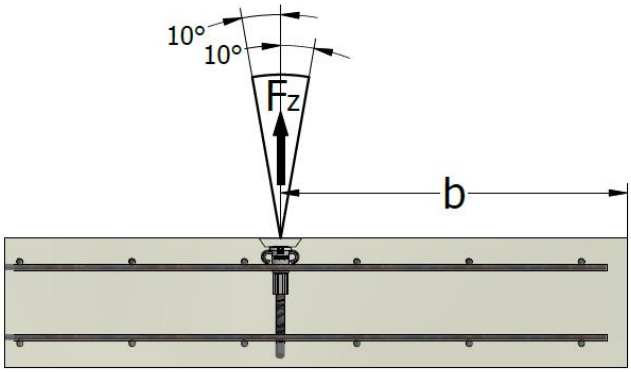




Note:

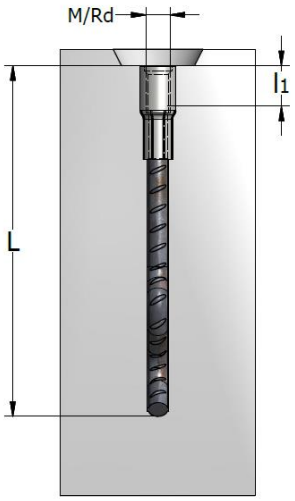
- The bend diameter D according to EN 1992-1-1 is not mandatory.
- There must be two layers of mesh reinforcement.
- Diagonal reinforcement must be placed in direct contact with the socket anchor.
- Always install diagonal reinforcement opposite the load direction.
- The dimensions in the illustrations are in [mm].





LIFTING SOCKET – LONG WAVED END REINFORCING STEEL – TGL

Long waved lifting sockets are used for lifting all types of precast concrete elements, especially for erecting thin panels. They are also well-suited for lifting thin, low-grade reinforcement panels.



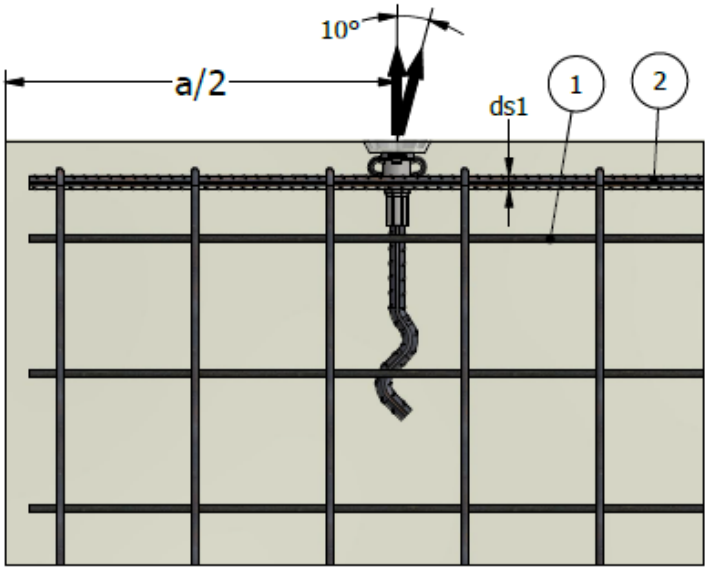
TGL-M	Product number			Load group f_{cu}> 15 MPa	Thread	Bar diam.	Overall length L	l_1
	Zinc galvanizing	Stainless steel SS4	Stainless steel SS2	[t]	M	[mm]	[mm]	[mm]
TGL-M12-137	45696	48477	48478	0.5	12	8	137	22
TGL-M16-216	45697	48480	48481	1.2	16	12	216	30
TGL-M20-257	45787	48482	48483	2.0	20	14	257	35
TGL-M24-360	45699	48486	48487	2.5	24	16	360	41
TGL-M24-1000	45701	48488	48489	2.5	24	16	1000	41
TGL-M30-450	45700	48484	48485	4.0	30	20	450	55
TGL-M36-570	45788	48490	48491	6.3	36	25	570	65
TGL-M42-620	45789	48492	48493	8.0	42	28	620	70

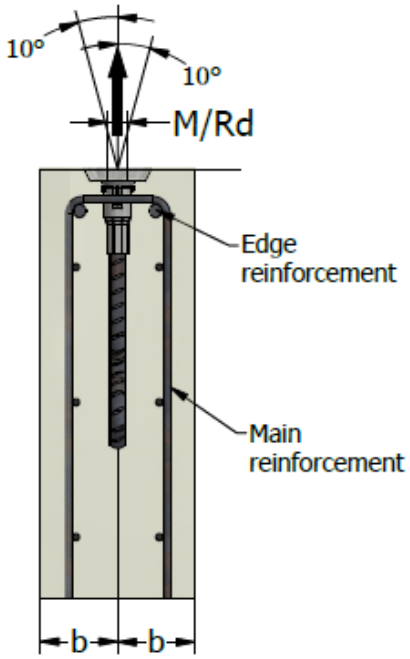
TGL-Rd	Product number			Load group f_{cu}> 15 MPa	Thread	Bar diam.	Overall length L	l_1
	Zinc galvanizing	Stainless steel SS4	Stainless steel SS2	[t]	Rd	[mm]	[mm]	[mm]
TGL-Rd12-137	45778	48496	48497	0.5	12	8	137	22
TGL-Rd16-216	45779	48494	48495	1.2	16	12	216	30
TGL-Rd20-257	45780	48498	48499	2.0	20	14	257	35
TGL-Rd24-360	45781	48500	48501	2.5	24	16	360	41
TGL-Rd24-1000	45980	48502	48503	2.5	24	16	1000	41
TGL-Rd30-450	45782	48504	48505	4.0	30	20	450	55
TGL-Rd36-570	45783	48506	48507	6.3	36	25	570	65
TGL-Rd36-900	46071	48508	48509	6.3	36	25	900	65
TGL-Rd42-620	45784	48510	48511	8.0	42	28	620	70

LIFTING SOCKETS TGL ANCHOR – INSTALLATION AND REINFORCEMENTS

REINFORCEMENT AND LOAD CAPACITY – AXIAL LOAD UP TO 10°

- **No diagonal reinforcement is required**
- **100% load capacity**

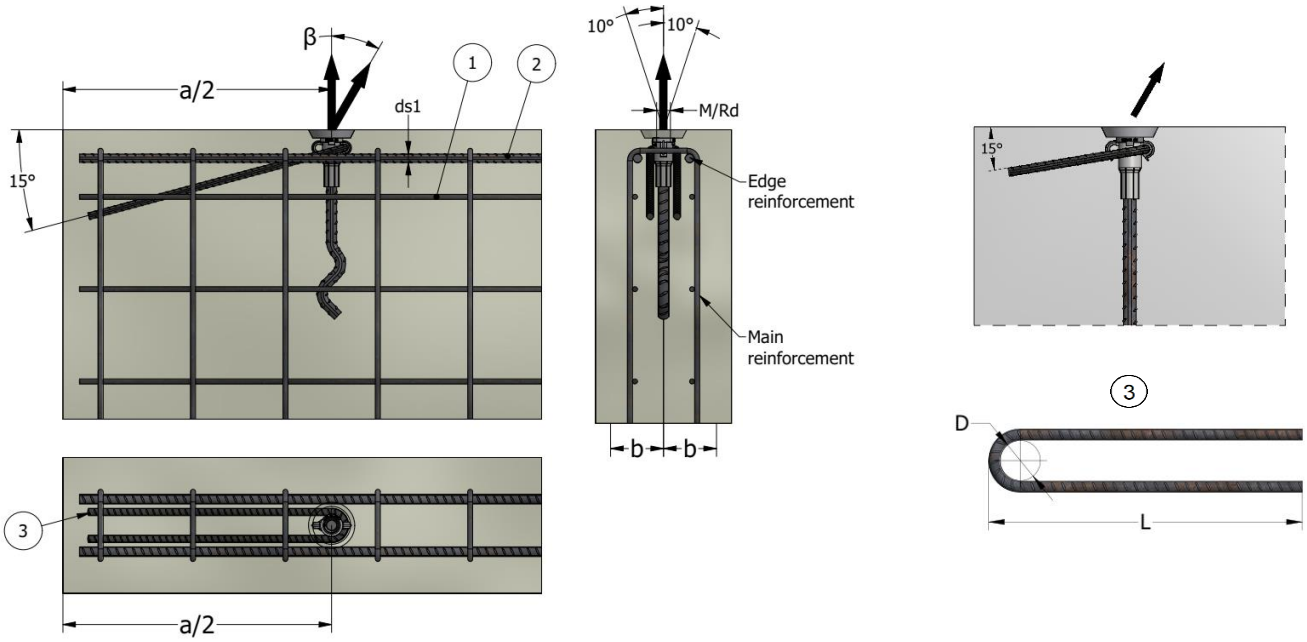




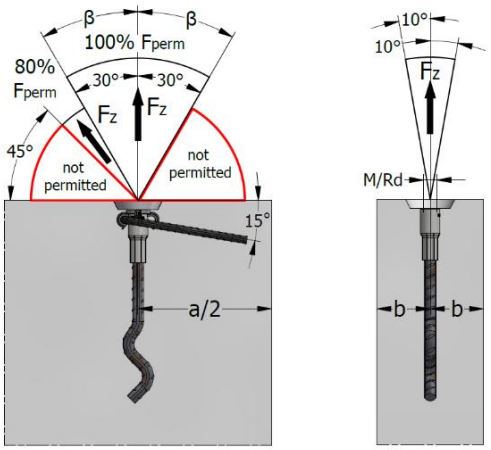
TGL-M(Rd)	Load group	Minimum unit thickness	Minimum axial spacing	Mesh reinforcement ①	Edge reinforcement ②	Load capacity	
		2 x b	a		d_{s1}	f_{cu}> 15 MPa	f_{cu}> 25 MPa
	[t]	[mm]	[mm]	[mm²/m]	[mm]	[kN]	[kN]
M(Rd)12-137	0.5	60	300	1 x 188	Ø8	5.0	5.0
M(Rd)16-216	1.2	80	400	2 x 131	2 x Ø8	12.0	12.0
M(Rd)20-257	2.0	100	550	2 x 188	2 x Ø10	16.9	20.0
M(Rd)24-360	2.5	100	600	2 x 188	2 x Ø12	25.0	25.0
M(Rd)30-450	4.0	120	700	2 x 188	2 x Ø12	31.4	40.0
M(Rd)36-570	6.3	130	1000	2 x 188	2 x Ø12	51.3	63.0
M(Rd)42-620	8.0	140	1000	2 x 188	2 x Ø14	67.0	80.0

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**



TGL-M(Rd)	Load group	Minimum unit thickness	Minimum axial spacing	Mesh reinforcement (1)	Edge reinforcement (2)	Diagonal reinforcement β > 30° max. 45° (3)			Load capacity for lifting loop application		Load capacity for lifting THS application
		2 x b	a		d_{s1}	d_s	L	Length before bending	f_{cu}> 15 MPa	f_{cu}> 25 MPa	f_{cu}> 25 MPa
	[t]	[mm]	[mm]	[mm²/m]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
M(Rd)12-137	0.5	60	300	1 x 188	Ø8	Ø6	150	310	4.0	5.0	5.0
M(Rd)16-216	1.2	80	400	2 x 131	2 x Ø8	Ø8	200	420	8.0	10.3	12.0
M(Rd)20-257	2.0	110	550	2 x 188	2 x Ø10	Ø10	300	620	13.0	16.8	20.0
M(Rd)24-360	2.5	125	600	2 x 188	2 x Ø10	Ø10	300	620	16.0	20.7	25.0
M(Rd)30-450	4.0	140	700	2 x 188	2 x Ø12	Ø12	400	820	26.0	33.5	40.0
M(Rd)36-570	6.3	150	1000	2 x 188	2 x Ø12	Ø14	550	1120	37.0	47.8	63.0
M(Rd)42-620	8.0	160	1000	2 x 188	2 x Ø14	Ø16	750	1530	49.0	63.2	80.0

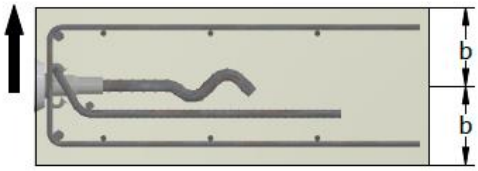


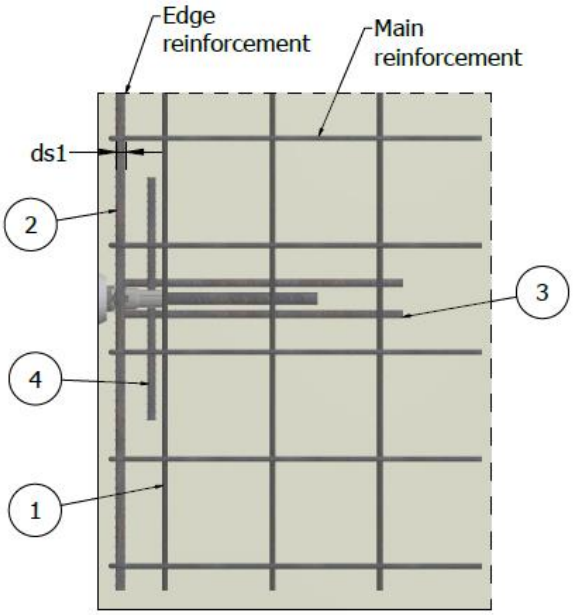
Note:

- The bend diameter D, for item 3, according to EN 1992-1-1 is not mandatory.

- 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°



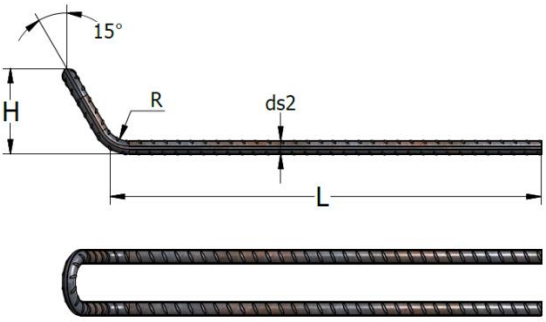


Note:

- The bend radius R according to EN 1992-1-1 is not mandatory.

- Only a long socket anchor may be used for tilting operations.
- The turning reinforcement must be placed in direct contact with the socket anchor.
- The dimensions in the illustrations are in [mm].
- Do not use lifting loop for tilting.

④

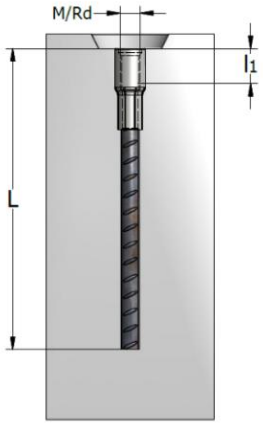


③

TGL-M(Rd)	Load group	Minimum unit thickness 2 x b	Mesh reinforcement ①	Edge reinforcement ②	Turning reinforcement ③				Lateral reinforcement ④		Load capacity	
				d_{s1}	d_{s2}	L	H	R	d_{s3}	l	f_{cu}> 15 MPa	f_{cu}> 25 MPa
	[t]	[mm]	[mm²/m]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]
M(Rd)12-137	0.5	60	1 x 188	Ø8	6	270	35	12	8	280	2.0	2.5
M(Rd)16-216	1.2	80	2 x 131	2 x Ø8	8	420	50	16	12	400	4.8	6.0
M(Rd)20-257	2.0	110	2 x 188	2 x Ø10	10	490	65	20	14	500	9.0	10.0
M(Rd)24-360	2.5	125	2 x 188	2 x Ø10	12	520	75	24	14	550	11.0	12.5
M(Rd)30-450	4.0	140	2 x 188	2 x Ø12	12	550	95	24	16	600	16.0	20.0
M(Rd)36-570	6.3	210	2 x 188	2 x Ø12	14	690	120	30	16	700	27.0	31.5
M(Rd)42-620	8.0	240	2 x 188	2 x Ø14	16	830	145	32	20	850	37.0	40.0

LIFTING SOCKET – STRAIGHT END REINFORCING STEEL – TRL

The TRL anchors are especially suitable for lifting thin concrete panels. There are two versions of lifting sockets with straight ends – with metric thread (M) or with round thread (Rd). The threaded socket is made of steel S355J0, zinc-plated, or stainless steel and a reinforcing bar made of B500B with no coating.



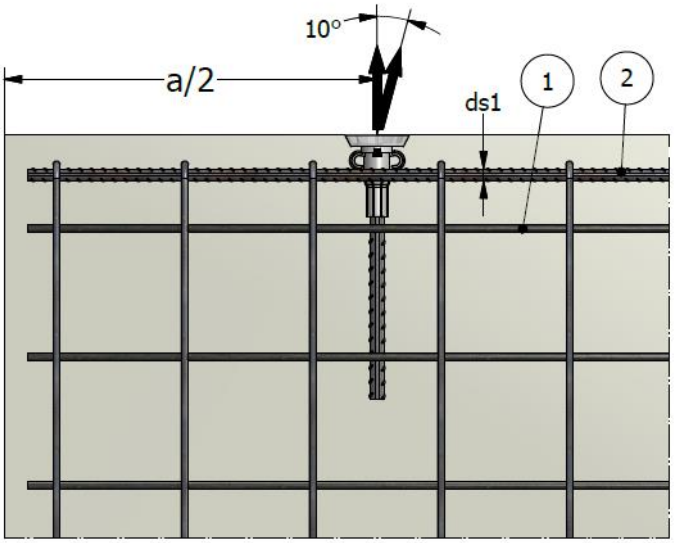
TRL-M	Product number			Load group f_{cu}> 15 MPa	Thread	Bar diam.	Overall length L	l_1
	Zinc galvanizing	Stainless steel SS4	Stainless steel SS2	[t]	M	[mm]	[mm]	[mm]
TRL-M12-195	63351	63353	63352	0.5	12	8	195	22
TRL-M16-270	63354	63356	63355	1.2	16	12	270	30
TRL-M20-350	63357	63359	63358	2.0	20	14	350	35
TRL-M24-400	63360	63362	63361	2.5	24	16	400	41
TRL-M30-505	63363	63365	63364	4.0	30	20	505	55
TRL-M36-680	63366	63368	63367	6.3	36	25	680	65
TRL-M42-790	63369	63371	63370	8.0	42	28	790	70

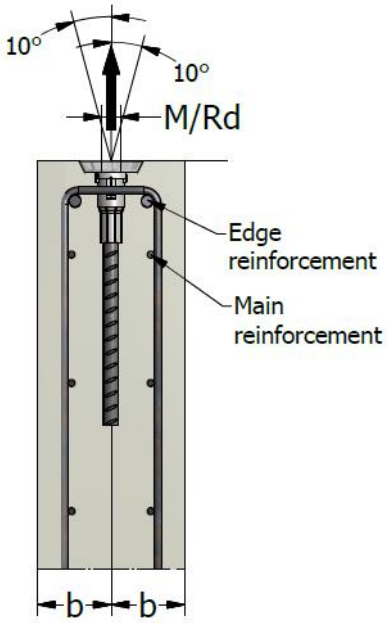
TRL-Rd	Product number			Load group f_{cu}> 15 MPa	Thread	Bar diam.	Overall length L	l_1
	Zinc galvanizing	Stainless steel SS4	Stainless steel SS2	[t]	Rd	[mm]	[mm]	[mm]
TRL-Rd12-195	60070	63333	63332	0.5	12	8	195	22
TRL-Rd16-270	63334	63336	63335	1.2	16	12	270	30
TRL-Rd20-350	63337	63339	63338	2.0	20	14	350	35
TRL-Rd24-400	60075	63341	63340	2.5	24	16	400	41
TRL-Rd30-469	46027	62847	62846	4.0	30	20	469	55
TRL-Rd30-505	63342	63344	63343	4.0	30	20	505	55
TRL-Rd36-680	63345	63347	63346	6.3	36	25	680	65
TRL-Rd42-790	63348	63350	63349	8.0	42	28	790	70

LIFTING SOCKETS TRL ANCHOR – INSTALLATION AND REINFORCEMENTS

REINFORCEMENT AND LOAD CAPACITY – AXIAL LOAD UP TO 10°

- **No diagonal reinforcement is required**
- **100% load capacity**

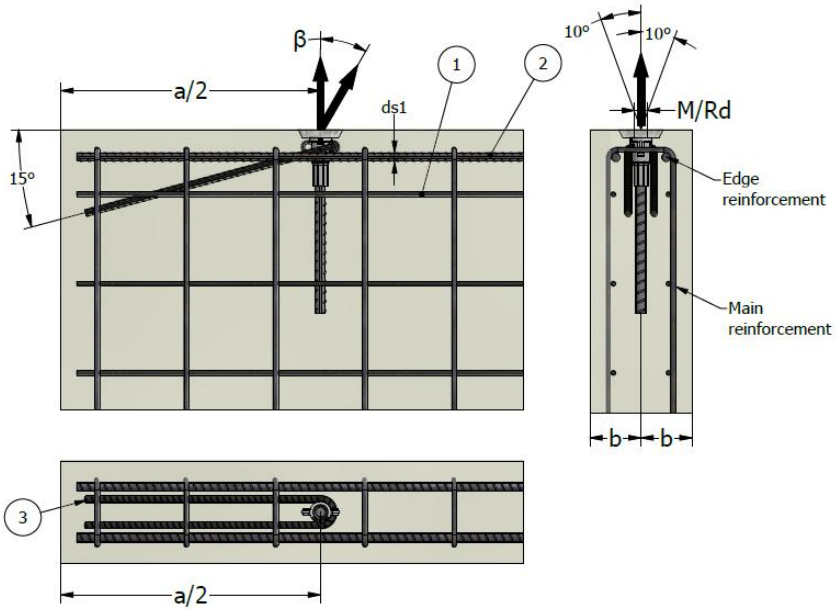


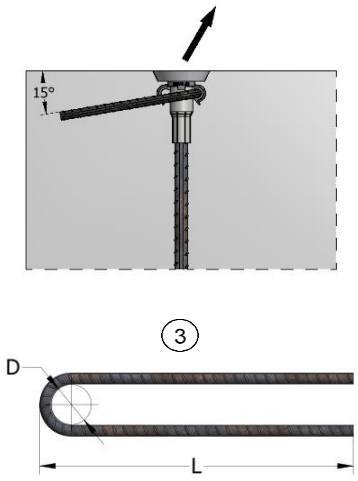


TRL-M(Rd)	Load group	Minimum unit thickness	Minimum axial spacing	Mesh reinforcement ①	Edge reinforcement ②	Load capacity	
		2 x b	a		d_{s1}	f_{cu}> 15 MPa	f_{cu}> 25 MPa
	[t]	[mm]	[mm]	[mm²/m]	[mm]	[kN]	[kN]
M(Rd)12-195	0.5	60	410	1 x 188	Ø8	5.0	5.0
M(Rd)16-270	1.2	80	550	2 x 131	2 x Ø8	12.0	12.0
M(Rd)20-350	2.0	80	720	2 x 188	2 x Ø10	16.9	20.0
M(Rd)20-350	2.0	100	720	2 x 188	2 x Ø10	20.0	20.0
M(Rd)24-400	2.5	100	1000	2 x 188	2 x Ø12	25.0	25.0
M(Rd)30-469	4.0	100	940	2 x 188	2 x Ø12	29.1	40.0
M(Rd)30-505	4.0	100	1010	2 x 188	2 x Ø12	31.4	40.0
M(Rd)30-505	4.0	120	1010	2 x 188	2 x Ø12	40.0	40.0
M(Rd)36-680	6.3	120	1360	2 x 188	2 x Ø12	51.3	63.0
M(Rd)36-680	6.3	140	1360	2 x 188	2 x Ø12	63.0	63.0
M(Rd)42-790	8.0	140	1580	2 x 188	2 x Ø14	67.0	80.0
M(Rd)42-790	8.0	160	1580	2 x 188	2 x Ø14	80.0	80.0

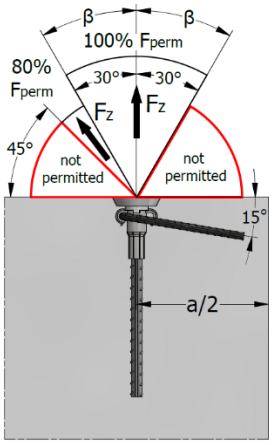
REINFORCEMENT AND LOAD CAPACITY – DIAGONAL LOAD UP TO 45°

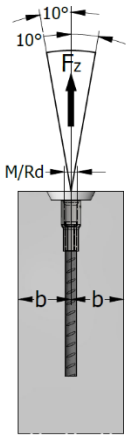
- **Diagonal reinforcement is always required**
- **Approx. 80% load capacity in 15 MPa**
- **100% load capacity from 25 MPa**





TRL-M(Rd)	Load group	Minimum unit thickness	Minimum axial spacing	Mesh reinforcement (1)	Edge reinforcement (2)	Diagonal reinforcement β > 30° max. 45° (3)			Load capacity for lifting loop application		Load capacity for lifting THS application
		2 x b	a		d_{s1}	d_s	L	Length before bending	f_{cu}> 15 MPa	f_{cu}> 25 MPa	f_{cu}> 25 MPa
	[t]	[mm]	[mm]	[mm²/m]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
M(Rd)12-195	0.5	60	350	1 x 188	Ø8	Ø6	150	310	4.0	5.0	5.0
M(Rd)16-270	1.2	100	420	2 x 131	2 x Ø8	Ø8	300	620	8.0	10.3	12.0
M(Rd)20-350	2.0	100	550	2 x 188	2 x Ø10	Ø10	400	820	13.0	16.8	20.0
M(Rd)24-400	2.5	100	620	2 x 188	2 x Ø10	Ø10	500	1020	16.0	20.7	25.0
M(Rd)30-469	4.0	140	620	2 x 188	2 x Ø12	Ø12	600	1220	23.0	30.5	40.0
M(Rd)30-505	4.0	140	650	2 x 188	2 x Ø12	Ø12	620	1260	26.0	33.5	40.0
M(Rd)36-680	6.3	140	840	2 x 188	2 x Ø12	Ø16	780	1600	37.0	47.8	63.0
M(Rd)42-790	8.0	160	1000	2 x 188	2 x Ø14	Ø20	960	2000	49.0	63.2	80.0





Note:
- The bend diameter D according to EN 1992-1-1 is not mandatory.

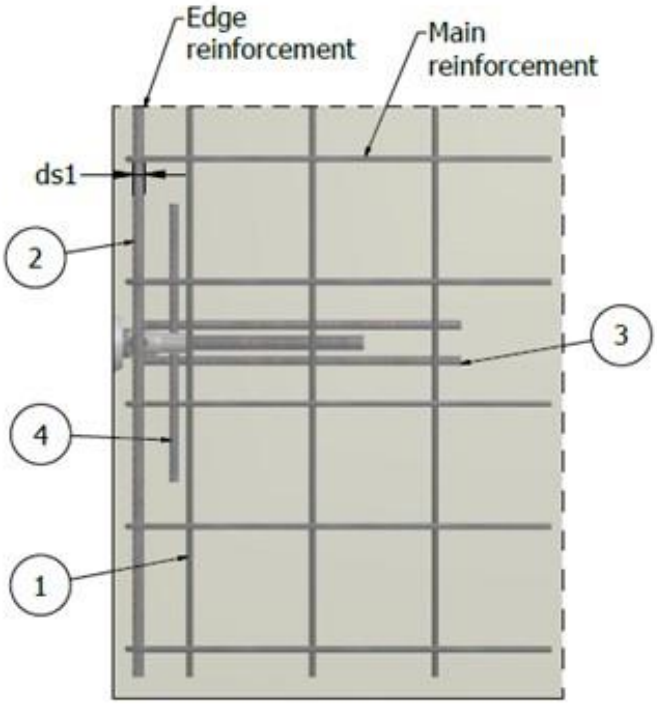
- Diagonal reinforcement must be placed in direct contact with the socket anchor.
- Always install diagonal reinforcement opposite the load direction.
- The dimensions in the illustrations are in [mm].

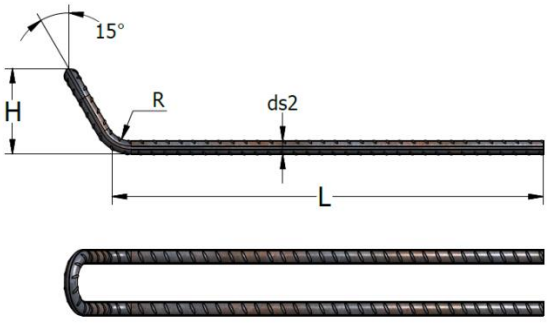
REINFORCEMENT AND LOAD CAPACITY – DIAGONAL LOAD AND TILTING UP TO 90°

Note:
- The bend radius R according to EN 1992-1-1 is not mandatory.

- Only a long socket anchor may be used for tilting operations.
- The turning reinforcement must be placed in direct contact with the socket anchor.
- The dimensions in the illustrations are in [mm].
*- **Do not use lifting loop for tilting.***

④

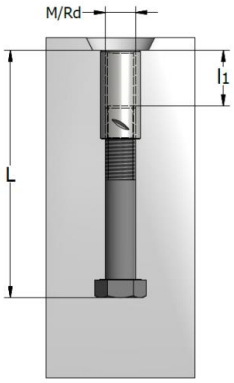




③

TRL-M(Rd)	Load group	Minimum unit thickness 2 x b	Mesh reinforcement ①	Edge reinforcement ②	Turning reinforcement ③				Lateral reinforcement ④		Load capacity	
				d_{s1}	d_{s2}	L	H	R	d_{s3}	l	f_{cu}> 15 MPa	f_{cu}> 25 MPa
	[t]	[mm]	[mm²/m]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]
M(Rd)12-195	0.5	80	1 x 188	Ø8	6	270	35	12	8	280	2.0	2.5
M(Rd)16-270	1.2	100	2 x 131	2 x Ø8	8	420	50	16	12	400	4.0	5.2
M(Rd)20-350	2.0	120	2 x 188	2 x Ø10	10	490	65	20	14	500	9.0	10.0
M(Rd)24-400	2.5	140	2 x 188	2 x Ø10	12	520	75	24	14	550	11.0	12.5
M(Rd)30-469	4.0	160	2 x 188	2 x Ø12	12	550	95	24	16	600	16.0	20.0
M(Rd)30-505	4.0	160	2 x 188	2 x Ø12	12	570	95	24	16	600	16.0	20.0
M(Rd)36-680	6.3	210	2 x 188	2 x Ø12	14	690	120	30	16	700	27.0	31.5
M(Rd)42-790	8.0	240	2 x 188	2 x Ø14	16	830	145	32	20	850	37.0	40.0

LIFTING BOLT ANCHOR – HBB



The lifting bolt anchors are suitable for shallow embedded elements with no need for a reinforcement tail. The force transfer into the concrete is provided by the bolt head of the screw. Additional reinforcement is necessary for angled lifts. The lift angle must not exceed 30°. Special tilting reinforcement must be used for turning/tilting. In all cases, standard mesh reinforcement must be present in the concrete element.
These fixing and lifting systems consist of a threaded bush locked on a standard bolt. The threaded bush is made of steel S355J0 (yield strength min 355 MPa) galvanic protected (EV) or hot-dipped galvanised (TV); the bolt is made of steel group 8.8. The threaded bush can also be made of stainless-steel W 1.4571 –AISI 316Ti (SS4).

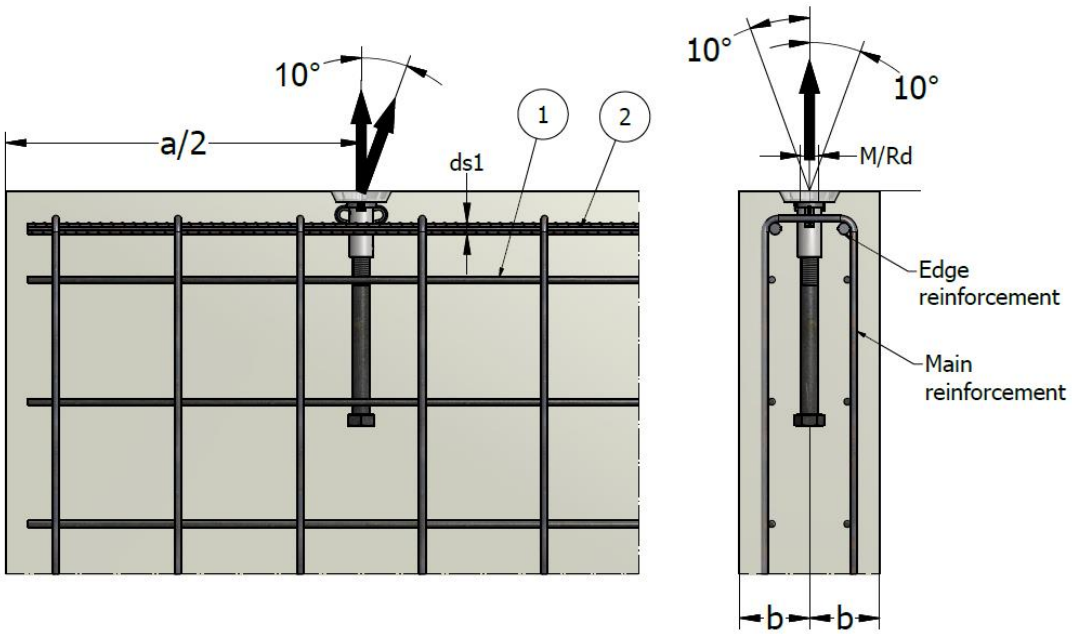
HBB	Product number			Load group f_{cu}> 20N/mm²	Thread	Overall length L	l_1	Bolt
	Zinc galvanizing	Stainless steel SS4	Hot dipped galvanized	[t]	M	[mm]	[mm]	
HBB M12x150	43703	43704	45753	0.5	12	150	22	M12x120
HBB M16x220	43711	43712	45754	1.2	16	220	30	M16x180
HBB M20x180	43921	43922	45291	2.0	20	180	35	M20x130
HBB M20x270	44534	44535	45756	2.0	20	270	35	M20x220
HBB M24x320	44623	44624	45758	2.5	24	320	45	M24x260
HBB M30x380	44631	44632	45640	4.0	30	380	60	M30x300
HBB M36x300	44753	44754	45641	6.3	36	300	74	M36x200
HBB M36x420	44757	44758	45642	6.3	36	420	74	M36x320
HBB M42x460	44765	44780	45644	8.0	42	460	70	M42x360

HBB	Product number			Load group f_{cu}> 20N/mm²	Thread	Overall length L	l_1	Bolt
	Zinc galvanizing	Stainless steel SS4	Hot dipped galvanized	[t]	Rd	[mm]	[mm]	
HBB Rd12x150	62927	62931	62935	0.5	12	150	22	M12x120
HBB Rd16x220	62937	62940	62943	1.2	16	220	30	M16x180
HBB Rd20x180	62946	62949	62953	2.0	20	180	35	M20x130
HBB Rd20x270	49480	62950	62954	2.0	20	270	35	M20x220
HBB Rd24x320	62955	62957	62959	2.5	24	320	45	M24x260
HBB Rd30x380	62962	62965	62968	4.0	30	380	60	M30x300
HBB Rd36x300	62969	62971	62973	6.3	36	300	74	M36x200
HBB Rd36x420	62970	62972	62974	6.3	36	420	74	M36x320
HBB Rd42x460	62976	62978	62980	8.0	42	460	70	M42x360

LIFTING BOLT ANCHOR – INSTALLATION AND REINFORCEMENTS

REINFORCEMENT AND LOAD CAPACITY – AXIAL LOAD UP TO 10°

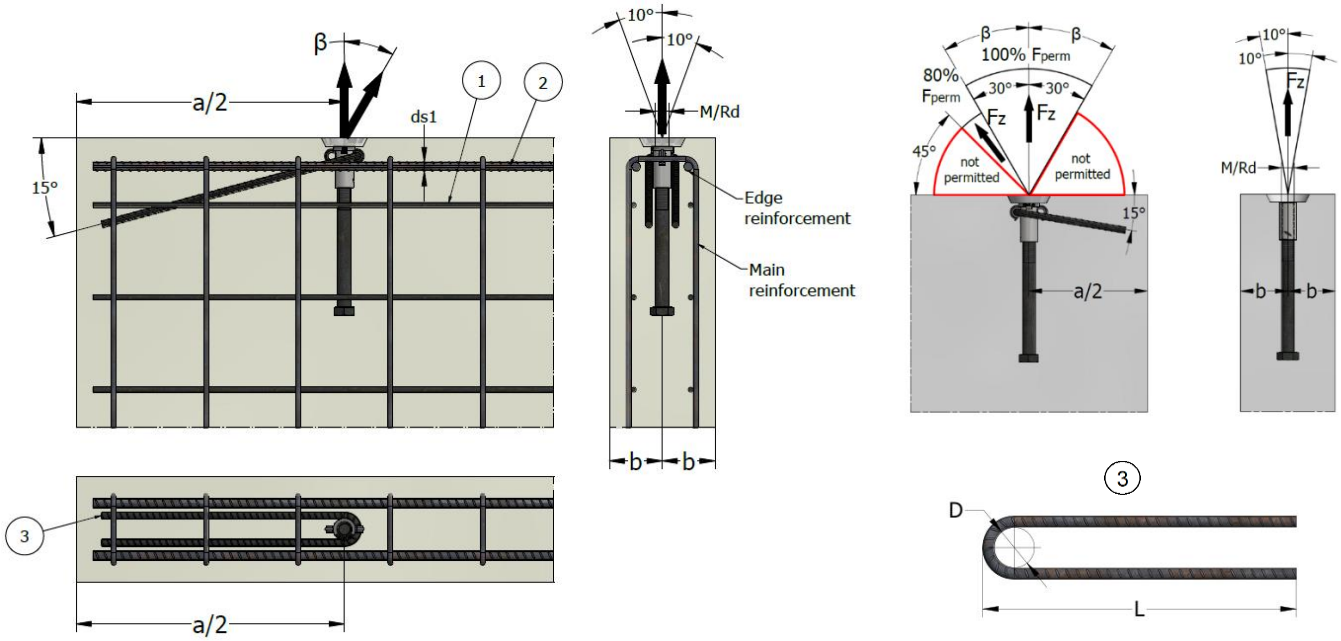
- **No diagonal reinforcement is required**
- **100% load capacity**



HBB-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}> 20 MPa	f_{cu}> 25 MPa
	[t]	[mm]	[mm]	[mm²/m]	[mm]	[kN]	[kN]
M(Rd)12-150	0.5	60	400	1 x 188	Ø8	5.0	5.0
M(Rd)16-220	1.2	90	620	2 x 131	2 x Ø8	10.0	11.2
M(Rd)16-220	1.2	100	620	2 x 131	2 x Ø8	11.2	12.0
M(Rd)20-180	2.0	130	500	2 x 188	2 x Ø10	18.1	20.0
M(Rd)20-180	2.0	150	500	2 x 188	2 x Ø10	20.0	20.0
M(Rd)20-270	2.0	130	750	2 x 188	2 x Ø10	18.1	20.0
M(Rd)20-270	2.0	150	750	2 x 188	2 x Ø10	20.0	20.0
M(Rd)24-320	2.5	140	900	2 x 188	2 x Ø12	23.4	25.0
M(Rd)24-320	2.5	150	900	2 x 188	2 x Ø12	25.0	25.0
M(Rd)30-380	4.0	170	1000	2 x 188	2 x Ø12	36.9	40.0
M(Rd)30-380	4.0	190	1000	2 x 188	2 x Ø12	40.0	40.0
M(Rd)36-300	6.3	220	800	2 x 188	2 x Ø12	57.0	63.0
M(Rd)36-300	6.3	245	800	2 x 188	2 x Ø12	63.0	63.0
M(Rd)36-420	6.3	220	1100	2 x 188	2 x Ø12	57.0	63.0
M(Rd)36-420	6.3	245	1100	2 x 188	2 x Ø12	63.0	63.0
M(Rd)42-460	8.0	240	1300	2 x 188	2 x Ø12	74.2	80.0
M(Rd)42-460	8.0	260	1300	2 x 188	2 x Ø12	80.0	80.0

REINFORCEMENT AND LOAD CAPACITY – DIAGONAL LOAD UP TO 45°

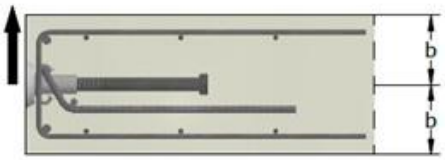
- **Diagonal reinforcement is always required**
- **Approx. 80% load capacity in 20 MPa**
- **100% load capacity from 25 MPa**

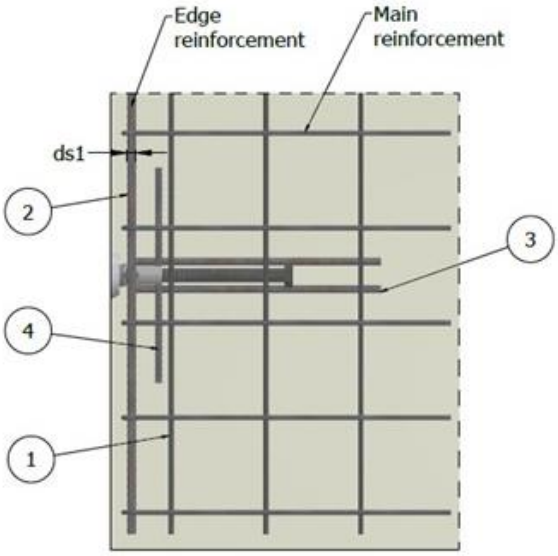


HBB-M(Rd)	Load group	Minimum unit thickness	Axial spacing	Mesh reinforcement ①	Edge reinforcement ②	Diagonal reinforcement β > 30° max. 45° ③			Load capacity for lifting loop application		Load capacity for lifting THS application
		2 x b	a		d_{s1}	d_s	L	Length before bending	f_{cu}> 20 MPa	f_{cu}> 25 MPa	f_{cu}> 25 MPa
	[t]	[mm]	[mm]	[mm²/m]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
M(Rd)12-150	0.5	60	400	1 x 188	Ø8	Ø6	170	350	4.0	5.0	5.0
M(Rd)16-220	1.2	100	620	2 x 131	2 x Ø8	Ø8	320	650	8.9	12.0	12.0
M(Rd)20-180	2.0	130	500	2 x 188	2 x Ø10	Ø10	420	860	14.5	20.0	20.0
M(Rd)20-180	2.0	150	500	2 x 188	2 x Ø10	Ø10	420	860	16.0	20.0	20.0
M(Rd)20-270	2.0	150	750	2 x 188	2 x Ø10	Ø10	420	860	16.0	20.0	20.0
M(Rd)24-320	2.5	150	900	2 x 188	2 x Ø10	Ø10	520	1060	20.0	25.0	25.0
M(Rd)30-380	4.0	190	1000	2 x 188	2 x Ø12	Ø12	550	1200	32.0	40.0	40.0
M(Rd)36-300	6.3	220	800	2 x 188	2 x Ø12	Ø16	780	1600	45.6	63.0	63.0
M(Rd)36-300	6.3	245	800	2 x 188	2 x Ø12	Ø16	780	1600	50.4	63.0	63.0
M(Rd)36-420	6.3	220	1100	2 x 188	2 x Ø12	Ø16	780	1600	45.6	63.0	63.0
M(Rd)36-420	6.3	245	1100	2 x 188	2 x Ø12	Ø16	780	1600	50.4	63.0	63.0
M(Rd)42-460	8.0	240	1300	2 x 188	2 x Ø12	Ø20	960	2000	59.4	80.0	80.0
M(Rd)42-460	8.0	260	1300	2 x 188	2 x Ø12	Ø20	960	2000	64.0	80.0	80.0

Note:
- The bend diameter D according to EN 1992-1-1 is not mandatory.
- 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 – TILTING UP TO 90°

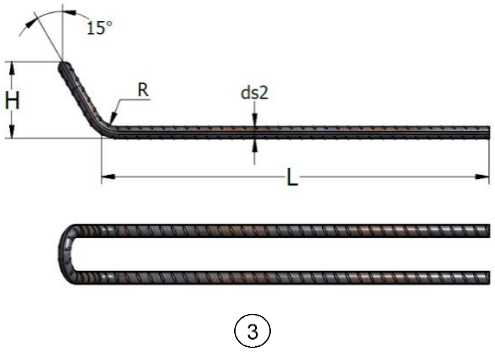




Note:

- The bend radius R according to EN 1992-1-1 is not mandatory.

- Only a long socket anchor may be used for tilting operations.
- The turning reinforcement must be placed in direct contact with the socket anchor.
- The dimensions in the illustrations are in [mm].
*- **Do not use lifting loop for tilting.***

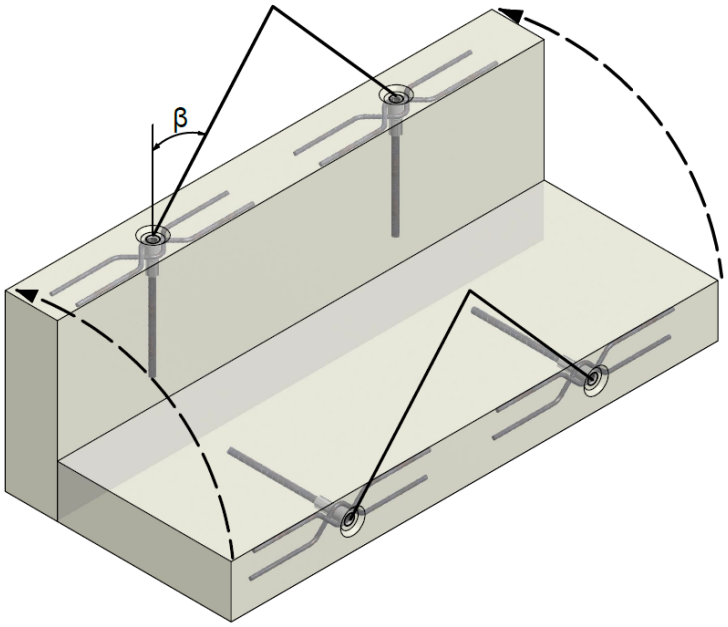


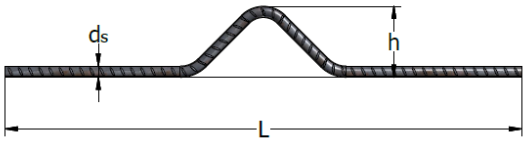
HBB-M(Rd)	Load group	Minimum unit thickness 2 x b	Mesh reinforcement (1)	Edge reinforcement (2)	Turning reinforcement (3)				Lateral reinforcement (4)		Load capacity	
				d_{s1}	d_{s2}	L	H	R	d_{s3}	l	f_{cu}>20 MPa	f_{cu}> 25 MPa
	[t]	[mm]	[mm²/m]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]
M(Rd)12-150	0.5	80	2 x 131	2 x Ø8	8	270	35	12	8	500	2.5	2.5
M(Rd)16-220	1.2	120	2 x 131	2 x Ø8	8	420	50	16	8	500	6.0	6.0
M(Rd)20-270	2.0	140	2 x 188	2 x Ø10	10	490	65	20	14	500	10.0	10.0
M(Rd)24-320	2.5	160	2 x 188	2 x Ø12	12	520	75	24	14	550	12.5	12.5
M(Rd)30-380	4.0	160	2 x 188	2 x Ø12	12	570	95	24	16	600	20.0	20.0
M(Rd)36-300	6.3	210	2 x 188	2 x Ø12	14	690	120	30	16	700	31.5	31.5
M(Rd)36-420	6.3	210	2 x 188	2 x Ø12	14	690	120	30	16	700	31.5	31.5
M(Rd)42-460	8.0	240	2 x 188	2 x Ø14	16	830	145	32	20	850	40.0	40.0

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.
We recommend not exceeding an angle of ß 30°, if possible.

This type of reinforcement is recommended for tilting concrete elements with TGL, TRL or HBB anchors.



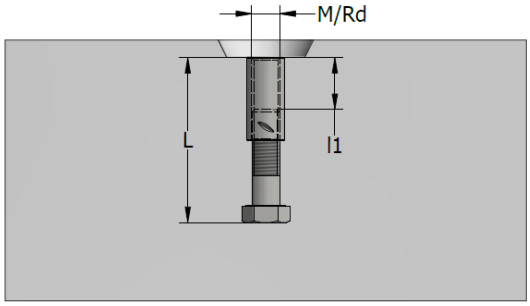


Tilt reinforcement

Note:
- The bend diameter will be determined according to EN 1992-1-1.
- Only a long socket anchor may be used for tilting operations.
- Tilting reinforcement must be placed in direct contact with the socket anchor.

TGL/ TRL/ HBB - M(Rd)	Tilt reinforcement		
	Ød$_3$	L	h
	[mm]	[mm]	[mm]
M(Rd)12	6	270	35
M(Rd)16	8	420	50
M(Rd)20	10	500	65
M(Rd)24	12	520	75
M(Rd)30	12	570	92
M(Rd)36	14	700	120
M(Rd)42	16	830	145

LIFTING BOLT ANCHOR – HBB-SHORT



The lifting bolt anchors HBB-SHORT are suitable for lifting and transporting slabs precast concrete elements. The force transfer into the concrete is provided by the bolt head of the screw. Additional reinforcement is necessary for angled lifts. The lift angle must not exceed 30°. In all cases, standard mesh reinforcement must be present in the concrete element.
These fixing and lifting systems consist of a threaded bush locked on a standard bolt. The threaded bush is made of steel S355J0 (yield strength min 355 MPa) galvanic protected (EV) or hot-dipped galvanised (TV); the bolt is made of steel group 8.8. The threaded bush can also be made of stainless-steel W 1.4571 –AISI 316Ti (SS4).

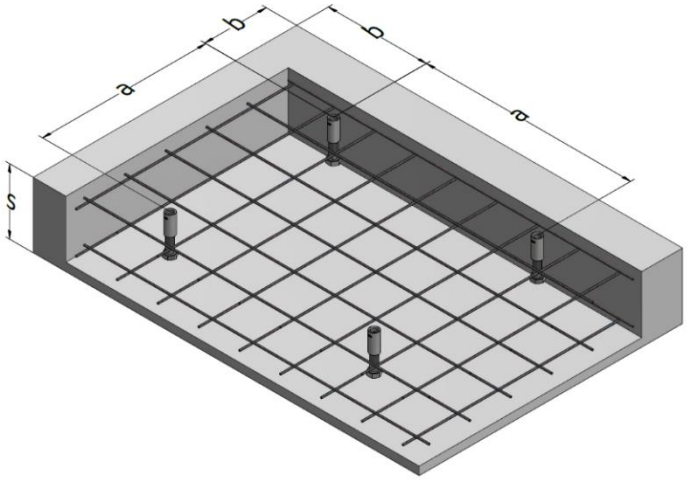
HBB-SHORT	Product number			Load group f_{cu}> 20 MPa	Thread	Overall length L	l_1	Bolt
	Zinc galvanizing	Stainless steel SS4	Hot dipped galvanized	[t]	M	[mm]	[mm]	
HBB M12x90	45627	45629	45286	0.5	12	90	22	M12x60
HBB M12x100	43699	43700	45287	0.5	12	100	22	M12x70
HBB M16x140	43707	43708	45288	1.2	16	140	30	M16x100
HBB M20x140	45628	45631	45289	2.0	20	140	35	M20x90
HBB M20x150	43715	43716	45290	2.0	20	150	35	M20x100
HBB M24x200	44619	45757	45292	2.5	24	200	45	M24x140
HBB M30x240	44627	44628	45639	4.0	30	240	60	M30x160

HBB-SHORT	Product number			Load group f_{cu}> 20 MPa	Thread	Overall length L	l_1	Bolt
	Zinc galvanizing	Stainless steel SS4	Hot dipped galvanized	[t]	Rd	[mm]	[mm]	
HBB Rd12x90	62925	62929	62933	0.5	12	90	22	M12x60
HBB Rd12x100	62926	62930	62934	0.5	12	100	22	M12x70
HBB Rd16x140	49479	62939	62942	1.2	16	140	30	M16x100
HBB Rd20x140	62945	62948	62952	2.0	20	140	35	M20x90
HBB Rd24x200	49481	62956	62958	2.5	24	200	45	M24x140
HBB Rd30x240	62961	62964	62967	4.0	30	240	60	M30x160

LIFTING AND TRANSPORT – HBB SHORT ANCHORS

Edge distance and spacing for lifting sockets.

HBB-M(Rd)	s minimum	a minimum	b minimum
	[mm]	[mm]	[mm]
M(Rd)12-90	120	340	170
M(Rd)12-100	130	380	190
M(Rd)16-140	170	520	260
M(Rd)20-140	170	520	260
M(Rd)20-150	180	560	280
M(Rd)24-200	230	740	370
M(Rd)30-240	270	880	440

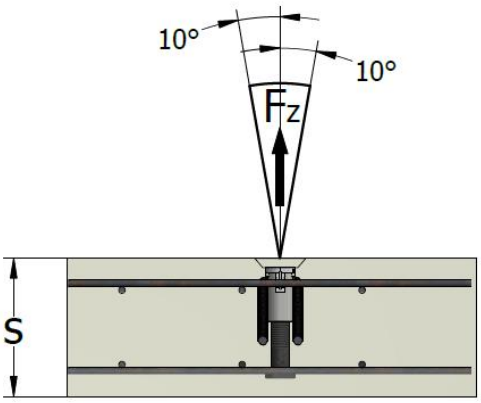


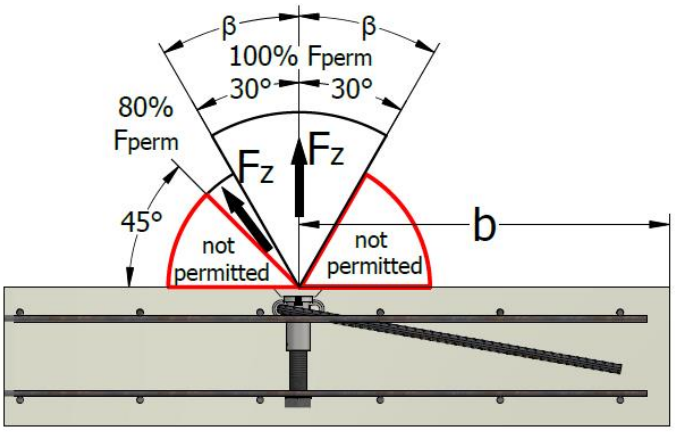
The HBB anchors are used for lifting flat elements such as floor slabs. The lifting angle must be ≤ 45°. For a lifting angle between 10° and 45°, additional reinforcement is required.

HBB-M(Rd)	Load group	Thread	Overall length	Element thickness	Axial load and diagonal load ≤ 45°
	f_{cu}> 20 MPa				f_{cu}> 25 MPa
	[t]	M(Rd)	[mm]	[mm]	[kN]
HBB-M(Rd)12-090	0.5	12	90	115	5
HBB-M(Rd)12-100	0.5	12	100	125	5
HBB-M(Rd)16-140	1.2	16	140	165	12
HBB-M(Rd)20-140	2.0	20	140	165	20
HBB-M(Rd)20-150	2.0	20	150	175	20
HBB -M(Rd)24-200	2.5	24	200	225	25
HBB -M(Rd)30-240	4.0	30	240	265	40

HBB-M(Rd) short	Thread	Two layers of mesh	Diagonal reinforcement		
			Rebar diameter	L	Length before bending
	M(Rd)	mm²/m	[mm]	[mm]	[mm]
HBB-M(Rd)12-090	12	2 x 188	Ø 6	150	310
HBB-M(Rd)12-100	12	2 x 188	Ø 6	150	310
HBB-M(Rd)16-140	16	2 x 188	Ø 8	200	420
HBB-M(Rd)20-140	20	2 x 188	Ø 8	300	620
HBB-M(Rd)20-150	20	2 x 188	Ø 8	300	620
HBB -M(Rd)24-200	24	2 x 188	Ø 10	300	620
HBB -M(Rd)30-240	30	2 x 188	Ø 12	400	820

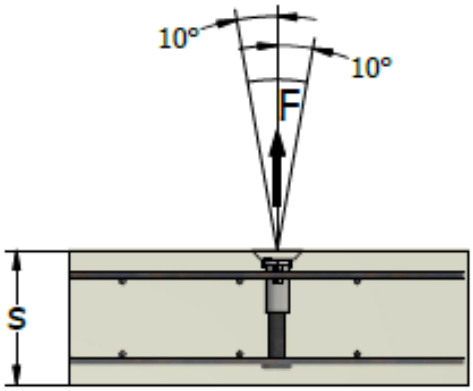
Note:
- The bend diameter D according to EN 1992-1-1 is not mandatory.
- There must be two layers of mesh reinforcement.
- Diagonal reinforcement must be placed in direct contact with the socket anchor.
- Always install diagonal reinforcement opposite the load direction.

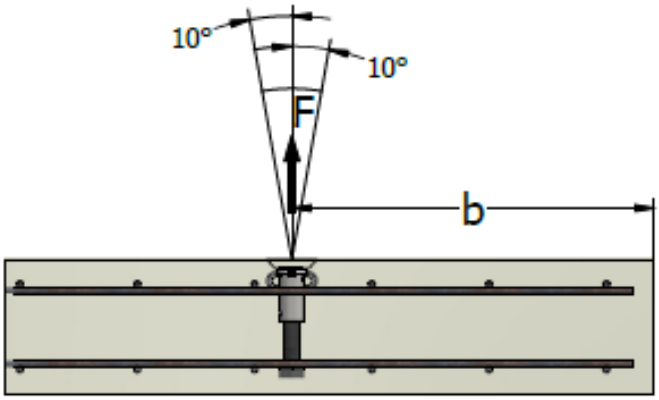




Note:

- The bend diameter D according to EN 1992-1-1 is not mandatory.
- 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.
- The dimensions in the illustrations are in [mm].



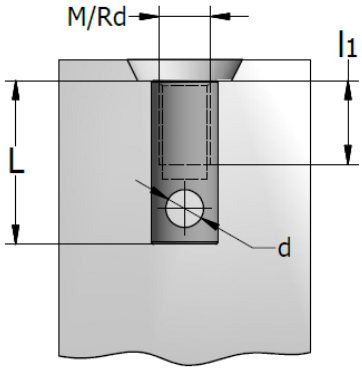


PLAIN LIFTING SOCKET AND LIFTING SOCKET WITH FLAT END

The plain lifting sockets and the lifting sockets with flat end are economical solutions and are suitable for thin concrete elements, where the long tail provides excellent anchorage. The reinforcement tail is important and must be installed as shown in the following illustrations. The plain lifting sockets are made of steel S355J0 zinc-plated or of stainless steel AISI 316Ti (SS4); the lifting sockets with flat end are made of galvanised steel tube S355J0**. These sockets are designated for lifting and are not to be confused with fixing sockets.** The safe working loads shown are after the application of a safety factor on test loads: c=2 for 15 MPa concrete and c=3 for steel. These anchors are not designed for tilting.

PLAIN LIFTING SOCKET HSB

These are plain lifting sockets made of a galvanised round bar of steel S355J0 or stainless steel (W 1.4571), without a plastic stopper.

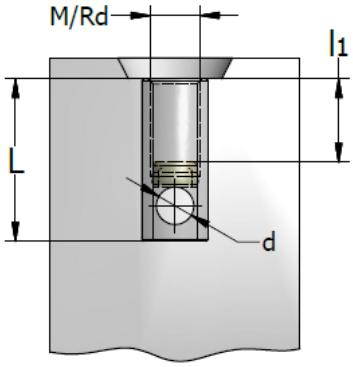


HSB-M	Product number		Thread	Load group f_{cu}> 15 MPa	Overall length L	D	l_1	d
	Zinc galvanizing	Stainless steel SS4	M	[t]	[mm]	[mm]	[mm]	[mm]
HSB-M12x40	45867	45237	12	0.5	40	17	22	8
HSB-M16x54	45868	45238	16	1.2	54	22	27	13
HSB-M20x69	45869	45239	20	2.0	69	27	35	15
HSB-M24x78	45870	45240	24	2.5	78	32	40	18
HSB-M30x105	45871	45241	30	4.0	105	39	55	22
HSB-M36x125	45884	45883	36	6.3	125	47	65	27
HSB-M42x145	45886	45885	42	8.0	145	55	78	32
HSB-M52x195	45888	45887	52	12.5	195	68	100	40

HSB-Rd	Product number		Thread	Load group f_{cu}> 15 MPa	Overall Length L	D	l_1	d
	Zinc galvanizing	Stainless steel SS4	Rd	[t]	[mm]	[mm]	[mm]	[mm]
HSB-Rd12x40	45872	45221	12	0.5	40	17	22	8
HSB-Rd16x54	45873	45222	16	1.2	54	22	27	13
HSB-Rd20x69	45874	45223	20	2.0	69	27	35	15
HSB-Rd24x78	45875	45224	24	2.5	78	32	40	18
HSB-Rd30x105	45876	45225	30	4.0	105	39	55	22
HSB-Rd36x125	45878	45877	36	6.3	125	47	65	27
HSB-Rd42x145	45880	45879	42	8.0	145	55	78	32
HSB-Rd52x195	45882	45881	52	12.5	195	68	100	40

PLAIN LIFTING SOCKET HSB-EV WITH STOPPER

This is a galvanised plain lifting socket made of a round tube of steel S355J0 with a plastic stopper inside made of polyethylene LDPE 035 to stop wet concrete from getting in the thread zone.

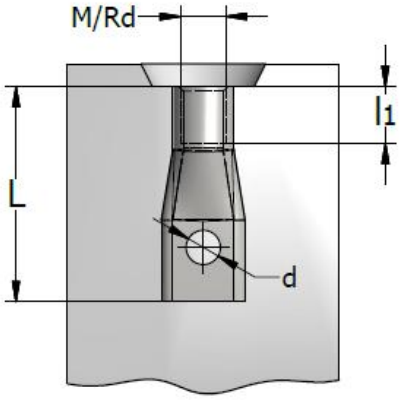


HSB-M	Product no.	Thread	Load group f_{cu}> 15 MPa	Overall Length L	D	l_1	d
	Zinc galvanizing	M	[t]	[mm]	[mm]	[mm]	[mm]
HSB-M12x40	45982	12	0.5	40	17	22	8
HSB-M16x54	45984	16	1.2	54	22	27	13
HSB-M20x69	45986	20	2.0	69	27	35	15
HSB-M24x78	45988	24	2.5	78	32	40	18
HSB-M30x105	45990	30	4.0	105	39	55	22
HSB-M36x125	45992	36	6.3	125	47	65	27
HSB-M42x145	45994	42	8.0	145	55	78	32
HSB-M52x195	45996	52	12.5	195	68	100	40

HSB-Rd	Product no.	Thread	Load group f_{cu}> 15 MPa	Overall Length L	D	l_1	d
	Zinc galvanizing	Rd	[t]	[mm]	[mm]	[mm]	[mm]
HSB-Rd12x40	45983	12	0.5	40	17	22	8
HSB-Rd16x54	45985	16	1.2	54	22	27	13
HSB-Rd20x69	45987	20	2.0	69	27	35	15
HSB-Rd24x78	45989	24	2.5	78	32	40	18
HSB-Rd30x105	45991	30	4.0	105	39	55	22
HSB-Rd36x125	45993	36	6.3	125	47	65	27
HSB-Rd42x145	45995	42	8.0	145	55	78	32
HSB-Rd52x195	45997	52	12.5	195	68	100	40

LIFTING SOCKET WITH FLAT END HSR

The lifting sockets with flat end are made of steel tube S355J0 galvanised or stainless steel.



HSR-M	Product number		Thread	Load group f_{cu}> 15 MPa	Overall Length L	D	l_1	d
	Zinc galvanizing	Stainless steel SS4	M	[t]	[mm]	[mm]	[mm]	[mm]
HSR-M12x60	45104	63285	12	0.5	60	17	20	8.2
HSR-M16x80	45105	63286	16	1.2	80	22	26	13.2
HSR-M20x100	45106	63287	20	2.0	100	27	32	15.2
HSR-M24x110	45107	63288	24	2.5	110	32	40	18.2
HSR-M30x135	45108	63289	30	4.0	135	39	48	22.2
HSR-M30x150	45153	63290	30	4.0	150	39	48	22.2

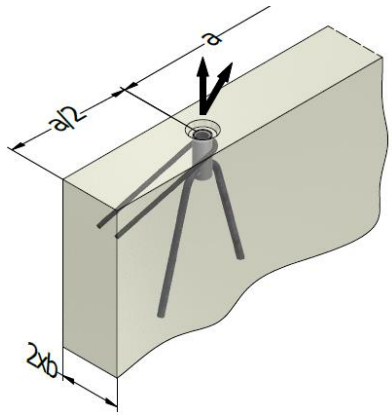
HSR-Rd	Product number		Thread	Load group f_{cu}> 15 MPa	Overall Length L	D	l_1	d
	Zinc galvanizing	Stainless steel SS4	Rd	[t]	[mm]	[mm]	[mm]	[mm]
HSR-Rd12x60	45154	63291	12	0.5	60	17	20	8.2
HSR-Rd16x80	45155	63292	16	1.2	80	22	26	13.2
HSR-Rd20x100	45156	63293	20	2.0	100	27	32	15.2
HSR-Rd24x110	45157	63294	24	2.5	110	32	40	18.2
HSR-Rd30x135	45158	63295	30	4.0	135	39	48	22.2
HSR-Rd30x150	45159	63296	30	4.0	150	39	48	22.2

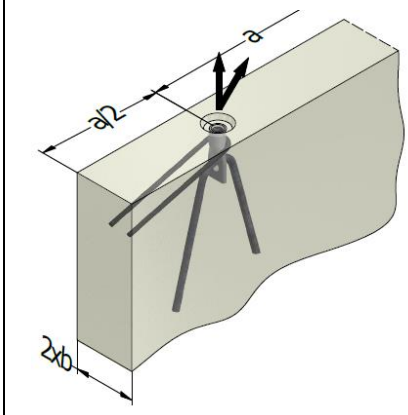
PLAIN LIFTING SOCKETS – INSTALLATION AND REINFORCEMENTS

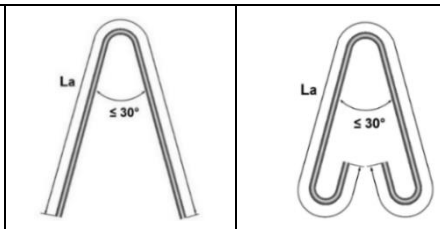
LIFTING AND TRANSPORT

The details on this page are applicable for panels, but they could equally apply to other components.

Edge distance and spacing of plain lifting sockets and lifting socket with flat end.





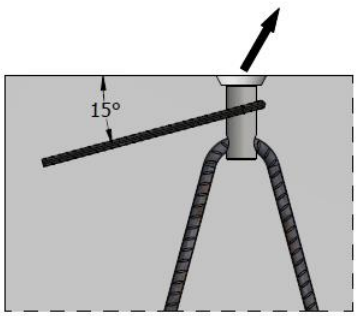


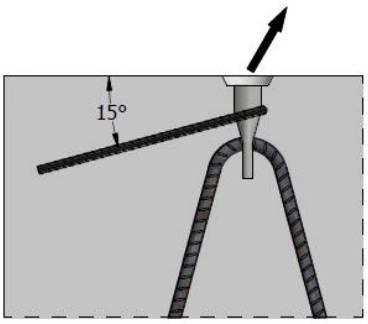
Anchorage reinforcement

Angled pull reinforcement

Note:
- The bend diameter D according to EN 1992-1-1 is not mandatory.
- The anchorage reinforcement must be in full contact with the bottom edge of the hole.
- Reducing the rebar length is permitted; the ends of rebar must be bent into hooks.
- The dimensions in the illustrations are in [mm].

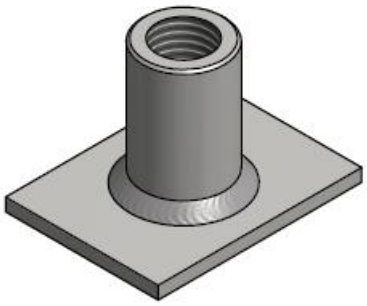
M / Rd	Minimum unit thickness	Axial spacing	Mesh reinforcement	Axial load ß ≤10°	Diagonal load 10°≤ ß≤30°			Diagonal load 10°≤ ß≤45°			Anchorage reinforcement	
	2 x b	a		Load capacity f_{cu}> 15MPa	Load capacity f_{cu}> 15MPa	Angled pull reinforcement Ø x L	Length before bending	Load capacity f_{cu}> 15MPa	Angled pull reinforcement Ø x L	Length before bending	d	Length before bending La
	[mm]	[mm]	[mm²/m]	[kN]	[kN]	[mm]	[mm]	[kN]	[mm]	[mm]	[mm]	[mm]
12	60	300	1 x 131	5.0	4.0	Ø 6 x 150	310	4.0	Ø 6 x 150	310	6	530
16	80	400	2 x 131	12.0	9.6	Ø 6 x 250	510	9.6	Ø 8 x 200	420	10	740
20	100	550	2 x 188	20.0	16.0	Ø 8 x 250	520	16.0	Ø 8 x 300	620	12	980
24	120	600	2 x 188	25.0	20.0	Ø 8 x 300	620	20.0	Ø 10 x 300	620	14	1070
30	140	650	2 x 188	40.0	32.0	Ø 10 x 350	720	32.0	Ø 12 x 400	820	16	1430
36	200	800	2 x 188	63.0	50.4	Ø 12 x 450	920	50.4	Ø 14 x 550	1130	20	1900
42	240	1000	2 x 188	80.0	64.0	Ø 14 x 600	1230	64.0	Ø 16 x 600	1230	25	2080
52	275	1200	2 x 188	125.0	100.0	Ø 16 x 700	1430	100.0	Ø 20 x 750	1570	28	2800

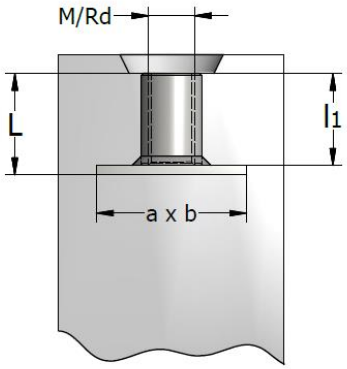




LIFTING SOCKET WITH FOOT PLATE - HSP

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 steel S355J0, and the plate is made of steel sheet S235JR. They are zinc-plated. These products can be made of stainless steel SS2 (W 1.4301) or SS4 (W 1.4571).
The preferred lift angle is **ß ≤30°.**
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.

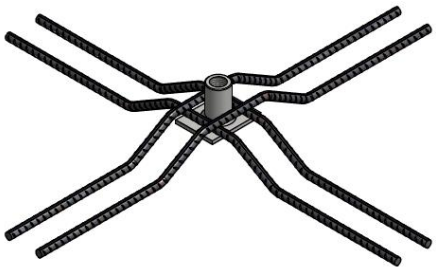


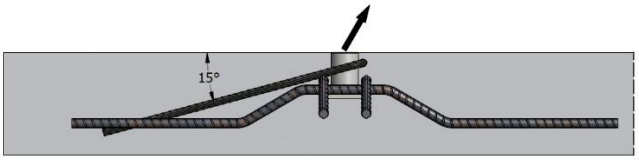


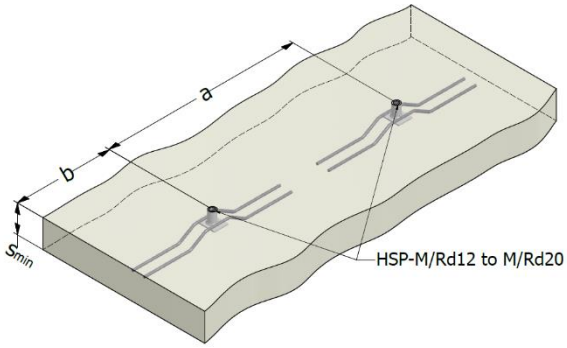
HSP-M	Product no.			Thread	Load group f_{cu}> 15 MPa	Overall length L	a	b
	Zinc galvanizing	Stainless steel SS4	Stainless steel SS2	M	[t]	[mm]	[mm]	[mm]
HSP-M12	45685	62702	48657	12	0.5	30	35	25
HSP-M16	45686	62701	62700	16	1.2	35	50	35
HSP-M20	43761	62703	48026	20	2.0	47	60	60
HSP-M24	45687	62705	62704	24	2.5	54	80	60
HSP-M30	45688	62707	62706	30	4.0	72	100	80
HSP-M36	45689	62708	48728	36	6.3	84	130	100
HSP-M42	60321	62710	62709	42	8.0	98	130	130
HSP-M52	60323	62712	62711	52	12.5	117	150	130

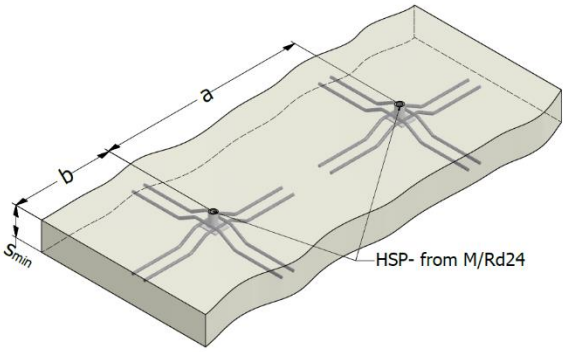
HSP-Rd	Product no.			Thread	Load group f_{cu}> 15 MPa	Overall length L	a	b
	Zinc galvanizing	Stainless steel SS4	Stainless steel SS2	Rd	[t]	[mm]	[mm]	[mm]
HSP-Rd12	45690	62785	62784	12	0.5	30	35	25
HSP-Rd16	45691	47483	45853	16	1.2	35	50	35
HSP-Rd20	45692	62786	60129	20	2.0	47	60	60
HSP-Rd24	45693	62787	47842	24	2.5	54	80	60
HSP-Rd30	45694	47434	62300	30	4.0	72	100	80
HSP-Rd36	45695	61244	61241	36	6.3	84	130	100
HSP-Rd42	60320	61245	61242	42	8.0	98	130	130
HSP-Rd52	60322	61246	61243	52	12.5	117	150	130

LIFTING SOCKETS HSP – INSTALLATION AND REINFORCEMENTS

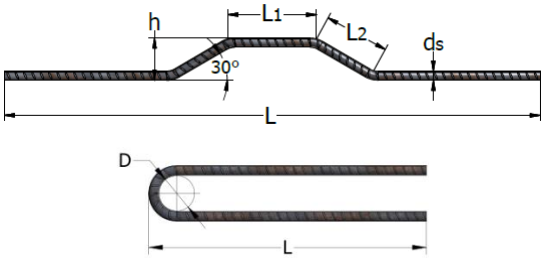








HSP M(Rd)	Load group	Minimum unit thickness	Anchor spacing	Edge distance	Mesh reinforcement
		Smin	a	b	
	[t]	[mm]	[mm]	[mm]	[mm²/m]
12	0.5	80	350	180	2 x 131
16	1.2	85	500	250	2 x 131
20	2.0	100	700	350	2 x 188
24	2.5	120	800	400	2 x 188
30	4.0	140	1000	500	2 x 221
36	6.3	160	1300	650	2 x 221
42	8.0	175	1300	650	2 x 513
52	12.5	215	1500	750	2 x 513



Note:

- The bend diameter D according to EN 1992-1-1 is not mandatory.

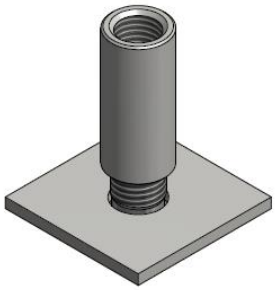
- Additional reinforcement must be placed and secured on top of the plate anchor and in direct contact with the plate.

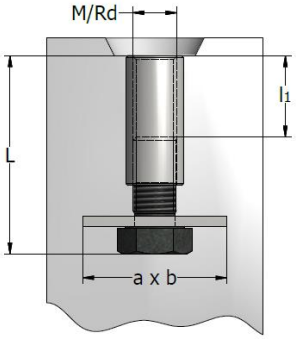
- For anchors with thread larger than M24, additional reinforcement must be placed crosswise in pairs.

- The dimensions in the illustrations are in [mm].

HSP M(Rd)	Additional reinforcement						Axial load ß ≤10°	Diagonal load 10°≤ ß≤30°			Diagonal load 30°≤ ß≤45°		
	number	d_s	L_1	L_2	H	L	Load capacity f_{cu}> 15MPa	Load capacity f_{cu}> 15MPa	Angled pull reinforcement Ø x L	Length before bending	Load capacity f_{cu}> 15MPa	Angled pull reinforcement Ø x L	Length before bending
	[pcs]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[mm]	[mm]	[kN]	[mm]	[mm]
12	2	6	60	60	30	250	5.0	5.0	Ø 6 x 150	310	4.0	Ø 6 x 150	310
16	2	8	90	70	35	420	12.0	12.0	Ø 6 x 250	510	9.6	Ø 8 x 200	420
20	2	10	90	80	40	640	20.0	20.0	Ø 8 x 250	520	16.0	Ø 8 x 300	620
24	4	10	100	100	50	640	25.0	25.0	Ø 8 x 300	620	20.0	Ø 10 x 300	620
30	4	12	110	110	55	850	40.0	40.0	Ø 10 x 350	720	32.0	Ø 12 x 400	820
36	4	14	140	120	60	1150	63.0	63.0	Ø 12 x 450	920	50.4	Ø 14 x 550	1120
42	4	16	140	120	60	1250	80.0	80.0	Ø 14 x 600	1220	64.0	Ø 16 x 600	1230
52	4	20	140	150	75	1550	125.0	125.0	Ø 16 x 700	1430	100.0	Ø 20 x 750	1570

LIFTING BOLT ANCHOR – HBP



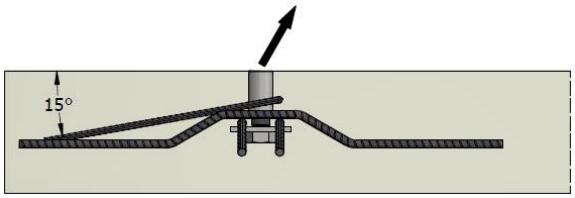


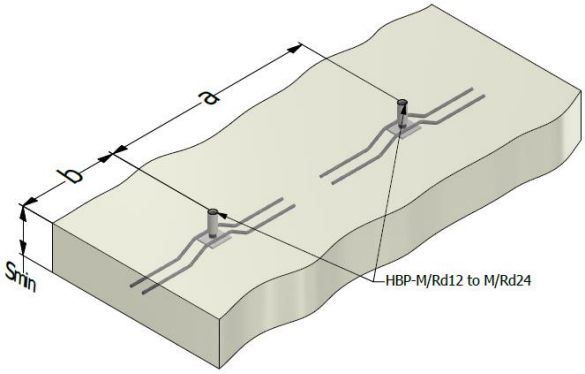
The lifting bolt anchor HBP is made of a threaded bush locked on a standard bolt and an anchorage plate. The threaded bush is made of steel S355J0, electrolytic galvanised (EV) or hot-dipped galvanised (TV); the bolt is made of steel 8.8 with no coating; and the plate is made of steel S235, also with no coating.
The threaded bush can also be made of stainless-steel W 1.4571 –AISI 316Ti (SS4).

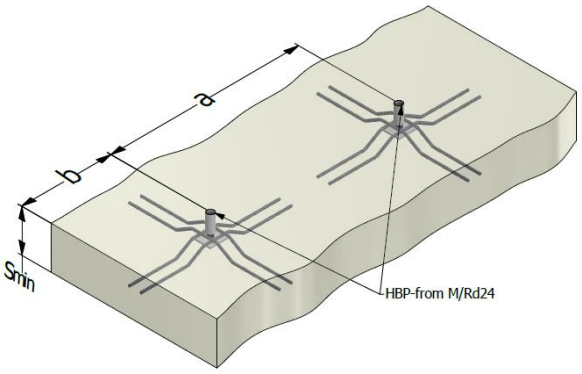
HBP-M	Product no.			Thread	Load group f_{cu}> 15 MPa	Overall length L	l_1	a	b	Screw
	Zinc galvanizing	Stainless steel SS4	Hot dipped galvanized	M	[t]	[mm]	[mm]	[mm]	[mm]	
HBP M12x55	43687	43688	45295	12	0.5	55	22.5	40	40	M12x25
HBP M16x75	43689	43690	45296	16	1.2	75	30	50	50	M16x35
HBP M20x90	43691	43692	45397	20	2.0	90	37.5	60	60	M20x40
HBP M24x110	43693	43694	45298	24	2.5	110	45	80	80	M24x50
HBP M30x140	43695	43696	46282	30	4.0	140	61	100	100	M30x60

HBP-Rd	Product no.			Thread	Load group f_{cu}> 15 MPa	Overall length L	l_1	a	b	Screw
	Zinc galvanizing	Stainless steel SS4	Hot dipped galvanized	Rd	[t]	[mm]	[mm]	[mm]	[mm]	
HBP Rd12x55	62987	62988	62989	12	0.5	55	22.5	40	40	M12x25
HBP Rd16x75	62990	62991	62992	16	1.2	75	30	50	50	M16x35
HBP Rd20x90	62993	62994	62995	20	2.0	90	37.5	60	60	M20x40
HBP Rd24x110	62996	62997	62998	24	2.5	110	45	80	80	M24x50
HBP Rd30x140	62999	63000	63001	30	4.0	140	61	100	100	M30x60

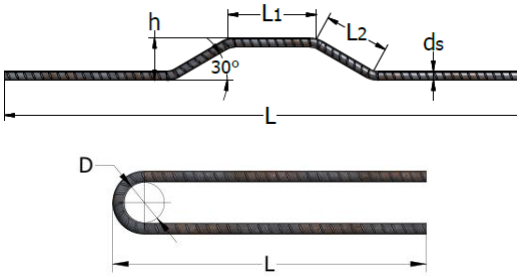
LIFTING SOCKETS HBP – INSTALLATION AND REINFORCEMENTS







HBP M(Rd)	Load group	Minimum unit thickness	Anchor spacing	Edge distance	Mesh reinforcement
		Smin	a	b	
	[t]	[mm]	[mm]	[mm]	[mm²/m]
12	0.5	105	350	180	2 x 188
16	1.2	130	500	250	2 x 188
20	2.0	145	700	350	2 x 188
24	2.5	175	800	400	2 x 188
30	4.0	210	1000	500	2 x 221



Note:

- The bend diameter D according to EN 1992-1-1 is not mandatory.

- Additional reinforcement must be placed and secured on top of the plate anchor and in direct contact with the plate.

- For anchors with thread larger than M24, additional reinforcement must be placed crosswise in pairs.

- The dimensions in the illustrations are in [mm].

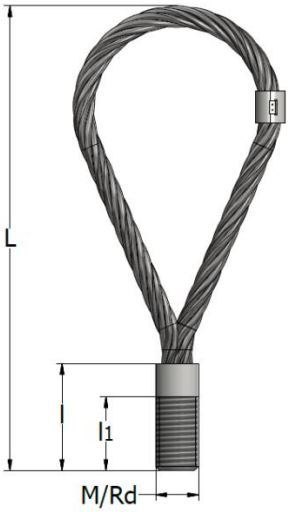
HBP M(Rd)	Additional reinforcement						Axial load ß ≤10°	Diagonal load 10°≤ ß≤30°			Diagonal load 30°≤ ß≤45°		
	number	d_s	L_1	L_2	H	L	Load capacity f_{cu}> 15MPa	Load capacity f_{cu}> 15MPa	Angled pull reinforcement Ø x L	Length before bending	Load capacity f_{cu}> 15MPa	Angled pull reinforcement Ø x L	Length before bending
	[pcs]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[mm]	[kN]		[mm]
12	2	6	60	60	30	250	5.0	5.0	Ø 6 x 150	310	4.0	Ø 6 x 150	310
16	2	8	90	70	35	420	12.0	12.0	Ø 6 x 250	510	9.6	Ø 8 x 200	420
20	2	10	90	80	40	640	20.0	20.0	Ø 8 x 250	520	16.0	Ø 8 x 300	620
24	4	10	100	100	50	640	25.0	25.0	Ø 8 x 300	620	20.0	Ø 10 x 300	620
30	4	12	110	110	55	850	40.0	40.0	Ø 10 x 350	720	32.0	Ø 12 x 400	820

LIFTING SYSTEMS

THREADED LIFTING LOOP - THL

Threaded lifting loops are suitable for use with all sizes of threaded lifting sockets. It is an economical lifting system that can be used for most applications, especially for on-site operations. **Threaded lifting loops are not suitable for turning or tilting. If the loops are kept in storage for reuse, they must be inspected every six months and retested every year. These lifting systems are not recommended for intensive reuse conditions.**
Threaded lifting loops should only be attached to the concrete unit and used after the concrete strength has reached 15 MPa. In some cases, it may be economical and practical to leave this lifting loop with the concrete unit for final installation.

The threaded lifting loop is made of high-grade steel wire rope according EN 12385-4, swaged in a steel ferrule S355J0. It is zinc-plated for protection against corrosion. A label marked with the admissible load, the thread type and the code number of the testing is attached to each threaded lifting loop. **Before use, 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 any further lifting.**



THL-M	Thread	Product no.	THL-Rd	Thread	Product no.	Load group	l_1	l	Wire diam.	L (approx.)
	M			Rd		[t]	[mm]	[mm]	[mm]	[mm]
THL-M12	12	45079	THL-Rd12	12	45737	0.5	18	30	6	155
THL-M16	16	45081	THL-Rd16	16	45738	1.2	24	37	8	155
THL-M20	20	45083	THL-Rd20	20	45739	2.0	30	48	10	215
THL-M24	24	45084	THL-Rd24	24	45740	2.5	36	54	12	255
THL-M30	30	45085	THL-Rd30	30	45741	4.0	45	68	16	300
THL-M36	36	45086	THL-Rd36	36	45742	6.3	54	82	18	340
THL-M42	42	45087	THL-Rd42	42	45743	8.0	63	96	20	425
THL-M52	52	45088	THL-Rd52	52	45744	12.5	85	110	26	510

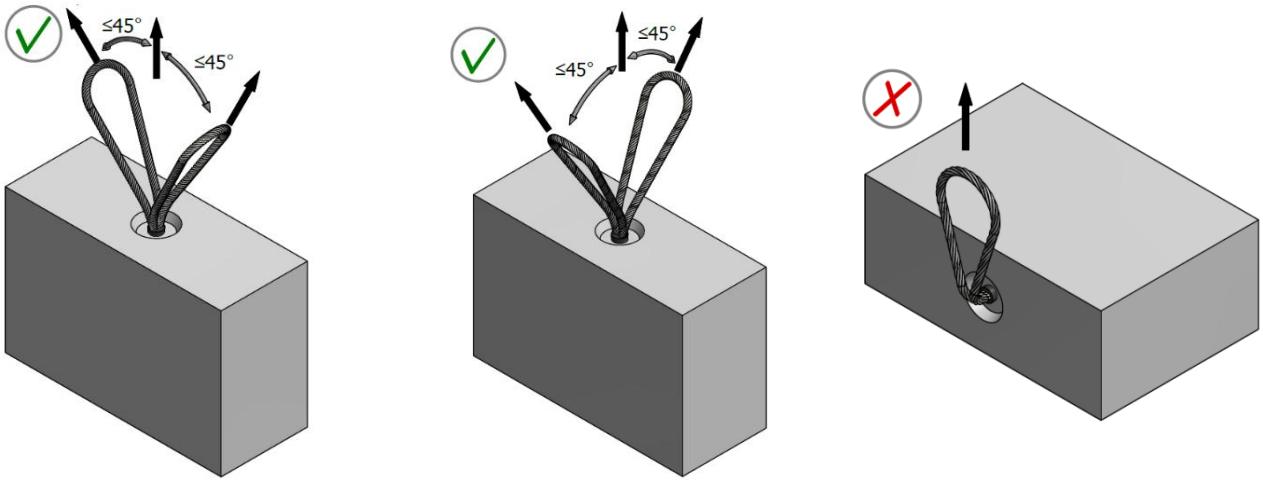
THL – APPLICATIONS

SCREWING DETAILS

Ensure that the thread is fully bottomed out in the socket before lifting. Backing off one turn is permitted to ensure that the wire is correctly aligned for 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.**

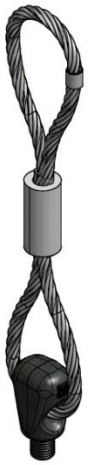
ADMISSIBLE LOAD DIRECTION

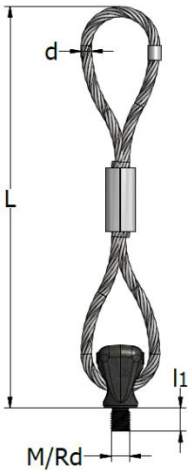
Threaded lifting loops are not suitable for turning or tilting.



LIFTING SLING - THS1

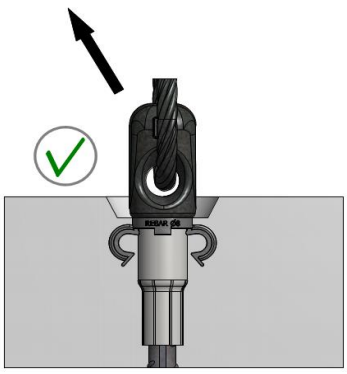
The threaded lifting sling is made of high-grade steel wire rope according EN 12385-4, swaged in a ferrule made of AlMg1.8 and a steel bolt made of high-strength steel. It is zinc-plated for protection against corrosion. Every lifting system is individually tested at 3 times the working load and comes 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.



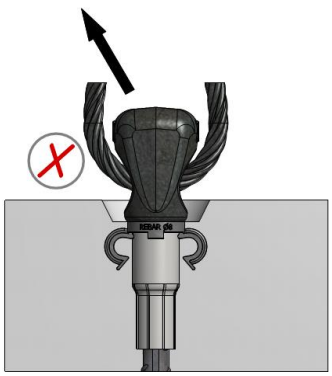


THS1-M	Product no.	Thread	THS1-Rd	Product no.	Thread	Load group	Axial load	L	d	l_1	Wire length
		M			Rd	[t]	[kN]	[mm]	[mm]	[mm]	[mm]
THS1-M12	45890	12	THS1-Rd12	46378	12	1.3	13	310	8	20	700
THS1-M16	45891	16	THS1-Rd16	46379	16	2.5	25	400	12	20	950
THS1-M20	45892	20	THS1-Rd20	46380	20	4.0	40	440	14	25	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, 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.

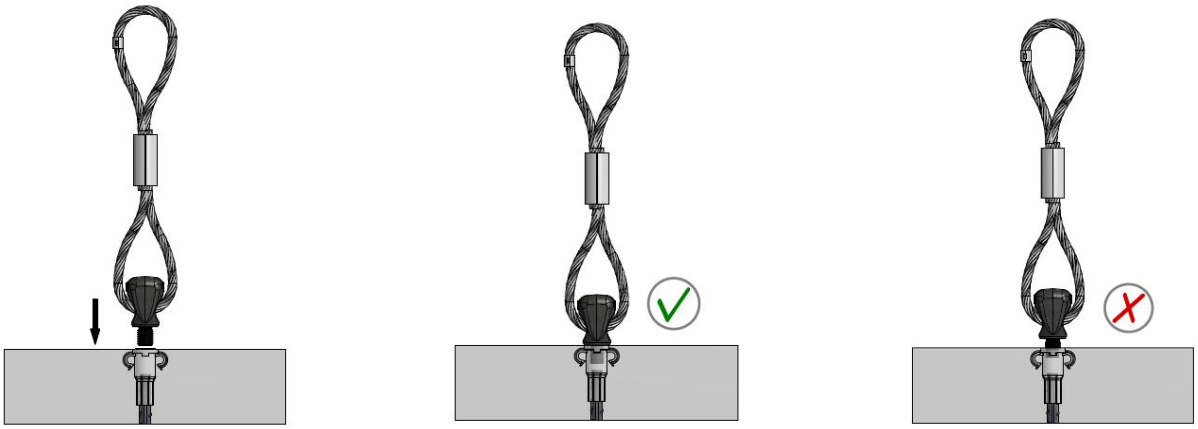


Diagonal or shear load is not permitted in this case.

THS1 – APPLICATIONS

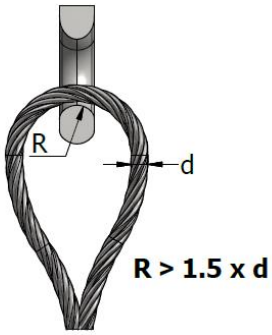
SCREWING DETAILS

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.**

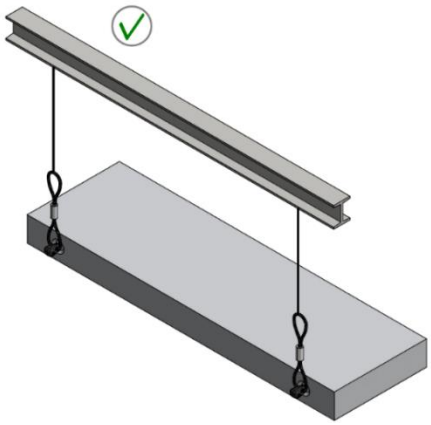


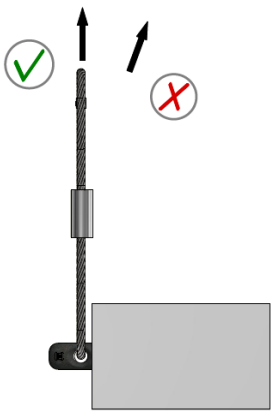
The preferred option is the vertical lift. Normally the angle of lift (ß) should not be greater than 30°. **Pulling back towards the unit is not permitted.**

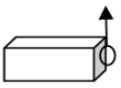
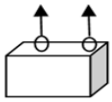
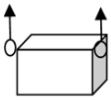
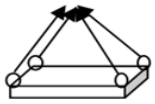
ADMISSIBLE LOAD DIRECTION



Note: Minimum radius of the crane hook for the wire loop must be **R =2 x d for cable with d ≤ 19 mm and R=5 x d for cable with d ≥ 20 mm.**





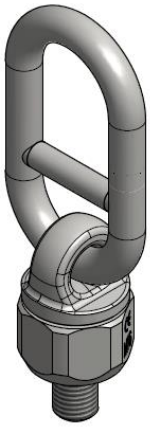
Number of pieces	1	1	2	2	2	2	3 or 4	3 or 4
Type of attachment								
Angle of inclination	0°	90°	0°	90°	0° - 45°	45° - 60°	0° - 45°	45° - 60°
THS1-M/Rd	WLL group	Axial load	Load group	Axial load	Load group	Axial load	Load group	Axial load
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
THS1-M/Rd12	13	6.5	26	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

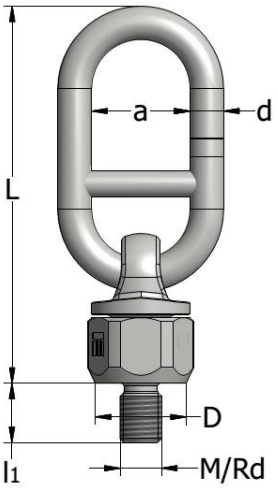
GENERAL GUIDANCE FOR LIFTING WITH TERWA THL and THS1

Ensure that the concrete has MPa strength of at least 15 or 20 before beginning lifting.
The first choice for most lifting applications is the lifting socket with waved rebar tail (TGK, TGL). 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 lifting systems are tested before delivery under a test load three times the working load (individual test for THS1) and test for every batch of THL).

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, of course, 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. 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 in flush with the surface of the unit or recessed using 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	Colour
		M	[t]	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	
THS3-HD-M12	61703	12	1.3	13	124	34	11	30	18	Red RAL 3020
THS3-HD-M16	61704	16	2.5	25	145	38	13	35	23.5	Dark grey RAL 7043
THS3-HD-M20	61705	20	4.0	40	169	45	15	44	29.5	Green RAL 6024
THS3-HD-M24	62748	24	5.0	50	198	49	17	44	35.5	Blue RAL 5017
THS3-HD-M30	62749	30	7.5	75	230	60	20	59	45.5	Light grey RAL 7004
THS3-HD-M36	62750	36	10.0	100	264	64	24	59	54.5	Orange RAL 2009
THS3-HD-M42	62751	42	12.5	125	285	68	26	75	59	Yellow RAL 1023
THS3-HD-M52	60828	52	15.0	150	307	72	31	84	69	Black RAL 9017

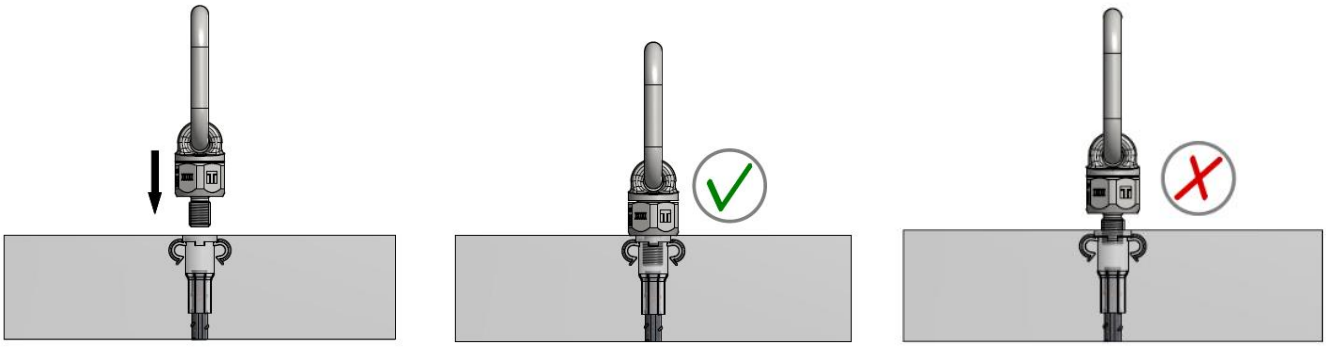
THS3-Rd	Product no.	Thread	Load group	Axial load	L	a	d	D	l_1	Colour
		Rd	[t]	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	
THS3-HD-Rd12	61706	12	1.3	13	124	34	11	30	18	Red RAL 3020
THS3-HD-Rd16	61707	16	2.5	25	145	38	13	35	23.5	Dark grey RAL 7043
THS3-HD-Rd20	61708	20	4.0	40	169	45	15	44	29.5	Green RAL 6024
THS3-HD-Rd24	62752	24	5.0	50	198	49	17	44	35.5	Blue RAL 5017
THS3-HD-Rd30	62753	30	7.5	75	230	60	20	59	45.5	Light grey RAL 7004
THS3-HD-Rd36	62754	36	10.0	100	264	64	24	59	54.5	Orange RAL 2009
THS3-HD-Rd42	62755	42	12.5	125	285	68	26	75	59	Yellow RAL 1023
THS3-HD-Rd52	60829	52	15.0	150	307	72	31	84	69	Black RAL 9017

THS3 – APPLICATIONS

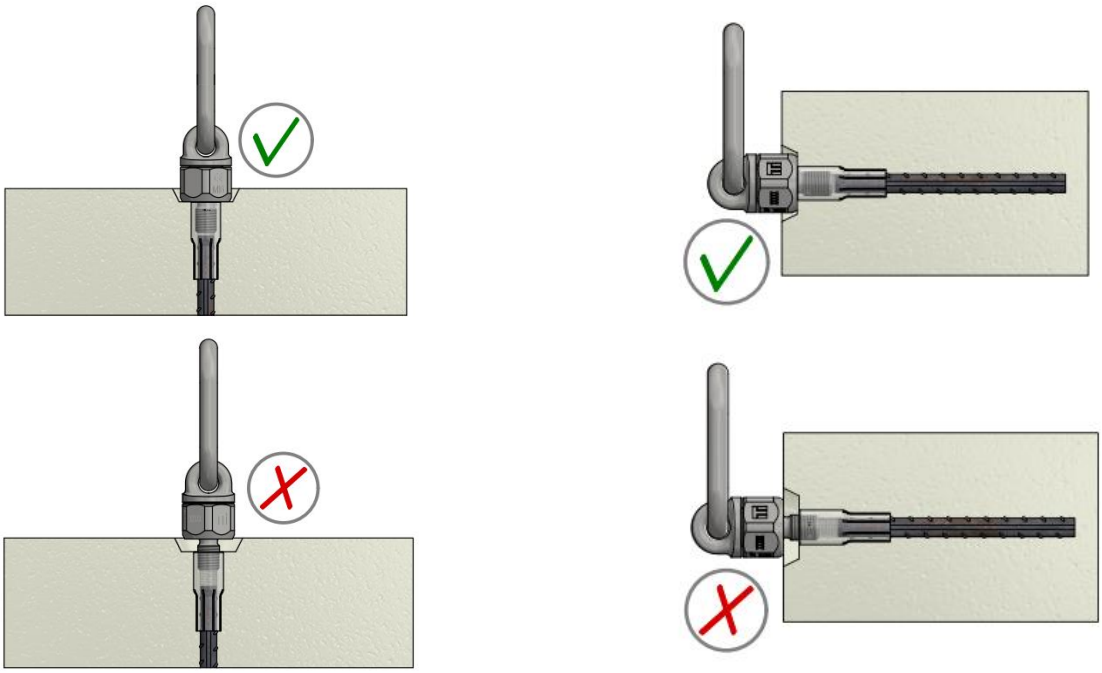
SCREWING DETAILS

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!

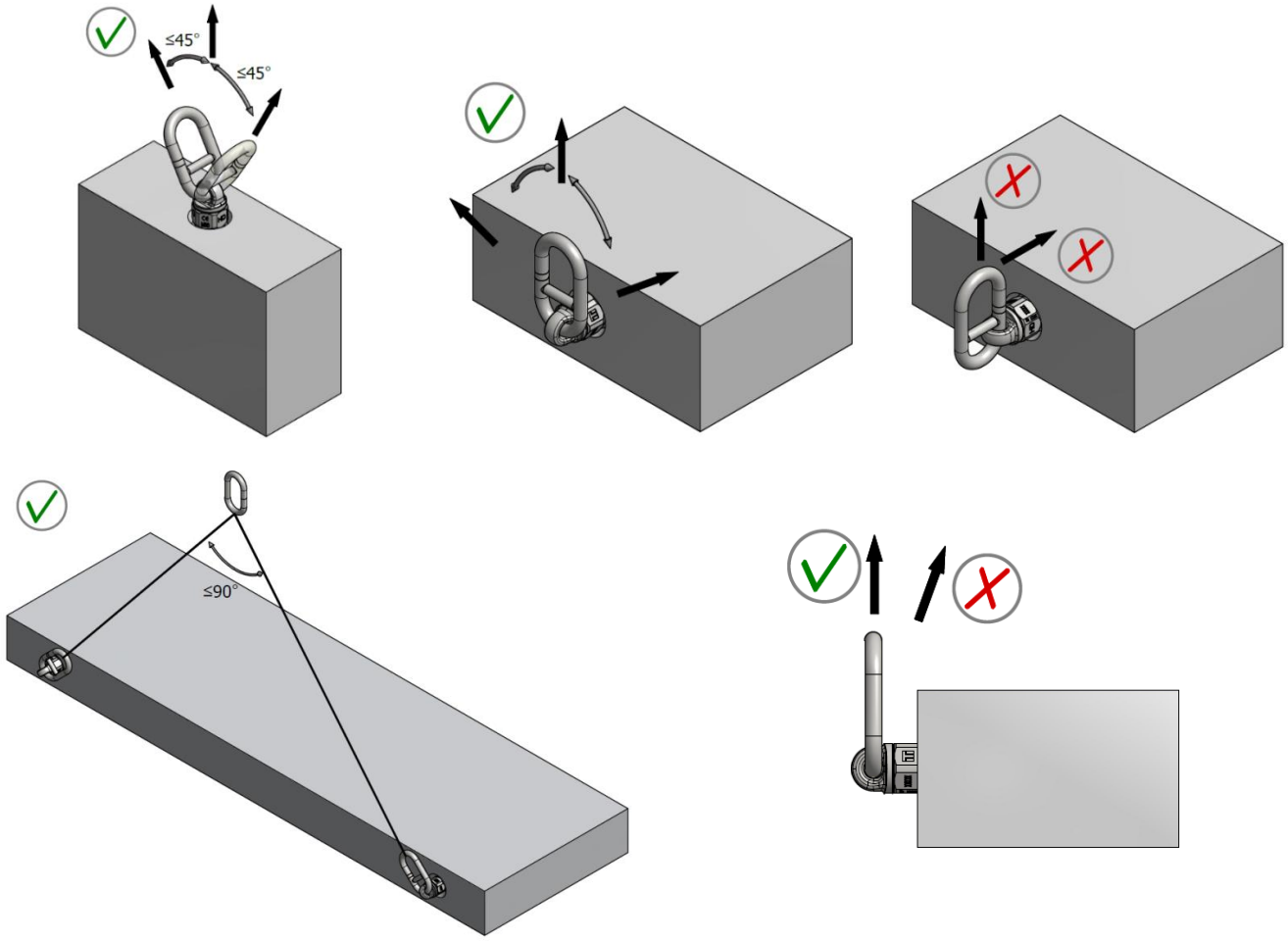
Ensure that the thread is fully bottomed out in the socket before lifting. **No gaps are permitted between the concrete element and the body of the lifting system: the thread must be fully threaded inside the socket.**

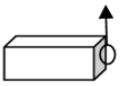
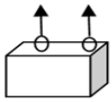
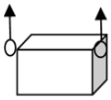
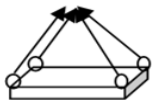


The preferred option is the vertical lift. Normally the angle of lift (ß) should not be greater than 30°. Pulling back towards the unit is not permitted. The chain link of the swivel lifting eye must be properly aligned in the direction of the force application and must be freely movable.



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 (ß) should not be greater than 30°. Pulling back towards the unit is not permitted.

GENERAL GUIDANCE FOR LIFTING WITH TERWA THS3

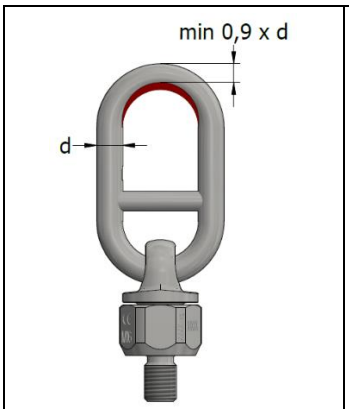
Ensure that the concrete has MPa strength of at least 15 before beginning lifting.
For positioning the inserts, always check the permitted edge distances and spacing between inserts.
We recommend restricting the lift angle to a maximum of 30° when an angled lift is necessary.
To choose the proper lifting 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 lifting systems are tested before delivery under a test load three times the working load (individual test for THS3).

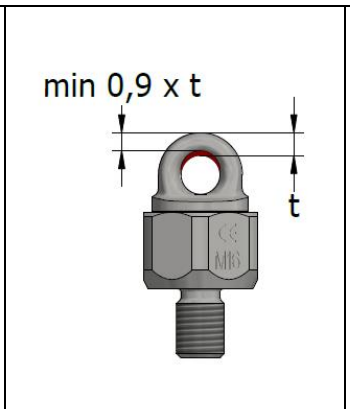
CHECKING THE LIFTING SYSTEM

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.

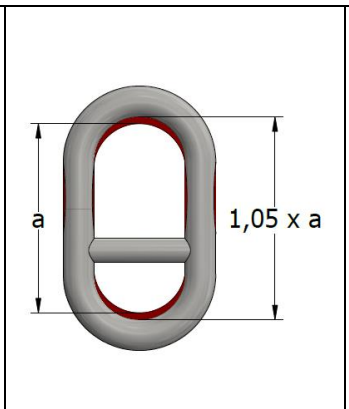
- ***Any deformation of the oval link, thread, or metal structural elements causes a weakening of the lifting device with the risk of falling of the precast element. Do not perform any repair work. The lifting device must be discarded.***
- ***Damage, distortions, cracks, and extensive corrosion can 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.***

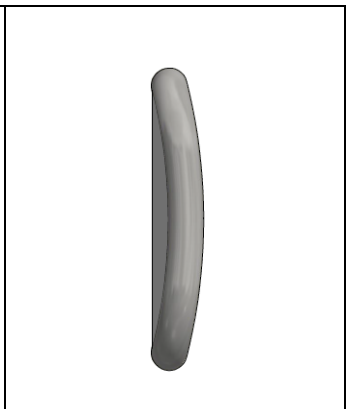
The lifting bolt thread must be regularly checked for signs of damage. Re-cutting the thread is not permitted.
Combining products from different companies is not recommended.





Damage by severe wear





Damage by distortion

SAFETY INSTRUCTIONS

Warning: Use only trained personnel. Use of 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.

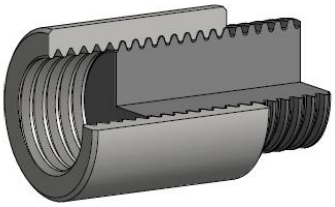
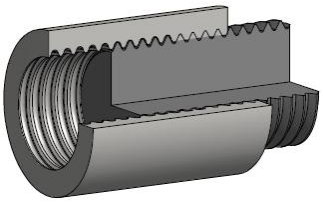
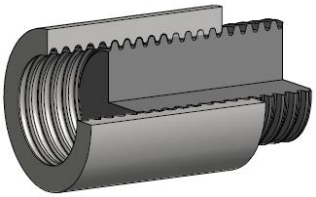
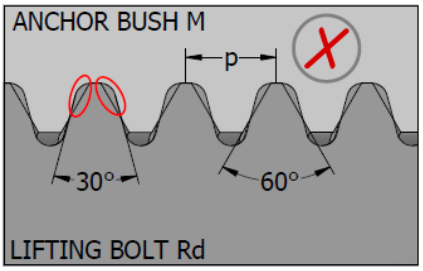
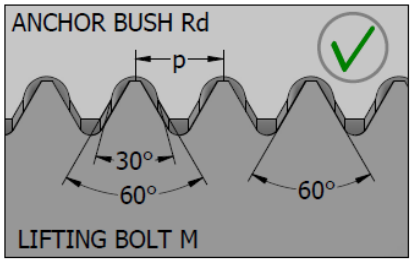
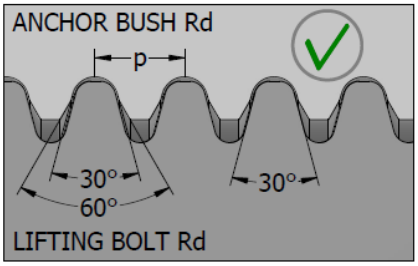
Obligatory instructions for safe working:
- All lifting anchors and lifting devices must be operated manually
- Visually inspect lifting anchors before use; check and clean all lifting inserts prior to use
- Hook in all lifting systems separately, without using force

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 suitably qualified personnel.

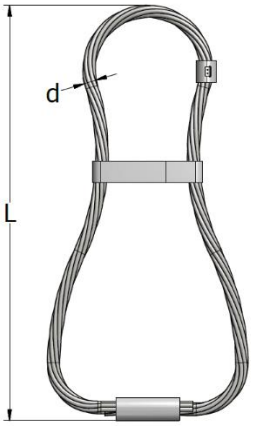
SPECIAL THREAD DESCRIPTION

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.

M thread bush and Rd thread bolt	***Rd thread bush and metric thread bolt***	***Rd thread bush and Rd thread bolt***
		
		

CAST-IN LIFTING LOOPS – TIL

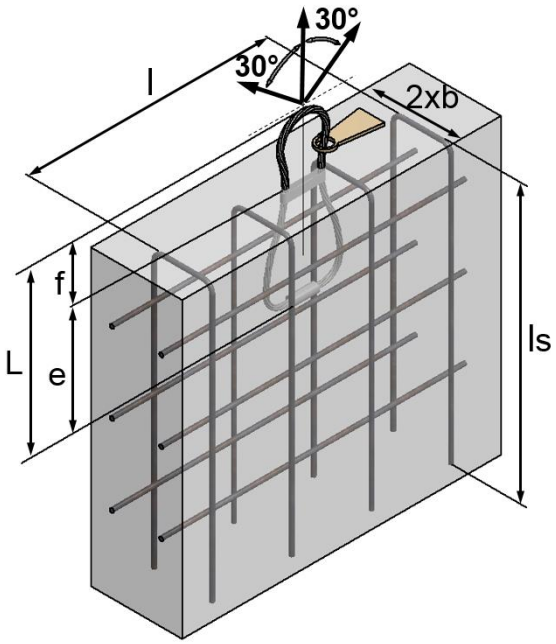
Cast-in lifting loops are the most economical lifting system. They require relatively large edge distances. Take the exposure of steel wire loops after the installation of the concrete unit into consideration. Once the unit is set in the final position, protruding loops can be cut off, if necessary, but the cut ends must be protected against corrosion to prevent staining from rust. The steel wire rope is more suitable for forming a cast-in loop because it is flexible, and the lifting loop made from reinforcing bar is liable to fatigue, especially if bent during angled lift. The minimum dimensions for installation in reinforced concrete are indicated in the table below. Additional lateral reinforcement may be required for acute angled lifts. Cast-in lifting loops are made of a high-grade steel wire rope according to EN 12385-4, swaged in a ferrule made of AlMg1.8, with a fixing strip in the middle with an identification label, which must not slide down the hoop during casting and should remain visible. Each lifting loop has a label attached, marked with the admissible load and the code number of the testing. Cast-in lifting loops are zinc-plated for protection against corrosion. These lifting systems are suitable for use through a single cycle from production to final installation. They are not suitable for multiple use applications. To choose the correct size for any lift, it is important to consider the angle of lift, the crane factor and the adhesion to the formwork.
Cast-in lifting loops must be installed in the direction of the expected load. They should be suspended from supports attached to the formwork so that 2/3 of the loop will be cast in and 1/3 will remain exposed. The loops must be fastened to the reinforcement cage to avoid movement during concreting. Avoid bending the steel wire rope while the precast unit is in storage. Exposed loops can be attached to standard crane hooks, but the curvature radius of the crane hook should at least be equal to the diameter of the wire rope. It is essential to check that the wire rope is in good condition, with no broken, crushed or unravelled wire. Also, do not use if there are kinks in the loop or the wire rope is badly corroded - discard in accordance with EN 13414-1! Cast-in lifting loops with any signs of damage should not be used.



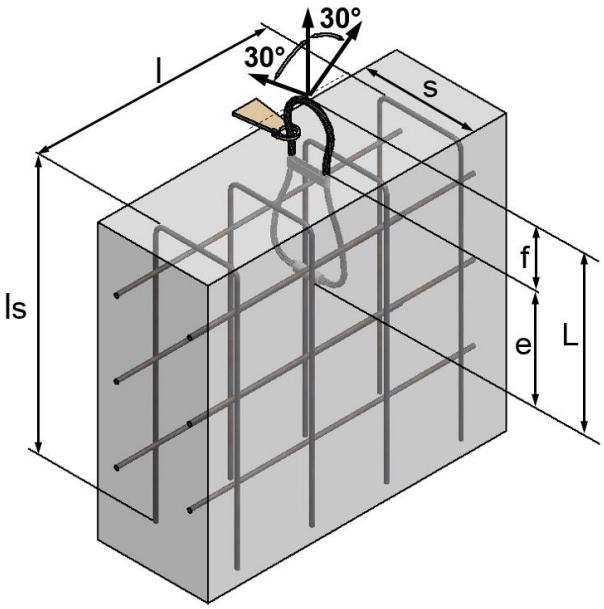
TIL	Product no.	Overall length	Wire rope dimensions		Load group
		L	d	L	f_{cu}> 30 MPa
		[mm]	[mm]	[mm]	[t]
TIL-008-210	44812	210	6	540	0.8
TIL-012-225	44813	225	7	570	1.2
TIL-016-235	44814	235	8	615	1.6
TIL-020-275	44815	275	9	690	2.0
TIL-025-315	44816	315	10	780	2.5
TIL-040-340	44817	340	12	860	4.0
TIL-052-360	43599	360	14	1010	5.2
TIL-063-390	43600	390	16	1100	6.3
TIL-080-440	43601	440	18	1250	8.0
TIL-100-525	44818	525	20	1350	10.0
TIL-125-570	43602	570	22	1500	12.5
TIL-160-615	44819	615	26	1650	16.0
TIL-200-730	44820	730	28	1900	20.0
TIL-250-800	44821	800	32	2000	25.0
TIL-320-770	46961	770	36	2225	32.0
TIL-370-950	46962	950	36	2500	37.0
TIL-470-1100	46963	1100	44	3000	47.0
TIL-520-1200	47324	1200	44	3350	52.0

GENERAL GUIDANCE FOR CAST-IN WIRE LOOP SYSTEMS

Cast-in lifting loops TIL are used for lifting the precast concrete elements, especially beams. The lifting loop can easily be placed in the reinforcement cage of a precast unit. Part of the lifting system remains outside of the precast element for mounting the crane hook and lift.



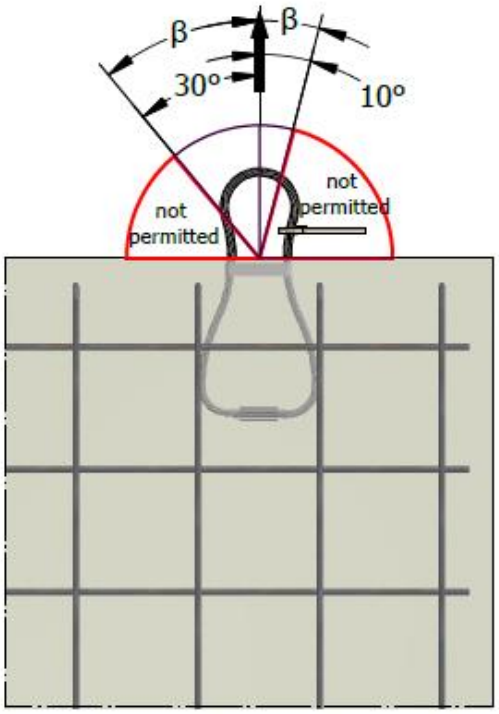
Longitudinal installation

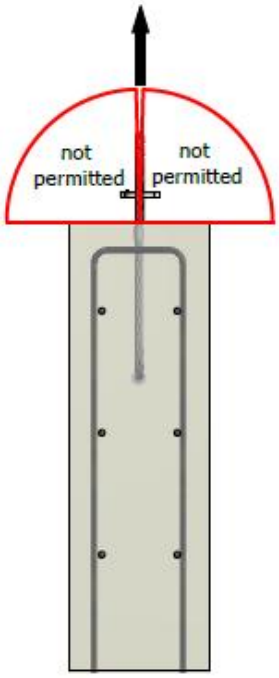


Transversal installation

Installation details and reinforcement required for TIL – cast-in lifting system

TIL	Dimensions cast-in		Surface reinforcement	Reinforcement dimension		Axial pull ß ≤10° Load capacity f_{cu}> 15 MPa	Diagonal pull ß ≤30° Load capacity f_{cu}> 15 MPa	Axial pull ß ≤10° Load group f_{cu}> 30 MPa	Diagonal pull ß ≤30° Load capacity f_{cu}> 30 MPa
	f	e		Min ls	Min l				
	[mm]	[mm]	[mm²/m]	[mm]	[mm]	[t]	[t]	[t]	[t]
TIL-008-210	60	150	188	250	400	0.7	0.5	0.8	0.6
TIL-012-225	65	160	188	300	450	1.1	0.9	1.2	1.0
TIL-016-235	70	165	188	350	500	1.5	1.2	1.6	1.3
TIL-020-275	75	200	188	350	550	1.8	1.4	2.0	1.6
TIL-025-315	85	230	188	450	650	2.3	1.8	2.5	2.0
TIL-040-340	100	240	188	500	700	3.6	2.9	4.0	3.2
TIL-052-360	100	260	257	550	800	4.7	3.8	5.2	4.2
TIL-063-390	110	280	257	600	950	5.7	4.6	6.3	5.0
TIL-080-440	120	320	257	700	1050	7.2	5.8	8.0	6.5
TIL-100-525	135	390	257	800	1200	9.0	7.2	10.0	8.0
TIL-125-570	150	420	257	900	1300	11.3	9.0	12.5	10.0
TIL-160-615	165	450	424	1000	1500	12.8	10.0	16.0	12.8
TIL-200-730	180	550	424	1150	1700	18.0	14.5	20.0	16.0
TIL-250-800	200	600	524	1300	1950	20.0	16.0	25.0	20.0
TIL-320-770	220	550	Reinforcement must be designed by the lifting design engineer and placed in accordance with the approved lifting design.			25.6	20.5	32.0	25.5
TIL-370-950	275	675				29.6	23.7	37.0	29.5
TIL-470-1100	320	780				37.6	30.0	47.0	37.5
TIL-520-1200	350	850				41.6	33.3	52.0	41.6

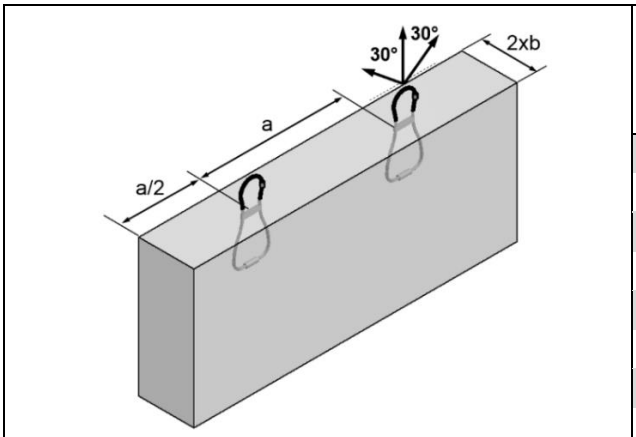


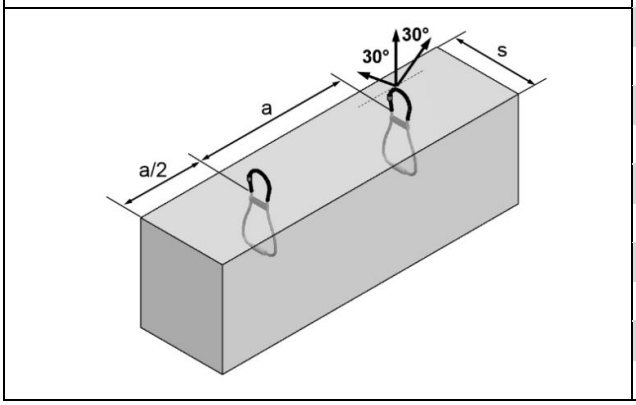


Load direction for cast in wire loop - TIL

Note:

Diagonal pull up to 30° is admissible.
No lateral pull resulting from tilting is permissible.



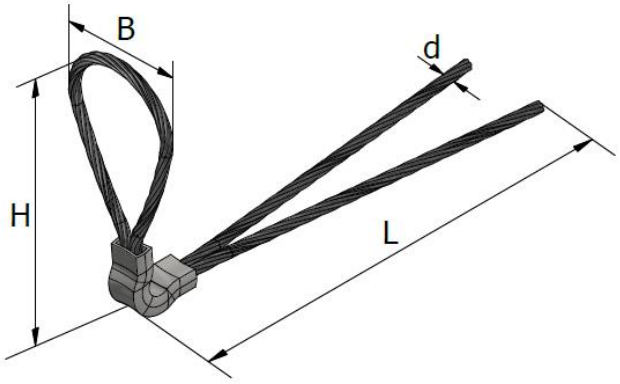


TIL	Installation dimensions		Minimum width of precast element	
	a/2	a	s	2xb
	[mm]	[mm]	[mm]	[mm]
TIL-008-210	270	540	140	80
TIL-012-225	310	620	150	100
TIL-016-235	345	690	170	120
TIL-020-275	415	830	180	140
TIL-025-315	445	890	190	160
TIL-040-340	500	1000	220	200
TIL-052-360	515	1030	300	240
TIL-063-390	575	1150	320	280
TIL-080-440	645	1290	410	300
TIL-100-525	730	1460	440	320
TIL-125-570	810	1620	570	360
TIL-160-615	930	1860	630	420
TIL-200-730	1060	2120	680	450
TIL-250-800	1205	2410	760	500
TIL-320-770	1350	2700	800	540
TIL-370-950	1480	2960	830	580
TIL-470-1100	1645	3290	940	630
TIL-520-1200	1870	3740	1050	690

BENDED LOOP - TBL

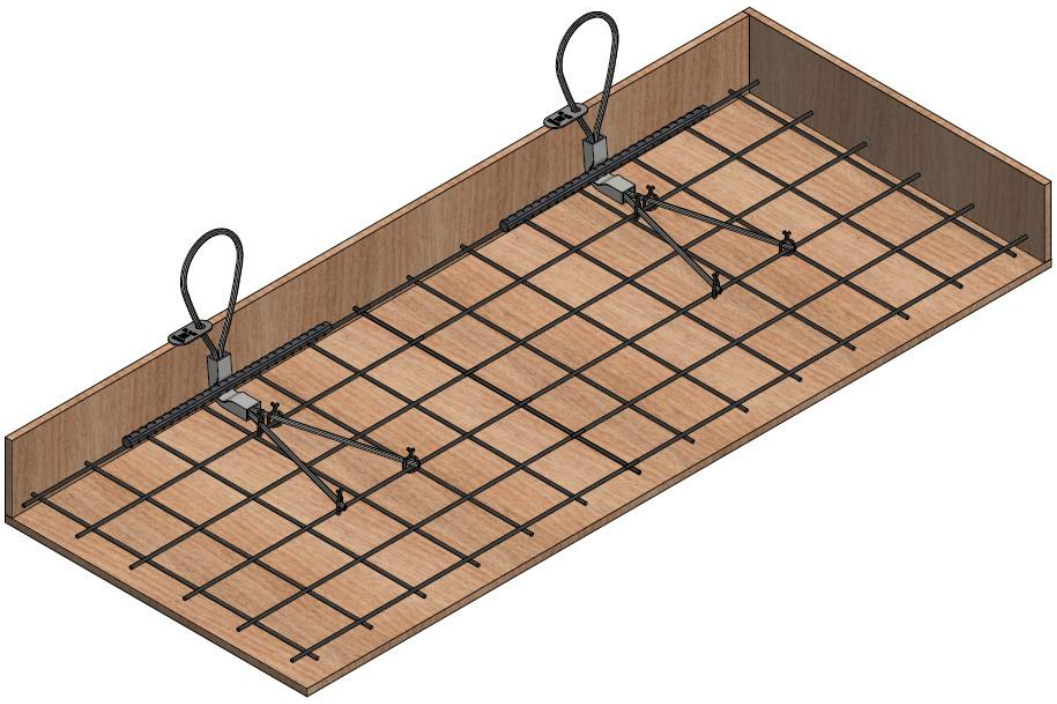
The threaded lifting loop is made of high-grade steel wire rope according EN 12385-4, swaged in a steel ferrule made of steel S355JR. A label marked with the admissible load and the code number of the testing is attached to each bended lifting loop. **Before use, check that the wires are in good condition. Do not use if the wire cable is bent, crushed or kinked or if there is any loosening of the outer layer. Discard if the wire is corroded according EN 13414-1.**

Avoid bending the steel wire rope while the precast unit is in storage. Exposed loops can be attached to standard crane hooks, but the curvature radius of the crane hook should at least be equal to the diameter of the wire rope. It is essential to check that the wire rope is in good condition, with no broken, crushed or unravelled wire. Bent lifting loops with any signs of damage should not be used.



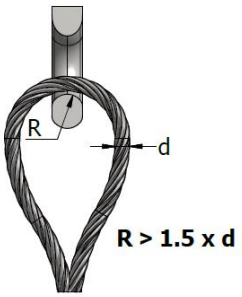
TBL	Product no.	Load group f_{cu}> 30 MPa [kN]	Wire rope dimensions				Weight
			d	H	L	B	
			[mm]	[mm]	[mm]	[mm]	[kg/pc]
TBL-008	63419	8	6	205	280	90	0.26
TBL-016	63420	16	8	205	330	90	0.42
TBL-024	63421	24	10	280	330	120	0.70
TBL-040	63422	40	12	280	380	140	1.00

INSTALLATION AND REINFORCEMENTS



Before concreting the precast element, the bent loops are installed into the mould. To avoid movement during concrete pouring the bent loops must be tied to the mesh reinforcement. An additionally reinforcement bar must be placed above the bent sleeve with pressure contact. Both open ends of the bent loop must be tied at a distance of approximately 300 mm.
The lifting devices can be hooked on the upper end of the bent loop only after the concrete strength has reached 15 MPa.
These lifting systems are suitable for use through a single cycle from production to final installation. They are not suitable for multiple use applications.
Avoid bending the steel wire rope while the precast unit is in storage. Exposed loops can be attached to standard crane hooks, but the curvature radius of the crane hook should at least be equal to the diameter of the wire rope. It is essential to check that the wire rope is in good condition, with no broken, crushed or unravelled wire. Also, do not use if there are kinks in the loop or the wire rope is badly corroded - discard in accordance with EN 13414!

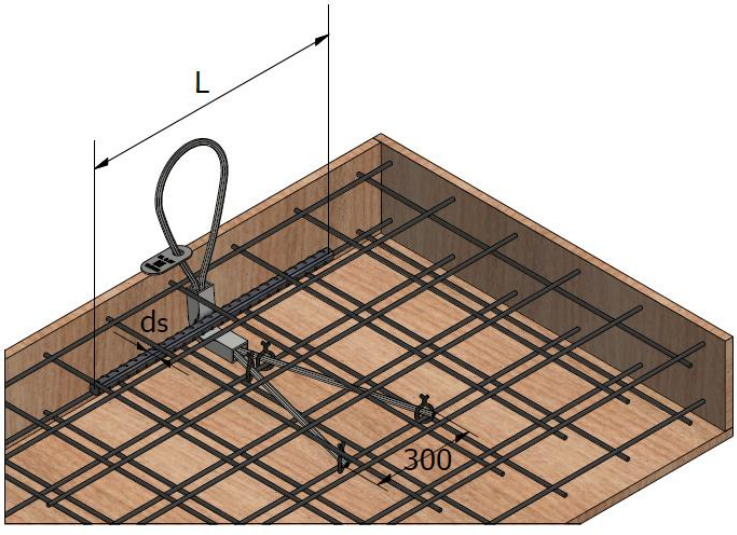
Recommended radii of used lifting hook:



Note: *Minimum radius of the crane hook*
R = 2 x d for cable d ≤ 19 mm
R = 5 x d for cable d ≥ 20 mm

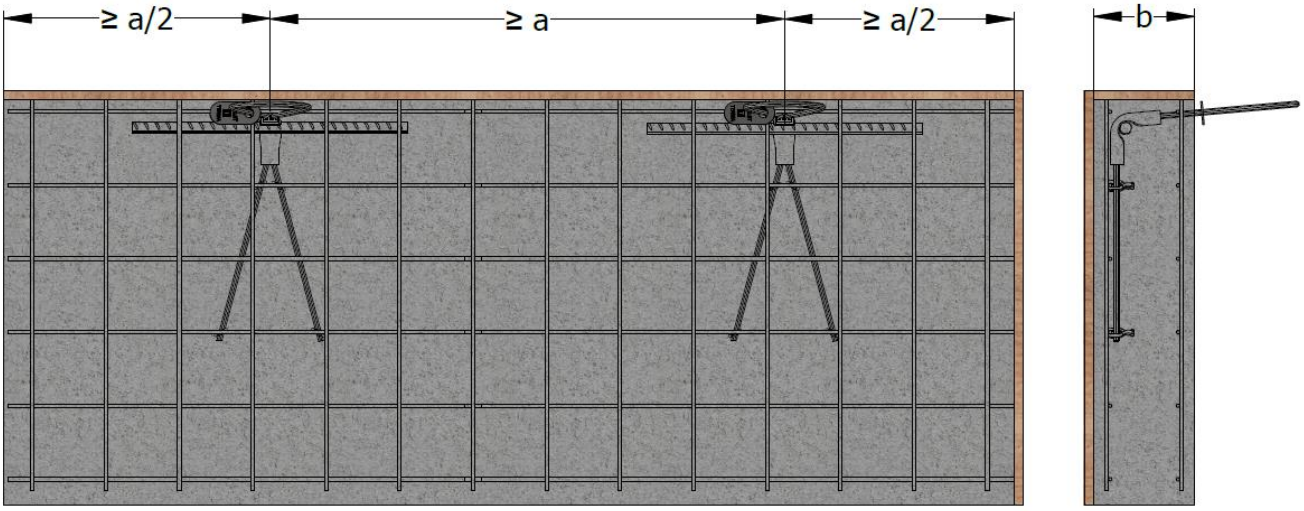
REINFORCEMENTS

For installing of bent loop, the precast concrete elements must be reinforced with a minimum mesh reinforcement. The additionally reinforcement rebar should be placed above and in pressure contact with the bent tube sleeve.
During the initial lifting, the concrete strength must have minimum 15 N/mm².



TBL	Load group f_{cu}> 15 MPa [kN]	Mesh reinforcement [mm²/m]	Additional reinforcement ds [mm]	Additional reinforcement L [mm]
TBL-008	8	188	10	300
TBL-016	16	188	12	300
TBL-024	24	188	14	300
TBL-040	40	188	16	350

Important! Welding or other strong heat influences on the bent loop are not allowed.



Installation dimensions are given in table below.

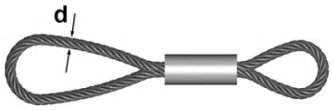
TBL	Load group f_{cu}> 15 MPa [kN]	Minimum distance from edge a/2 [mm]	Minimum centre to centre distances a [mm]	Minimum concrete element thickness b [mm]
TBL-008	8	240	480	120
TBL-016	16	240	480	120
TBL-024	24	240	480	150
TBL-040	40	300	600	200

CHECKING THE LIFTING SYSTEM

- ***Any modification to the wire rope (see the type of damages mentioned below), oval link, thread, or metal structural elements weakens the lifting device with the risk of the precast element falling. 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

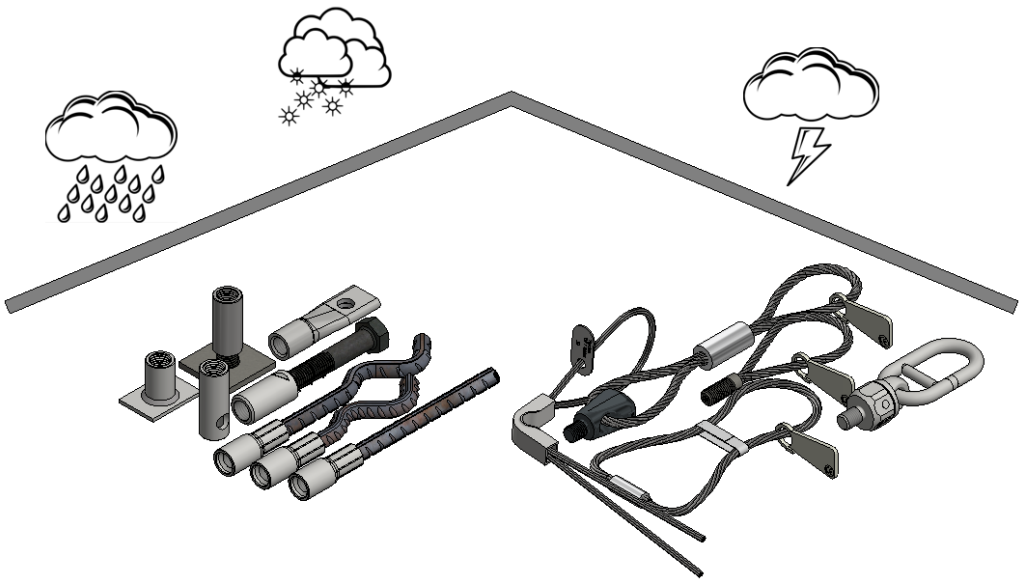
d = cable diameter

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 lifting bolt contact point with more than 4 broken wires on stranded cables or more than 10 broken 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

Types of wire rope damages		
		
Kinking	**Severe wear**	**Bird caging**
		
Broken wire	**Corrosion**	**Closing bush damage**

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.



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.

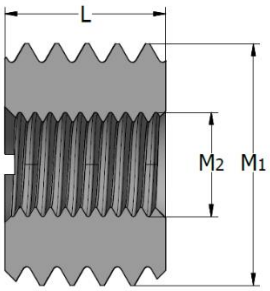
Obligatory instructions for safe working:

- All lifting anchors 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.

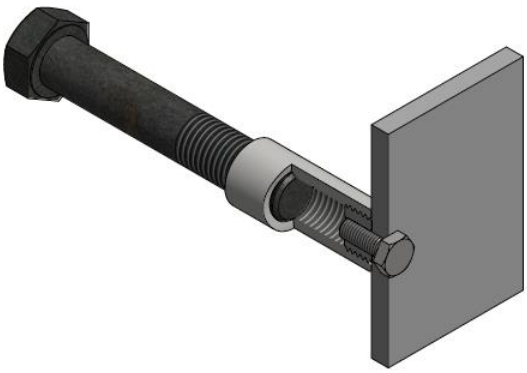
ACCESSORIES

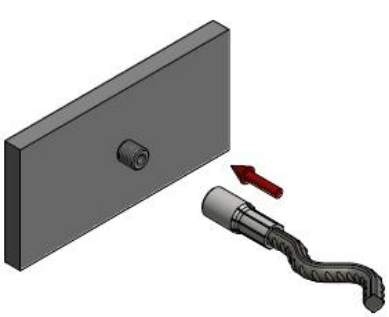
DOUBLE METRIC MOUNTING PLUG–SN

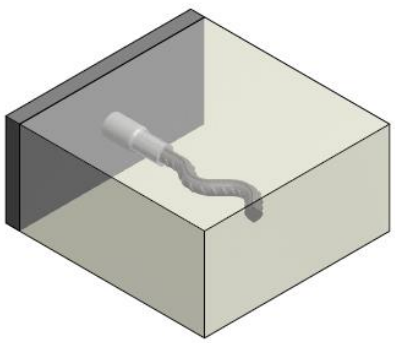


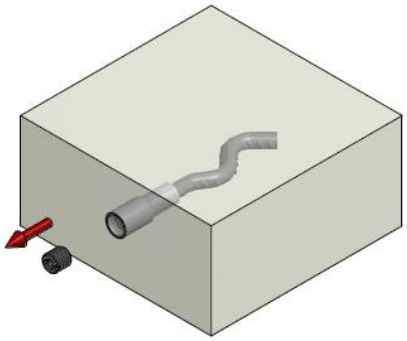
SN	Product no.	Thread M1	Thread M2	L [mm]
SN M12-M6	45214	12	6	16
SN M16-M8	45215	16	8	16
SN M20-M8	45216	20	8	16
SN M24-M8	46303	24	8	16
SN M24-M10	45217	24	10	16
SN M30-M10	45218	30	10	16
SN M30-M8	46079	30	8	16
SN M36-M10	45219	36	10	25
SN M42-M10	45220	42	10	30
SN M48-M10	45464	48	10	36
SN M48-M12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



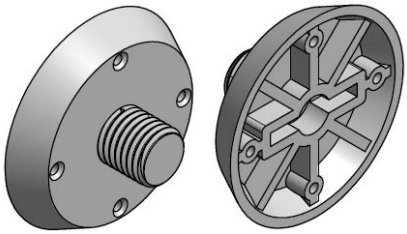


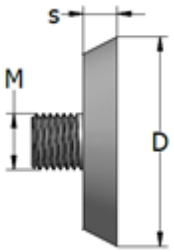




PLASTIC NAILING PLATE KU-10

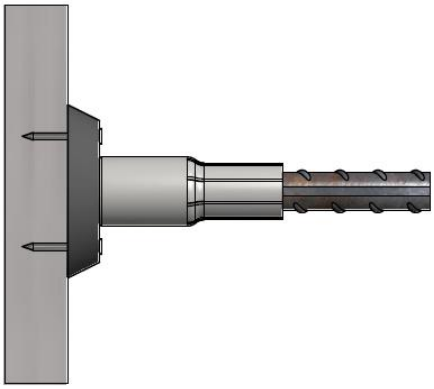
The nailing plates KU-10 are used for affixing the anchors and the lifting sockets to the formwork with nails. The fixing flange ensures a minimum recess around the head of the anchor. The recess is filled with fine concrete for protection against corrosion.

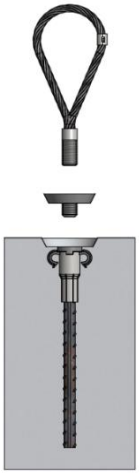


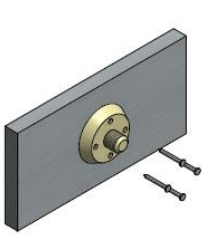


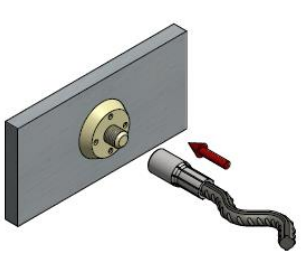
KU-10	Product no.	Thread	Diam. D	Diam. d	s	Colour
		M	[mm]	[mm]	[mm]	
KU-10-M12	63246	12	47	37	10	Red RAL 3020
KU-10-M16	63256	16	47	37	10	Grey RAL 7043
KU-10-M20	63257	20	60	50	10	Green RAL 6024
KU-10-M24	63258	24	60	50	10	Blue RAL 5017
KU-10-M30	63259	30	73	63	10	Light grey RAL 7004
KU-10-M36	63260	36	73	63	10	Orange RAL 2009
KU-10-M42	63261	42	96	86	12	Yellow RAL 1023
KU-10-M52	63262	52	96	86	12	Black RAL 9017

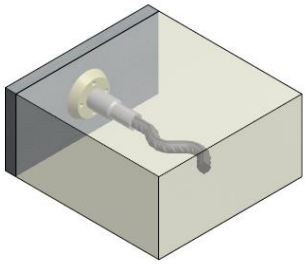
The plastic nailing plates KU-10 are nailed to formwork. Using forming wax on the nailing plate makes it easier to remove and screw on an anchor or fixing insert. The anchor must be fastened to the reinforcement by suitable means, so it does not move when concreting. After stripping, unscrew.

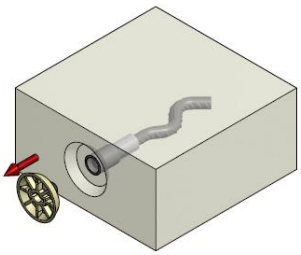




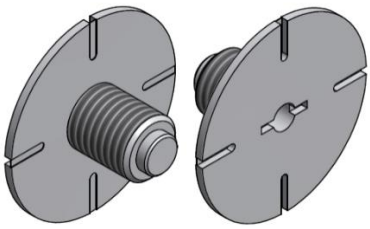


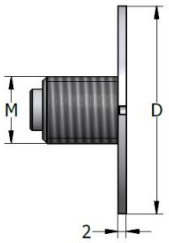






PLASTIC NAILING PLATE KU-02



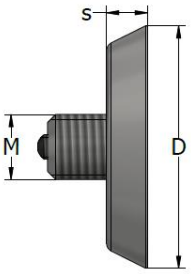


KU-02	Product no.	Thread	Diam. D	Thickness
		M	[mm]	[mm]
KU-02-M12	46050	M12	50	2
KU-02-M16	47113	M16	50	2
KU-02-M20	47114	M20	50	2
KU-02-M24	47115	M24	50	2

The nailing plates KU-02 are used for affixing the PSA or PSAD reinforcement coupler to the formwork with nails. These are suitable for fixing the PSA reinforcement coupler to the surface of the concrete units.

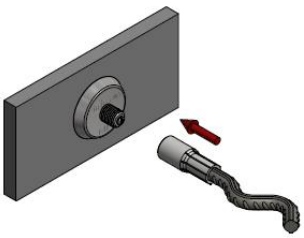
STEEL MAGNETIC PLATE - TPM

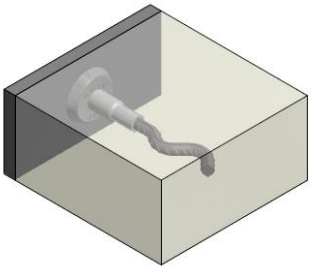
The plates with magnets TPM are used for affixing the anchors and the lifting sockets to the steel formwork. The fixing flange ensures a minimum recess around the head of the anchor. When using this magnetic recess former, it is very important that the surface of the formwork is clean. The recess is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

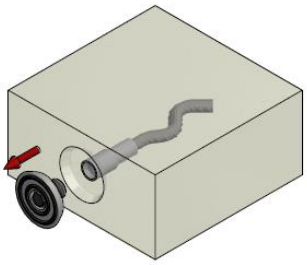


TPM-10	Product no.	Thread	Diam. D	s
		M	[mm]	[mm]
TPM-10-M12	63867	12	47	10
TPM-10-M16	63868	16	47	10
TPM-10-M20	63869	20	60	10
TPM-10-M24	63870	24	60	10
TPM-10-M30	63871	30	73	10
TPM-10-M36	63872	36	73	10
TPM-10-M42	63873	42	96	12
TPM-10-M52	63874	52	96	12

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



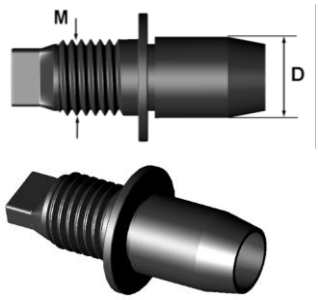




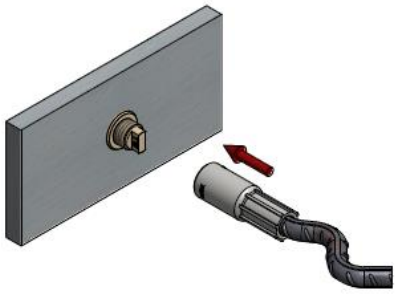
BREAKABLE FIXING PIN – TBP

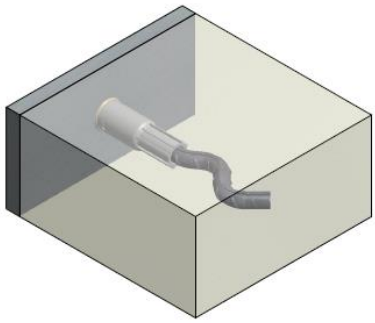
The breakable fixing pin is used for affixing the anchors or the lifting sockets to the formwork. The breakable fixing pin TBP is made of plastic nylon or polyamide 6.
Working method:

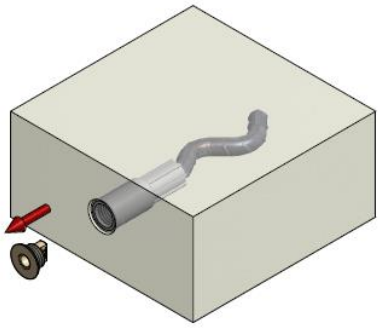
- Insert the breakable fixing pin TBP into the formwork
- Screw the anchor or the fixing insert onto the fixing pin TBP
- Pour concrete
- Remove the formwork; the fixing pin will break off in the formwork
- Remove the remaining part of the fixing pin just before using the thread of the anchor



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

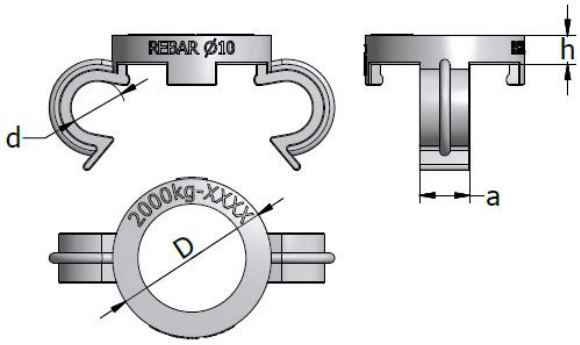






DATA CLIP

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.

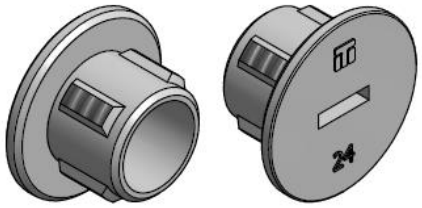


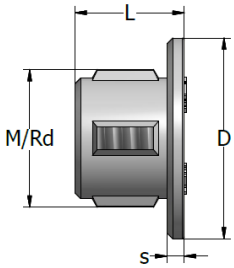
DATA CLIP	Product no.	Thread	D	h	a	d	Colour
		M	[mm]	[mm]	[mm]	[mm]	
DATA CLIP -M12	62602	12	20.5	4	6.5	6.5	Pink RAL 3015
DATA CLIP -M16	62538	16	26.5	5	7.5	8.5	Oyster white RAL 1013
DATA CLIP -M20	62539	20	31.5	6	10	10.5	Light green RAL 6019
DATA CLIP -M24	62540	24	36.5	6	10	10.5	Light blue RAL 5012
DATA CLIP -M30	62541	30	43.5	6	15	12.5	Lilac RAL 4005
DATA CLIP -M36	62542	36	52.5	8	18	17	Sulphur yellow RAL 1016
DATA CLIP -M42	62543	42	60.5	8	19.5	20	Light brown RAL 8001
DATA CLIP -M52	62544	52	73.5	9	22	20	Dark grey RAL 7037

DATA CLIP	Product no.	Thread	D	h	a	d	Colour
		Rd	[mm]	[mm]	[mm]	[mm]	
DATA CLIP -Rd12	62643	12	20.5	4	6.5	6.5	Pink RAL 3015
DATA CLIP -Rd16	62644	16	26.5	5	7.5	8.5	Oyster white RAL 1013
DATA CLIP -Rd20	62645	20	31.5	6	10	10.5	Light green RAL 6019
DATA CLIP -Rd24	62646	24	36.5	6	10	10.5	Light blue RAL 5012
DATA CLIP -Rd30	62647	30	43.5	6	15	12.5	Lilac RAL 4005
DATA CLIP -Rd36	62648	36	52.5	8	18	17	Sulphur yellow RAL 1016
DATA CLIP -Rd42	62649	42	60.5	8	19.5	20	Light brown RAL 8001
DATA CLIP -Rd52	62650	52	73.5	9	22	20	Dark grey RAL 7037

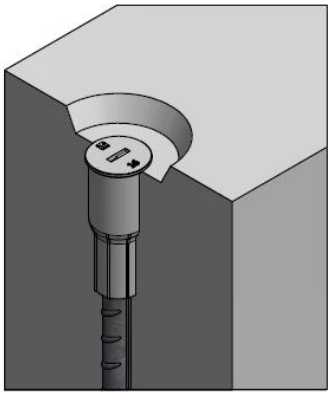
PLASTIC PLUG - TPP

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.





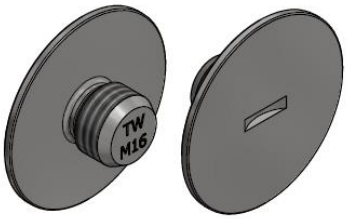
PLASTIC PLUG	Product no. (grey, RAL 7035)	Product no. (red, RAL 3020)	Thread M/Rd	Diam. D [mm]	L [mm]	s [mm]
TPP -M/Rd12	62768	65616	12	17.5	10	2
TPP -M/Rd16	62769	65617	16	22	12.5	2
TPP -M/Rd20	62770	65618	20	28	15	3
TPP -M/Rd24	62771	65619	24	34	18	3
TPP -M/Rd30	62772	65620	30	42.5	21	3
TPP -M/Rd36	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

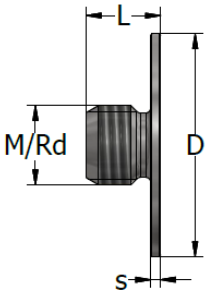


After removing the KU Nailing plate, mount the plastic plug inside the socket.
It can also be used to protect the socket anchor's thread before installation, thereby preventing dirt from getting into the anchor's thread zone.

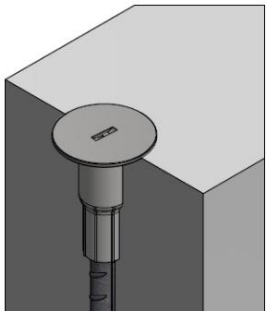
COVER SEALING CAP TP-02

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





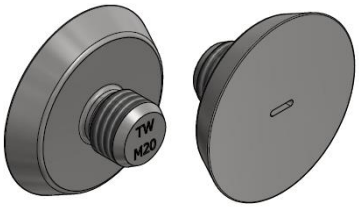
COVER SEALING CAP	Product no.	Thread	Diam. D	L	s
		M/Rd	[mm]	[mm]	[mm]
TP-02 - M/Rd12	61526	12	35	15	2
TP-02 - M/Rd16	61527	16	35	15	2
TP-02 - M/Rd20	61528	20	44	18	2
TP-02 - M/Rd24	61529	24	44	25	2
TP-02 - M/Rd30	61530	30	59	25	2
TP-02 - M/Rd36	61531	36	59	30	2

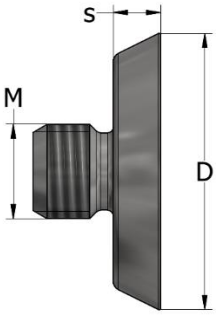


Mount the cap in the socket after removing the nailing plate.

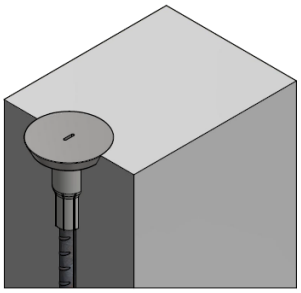
COVER SEALING CAP TP-10

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





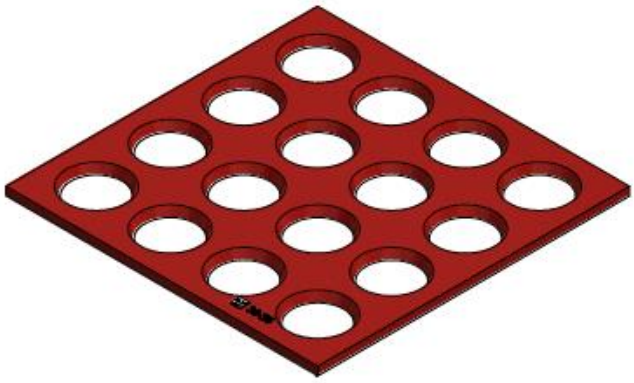
COVER SEALING CAP	Product no.	Thread	Diam. D	s
		M/Rd	[mm]	[mm]
TP-10 - M/Rd12	63115	12	45	10
TP-10 - M/Rd16	63116	16	45	10
TP-10 - M/Rd20	63117	20	54	10
TP-10 - M/Rd24	63118	24	54	10
TP-10 - M/Rd30	63119	30	69	10
TP-10 - M/Rd36	63120	36	69	10
TP-10 - M/Rd42	63121	42	94	12

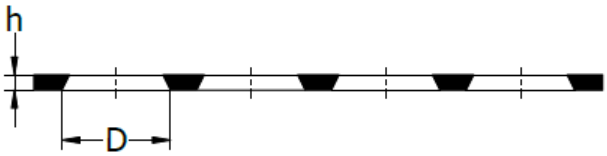


Mount the cap in the socket after removing the nailing plate.

KU CAP DIE

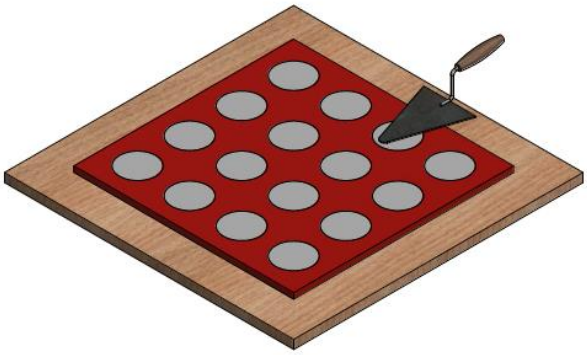
KU CAP DIE is a polyurethane mould used to produce concrete recess sealers. The recess made by the plastic nailing plates KU-10 in precast elements is covered with these concrete recess fillers. The mould KU CAP DIE is reusable. The concrete recess fillers cast with the same material as the main element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

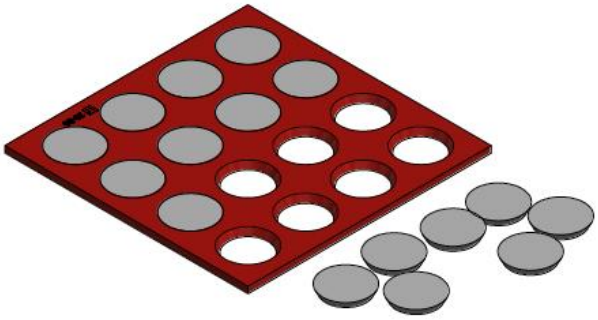




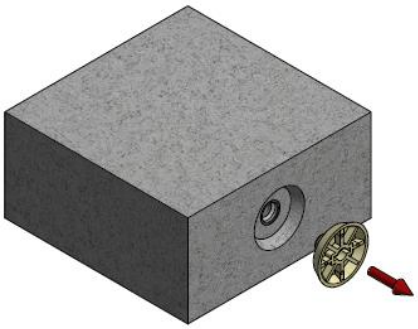
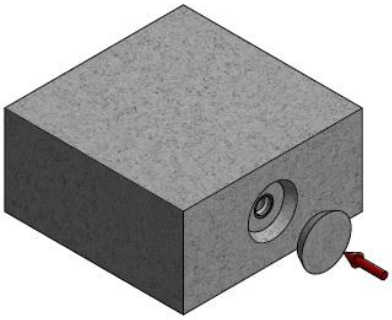
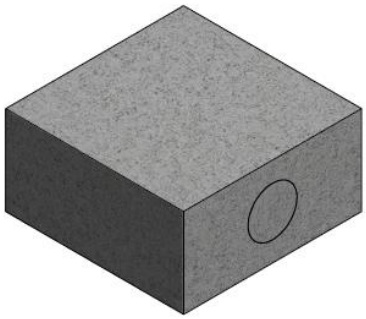
KU CAP DIE	Product number	For socket size	Diam.	h	Numbers of recess fillers
		M/Rd	[mm]	[mm]	pcs
KU CAP DIE M12-M16	63100	12 16	45	9	16
KU CAP DIE M20-M24	64150	20 24	58	9	16
KU CAP DIE M30-M36	63101	30 36	70	8	16
KU CAP DIE M42-M52	63103	42 52	94	10	9

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.

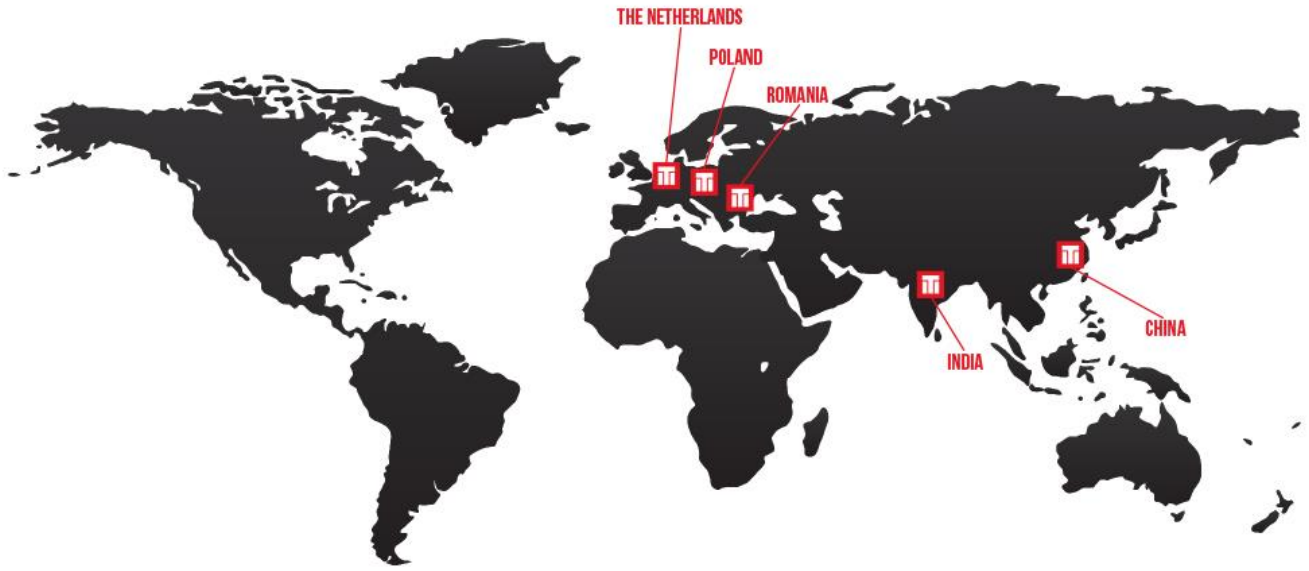




INSTALLING RECESS FILLERS

		
1. Remove the nailing plate (KU or TPM)	**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.**	

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.

TERWA CONSTRUCTION GROUP

Terwa Construction Netherlands (HQ)
Global Sales & Distribution
Kamerlingh Onneslaan 1-3
3401 MZ IJsselstein
The Netherlands
T +31-(0)30 699 13 29
F +31-(0)30 220 10 77
E info@terwa.com

Terwa Construction Central East Europe
Sales & Distribution
Strada Sânzienei
507075 Ghimbav
Romania
T +40 372 611 576
E info@terwa.com

Terwa Construction Poland
Sales & Distribution
Ul. Cicha 5 lok. 4
00-353 Warszawa
Poland
E info@terwa.com

Terwa Construction India & Middle East
Sales & Distribution
India
T +91 89 687 000 41
E info@terwa.com

Terwa Construction China
Sales & distribution
B05, 5F, No. 107, 2nd of the South
Zhongshan Road
200032 Shanghai
China
E info@terwa.com

ALL SPECIFICATIONS CAN BE CHANGED WITHOUT PREVIOUS NOTICE.

DISCLAIMER