## TECHNICAL DOCUMENTATION RNIN

## LIFTING SYSTEMS |1D-HD THREADED LIFTING SYSTEM



OVERVIEW
LIFTING SYSTEMS

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## INTRODUCTION

HD threaded lifting systems are used in the precast industry and are suitable for lifting, transporting and installing precast concrete elements on site.
Some of the advantages of this system include:

- a wide range of lifting sockets
- capability of establishing a connection in a safe, simple manner
- the lifting systems can be re-used.
- CE conforming system. All Terwa lifting systems have the CE marking which guarantees conformance with the European regulations
The threaded lifting system combines a lifting anchor embedded in a concrete unit and a lifting device.
The design for Terwa threaded lifting anchors and technical instructions complies with the national German guideline VDI/BVBS6205 "Lifting inserts and lifting insert for precast concrete elements". Based on this guideline, the manufacturer must also ensure that the lifting systems have enough strength to prevent concrete failure.
A failure of lifting anchors and lifting anchor devices can endanger human lives and may lead to significant damage. Therefore, lifting anchors and lifting devices must be produced with high quality and carefully selected. They are designed for the respective application and used by skilled personnel according to lifting and handling instructions.


## Quality

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

## Marking and traceability

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



## Anchor testing

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

## Application of lifting anchor system

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

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

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

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

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


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


## CE MARKING

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

## PRODUCT RANGE

## HD LIFTING SYSTEMS

- RE-USABLE THREADED LIFTING SYSTEM

Terwa offers various types of threaded lifting keys suitable for lifting, transporting and installing precast concrete elements.

- TRANSPORT ANCHORS

T-tail and rebar anchors with pressed sockets designed for lifting and transporting various precast concrete elements with a load range between 1.3 and 15 tonnes and lifting sockets with footplate suitable for thin panels or top slabs.

- RECESS FORMERS AND MOUNTING ACCESSORIES

Mounting accessories for fixing the anchors to the formwork during the production of the precast element.


## TECHNICAL INFORMATION - CHOOSING THE TYPE OF ANCHOR

Terwa has 3 types of lifting systems:

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

The method for choosing the anchor is identical for all these types and depends on the lifting method and/or experience.
The 1D threaded lifting system is mainly used when the hoisting angles are limited, while the 2D strip anchor lifting system and the 3D T-slot anchor lifting system can be used for all hoisting angles, with minor limitations for the 2D strip anchor lifting system. The difference between the 2D strip anchor lifting system and the 3D T-slot anchor lifting system lies principally in the experience one has in using one or the other system.
Terwa also has software for making the anchor calculations.


## SAFETY RULES

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

These lifting systems are not suitable for intensive re-use. Please see chapter Checking the lifting system for inspection requirements.
In designing the lifting system, the safety factors for the failure mode steel rupture derived from the Machinery Directive 2006/42/EC are:

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

$$
\gamma=4
$$

For this, the load-side dynamic working coefficient $\psi$ dyn $=1.3$
For the determination of the characteristic resistances based on method A in accordance with DIN EN 1990-Annex D for the concrete break-out, splitting, blow-out and pull-out failure modes, the safety factor is $\gamma=2.5$
The safety concept requires that the action $E$ does not exceed the admissible value for the resistance Radm:
$\boldsymbol{E} \leq R_{\text {adm }} \quad$ Where: E-action, Radm - admissible load (resistance)
The admissible load (resistance) of lifting anchor and lifting device is obtained as follows:
$R_{\text {adm }}=\frac{\boldsymbol{R} \boldsymbol{k}}{\boldsymbol{\gamma}} \quad$ Where: $\mathrm{R}_{\mathrm{k}}$ - characteristic resistance of the anchoring of a lifting anchor or lifting device, $\gamma-$ 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) <br> Concrete spalling at the side of the component that contains the anchor, at the level of the formfitting load application by the lifting anchor into the concrete break-out at the concrete surface. |  |  |
| Pry-out (rear breakout of concrete) <br> Failure mode characterised by the concrete breaking out opposite the direction of load, on lifting anchors with shear load. |  |  |
| Pull-out <br> 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 <br> Failure mode characterised by <br> fracture of the steel lifting anchor <br> parts. |  |  |

## DIMENSIONING OF LIFTING ANCHOR SYSTEM

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

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

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

Stress $\leq$ Resistance always applies


## LOAD CAPACITY

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

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


## WEIGHT OF PRECAST UNIT

 prefabricated elements composed of reinforcing elements with a higher concentration, this will be taken into consideration when calculating the weight.


$$
\begin{aligned}
& \boldsymbol{F}_{\boldsymbol{G}}=\boldsymbol{\rho} \times \mathbf{V} \\
& \mathbf{V}=\boldsymbol{L} \times \mathrm{w} \times \boldsymbol{h}
\end{aligned}
$$

Where:
$V$ - volume of precast unit in [m³
$L$ - length in [ m ]
$w$ - width in [m]
$h$ - thickness in [m]

## ADHESION TO FORMWORK COEFFICIENT

When a precast element is lifted from the formwork, adhesion force between element and formwork develops. This force must be taken into consideration for the calculation of the anchor load and depends on the total area in contact with the formwork, the shape of the precast element and the material of the formwork. The value "Fadh" of adhesion to the formwork is calculated using the following equation:
$F_{a d h}=\boldsymbol{q}_{\boldsymbol{a d h}} \times \boldsymbol{A}_{\boldsymbol{f}}[\boldsymbol{k N}]$
Where: $F_{\text {adh }}$ - action due to adhesion and form friction, in kN
$q_{a d h}$ - 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 | $q_{\text {adh }}$ in $\mathrm{kN} / \mathrm{m}^{2}$ |
| :--- | :---: |
| Oiled steel formwork, oiled plastic-coated plywood | $\geq 1$ |
| Varnished timber formwork with panel boards | $\geq 2$ |
| Rough timber formwork | $\geq 3$ |

In some cases, such as $\boldsymbol{\pi}$ - panel or other specially shaped elements, an increased adhesion coefficient must be taken into consideration.

| Adhesion to the formwork |  |
| :--- | :--- |
| Double-T beams | $F_{\text {adh }}=2 \times F_{G}[k N]$ |
| Ribbed elements | $F_{\text {adh }}=3 \times F_{G}[k N]$ |
| Waffled panel | $F_{\text {adh }}=4 \times F_{G}[k N]$ |



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 $\psi_{\text {dyn }}$.

| Lifting equipment | Dynamic factor |
| :--- | :---: |
| $\psi_{\text {dyn }}$ |  |
| Tower crane, portal crane and mobile crane | $\left.1.3^{*}\right)$ |
| Lifting and moving on flat terrain | 2.5 |
| Lifting and moving on rough terrain |  |
| *) 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 $\beta$ between the normal direction and the lifting chain.
The cable angle $\beta$ is determined by the length of the suspension chain. We recommend that, if possible, $\beta$ should be kept to $\beta \leq 30^{\circ}$. The tensile force on the anchor will be increased by a cable angle coefficient " $z$ ".
$z=1 / \cos \beta$
$F=\frac{F_{t o t} \times Z}{n}$
Where:
z - cable angle coefficient
$n$ - number of load-bearing anchors

$\left.\begin{array}{|ccc|}\hline \text { Cable angle } & \text { Spread angle } & \text { Cable angle factor } \\ \boldsymbol{\beta} \boldsymbol{a}\end{array}\right)$

* Preferred option $B \leq 30^{\circ}$

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

## ASYMMETRIC DISTRIBUTION OF THE LOAD

For asymmetrical elements, calculate the loads based on the centre of gravity before installing the anchors.
The load of each anchor depends on the embedded position of the anchor in the precast unit and on the transport mode:
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:
$F_{a}=F_{t o t} \times \mathbf{b} /(\mathbf{a}+\mathbf{b})$
$\boldsymbol{F}_{\boldsymbol{b}}=\boldsymbol{F}_{\boldsymbol{t o t}} \times \mathbf{a} /(\mathbf{a}+\mathbf{b})$
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 $(\mathrm{Cg})$ is directly under the crane hook.

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

## 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: $\mathbf{n}=\mathbf{3}$
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: $\mathbf{n}=\mathbf{2}$
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

The compensating lifting slings ensure equal force
distribution.
Load bearing anchors: $\mathbf{n}=\mathbf{4}$
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: $\mathbf{n}=\mathbf{2}$
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 $B=0^{\circ}$ to $10^{\circ}$ | Iiagonal load $B=10^{\circ}$ to |
| :--- |
| 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 $9<15^{\circ}$ |
| recommended |

POSITIONING THE ANCHORS IN WALLS


Lifting the walls from horizontal to vertical position without tiltup 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 |  | $F_{Z}=\frac{\left(F_{G}+F_{a d h}\right) \times Z}{n}$ <br> $\boldsymbol{F}_{\boldsymbol{Z}}$ - Load acting on the lifting anchor in kN | $\begin{aligned} & F_{Z} \leq N_{R, a d m} \\ & \boldsymbol{N}_{R, \text { adm }- \text { admissible }}^{\text {normal load }} \end{aligned}$ |
| Erecting |  | $F_{Q}=\frac{\left(F_{G} / 2\right) \times \psi_{d y n}}{n}$ <br> $\boldsymbol{F}_{\boldsymbol{Q}}$ - 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 | $\begin{gathered} F_{Q} \leq V_{R, a d m} \\ \begin{array}{c} V_{R, a d m}-\text { admissible } \\ \text { shear load } \end{array} \end{gathered}$ |
|  |  | $F_{Q Z}=\frac{\left(F_{G} / 2\right) \times \psi_{d y n} \times Z}{n}$ <br> $\boldsymbol{F}_{\boldsymbol{Q Z}}$ - 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 | $\begin{gathered} F_{Q Z} \leq V_{R, a d m} \\ \boldsymbol{V}_{R, a d m} \text { - admissible } \\ \text { shear load } \end{gathered}$ |
| Transport |  | $F_{Z}=\frac{F_{G} \times \psi_{d y n} \times Z}{n}$ <br> $\boldsymbol{F}_{\boldsymbol{Z}}$ - Load acting on the lifting anchor in kN | $\begin{gathered} \boldsymbol{F}_{\boldsymbol{Z}} \leq \boldsymbol{N}_{\boldsymbol{R}, \boldsymbol{a d m}} \\ \boldsymbol{N}_{\boldsymbol{R}, \boldsymbol{a d m}(\mathrm{m}}-\text { admissible } \\ \text { normal load } \end{gathered}$ |

INSTALLATION TOLERANCES FOR ALL TERWA LIFTING SOCKET ANCHORS


## CALCULATION EXAMPLE

## Example 1: SLAB UNIT



The slab unit has the following dimensions:
$L=5 m$
$w=2 m$
$t=0.2 \mathrm{~m}$
Weight $\boldsymbol{F}_{\boldsymbol{G}}=\boldsymbol{\rho} \times \boldsymbol{V}=\mathbf{2 5} \times(\mathbf{5} \times \mathbf{2} \times \mathbf{0 . 2})=$ 50kN
Formwork area $A_{f}=\boldsymbol{L} \times \boldsymbol{w}=\mathbf{5} \times \mathbf{2}=\mathbf{1 0} \mathrm{m}^{2}$
Anchor number $\boldsymbol{n}=\mathbf{2}$

| General data: | Symbol | De-mould | Transport | Mount |
| :--- | :---: | :---: | :---: | :---: |
| Concrete strength at de-mould [MPa] |  | 15 | 15 |  |
| Concrete strength on site [MPa] |  |  |  | 35 |
| Element weight $[\mathrm{kN}]$ | $\boldsymbol{F}_{\boldsymbol{G}}$ | 50 |  |  |
| Element area in contact with formwork $\left[\mathrm{m}^{2}\right]$ | $\boldsymbol{A}_{\boldsymbol{f}}$ | 10 |  |  |
| Cable angle factor at de-mould $\left(\beta=15.0^{\circ}\right)$ | $\boldsymbol{z}$ | 1.04 | 1.04 |  |
| Cable angle factor on site $\left(\beta=30.0^{\circ}\right)$ | $\boldsymbol{z}$ |  |  | 1.16 |
| Dynamic coefficient at transport | $\Psi_{\text {dyn }}$ |  | 1.3 |  |
| Dynamic coefficient on site | $\Psi_{\boldsymbol{d y n}}$ |  |  | 1.3 |
| Adhesion to formwork factor for varnished timber formwork $\left[\mathrm{kN} / \mathrm{m}^{2}\right]$ | $\boldsymbol{q}_{\boldsymbol{a d h}}$ | 2 |  |  |
| Anchor number for de-mould | $\boldsymbol{n}$ | 2 |  |  |
| Anchor number for transport at the plant | $\boldsymbol{n}$ |  | 2 |  |
| Anchor number for transport on site | $\boldsymbol{n}$ |  |  | 2 |

## DE-MOULD AT THE PLANT:

Adhesion to formwork factor:
$q_{\text {adh }}=2 \mathrm{kN} / \mathrm{m}^{2}$
Cable angle factor:
$\mathrm{z}=1.04\left(\beta=15.0^{\circ}\right)$
Concrete strength:
15 MPa
$F_{Z}=\frac{\left[\left(F_{G}+q_{a d h} \times A_{f}\right) \times z\right]}{n}=\frac{[(50+2 \times 10) \times 1.04]}{2}=36.4 \mathrm{kN}$

## TRANSPORT AT THE PLANT:

Dynamic coefficient:
Cable angle factor:
Concrete strength:
$\psi_{d y n}=1.3$
$z=1.04\left(\beta=15.0^{\circ}\right)$
15 MPa
$F_{Z}=\frac{F_{G} \times \psi_{d y n} \times Z}{n}=\frac{50 \times 1.3 \times 1.04}{2}=33.80 \mathrm{kN}$

## TRANSPORT ON SITE:

Dynamic coefficient:
Cable angle factor:
Concrete strength:
$\psi_{d y n}=1.3$
$z=1.16\left(\beta=30.0^{\circ}\right)$
35 MPa
$F_{Z}=\frac{F_{G} \times \psi_{d y n} \times Z}{n}=\frac{50 \times 1.3 \times 1.16}{2}=37.70 \mathrm{kN}$
An anchor in the $40 \mathbf{k N}$ range is required.

Example 2: WALL PANEL


The slab unit has the following dimensions:
$L=7.5 \mathrm{~m}$
$w=2 m$
$t=0.18 \mathrm{~m}$
Weight $\boldsymbol{F}_{G}=\rho \times V=25 \times(7.5 \times 2 \times 0.18)=67.5 \mathrm{kN}$
Formwork area $\boldsymbol{A}_{f}=\boldsymbol{L} \times \boldsymbol{w}=\mathbf{7 . 5} \times \mathbf{2}=\mathbf{1 5} \mathrm{m}^{2}$
Anchor number $\boldsymbol{n}=\mathbf{2}$

| General data: | Symbol | De-mould | Tilting | Mount |
| :--- | :---: | :---: | :---: | :---: |
| Concrete strength at de-mould [MPa] |  | 15 | 15 |  |
| Concrete strength on site [MPa] |  |  |  | 35 |
| Element weight $[\mathrm{kN}]$ | $\boldsymbol{F}_{\boldsymbol{G}}$ | 67.5 |  |  |
| Element area in contact with formwork $\left[\mathrm{m}^{2}\right]$ | $\boldsymbol{A}_{\boldsymbol{f}}$ | 15 |  |  |
| Cable angle factor at de-mould $\left(\beta=0.0^{\circ}\right)$ | $\boldsymbol{z}$ | 1.0 |  |  |
| Cable angle factor at tilting $\left(\beta=0.0^{\circ}\right)$ | $\boldsymbol{z}$ |  | 1.0 |  |
| Cable angle factor on site $\left(\beta=30^{\circ}\right)$ | $\boldsymbol{z}$ |  |  | 1.16 |
| Dynamic coefficient at tilting | $\psi_{\text {dyn }}$ |  | 1.3 |  |
| Dynamic coefficient on site | $\psi_{\text {dyn }}$ |  |  | 1.3 |
| Adhesion factor for oiled steel formwork $\left[\mathrm{kN} / \mathrm{m}^{2}\right]$ | $\boldsymbol{q}_{\boldsymbol{a d h}}$ | 1.0 |  |  |
| Anchor number for de-mould | $\boldsymbol{n}$ | 2 |  |  |
| Anchor number at tilting | $\boldsymbol{n}$ |  | 2 |  |
| Anchor number for transport on site | $\boldsymbol{n}$ |  |  | 2 |

## DE-MOULD / TILT-UP AT THE PLANT:

Adhesion to formwork factor:
Cable angle factor:
Concrete strength:
$q_{\text {adh }}=1 \mathrm{kN} / \mathrm{m}^{2}$
$\mathrm{z}=1\left(\beta=0^{\circ}\right)$
15 MPa
$F_{Q}=\frac{\left[\left(F_{G} / 2+q_{a d h} \times A_{f}\right) \times z\right]}{n}=\frac{[(67.5 / 2+1 \times 15) \times 1]}{2}=24.38 \mathrm{kN}$

## TRANSPORT AT THE PLANT:

Dynamic coefficient:
Cable angle factor:
Concrete strength:
$\psi_{d y n}=1.3$
$z=1\left(\beta=0^{\circ}\right)$
15 MPa

$$
F_{Q}=\frac{F_{G} \times \psi_{d y n} \times z}{n}=\frac{67.5 \times 1.3 \times 1}{2}=43.87 \mathrm{kN}
$$

## TRANSPORT ON SITE:

Dynamic coefficient:
$\psi_{d y n}=1.3$
Cable angle factor:
$z=1.16\left(\beta=30.0^{\circ}\right)$
Concrete strength:
$F_{Q}=\frac{F_{G} \times \psi_{d y n} \times z}{n}=\frac{67.5 \times 1.3 \times 1.16}{2}=50.89 \mathrm{kN}=51 \mathrm{kN}$
For embedding on the lateral side, two anchors in the 75 kN 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 $[\mathrm{kN}]$ | $\boldsymbol{F}_{\boldsymbol{G}}$ | 102 |  |
| Formwork area $\left[\mathrm{m}^{2}\right]$ | $\boldsymbol{A}_{\boldsymbol{f}}$ | 35.8 |  |
| Cable angle factor at de-mould $\left(B=30.0^{\circ}\right)$ | $\mathbf{z}$ | 1.16 |  |
| Cable angle factor on site $\left(B=30.0^{\circ}\right)$ | $\mathbf{z}$ |  | 1.16 |
| Dynamic coefficient at transport | $\psi_{\text {dyn }}$ |  | 1.3 |
| Anchor number for de-mould and transport | $\mathbf{n}$ | 4 | 4 |

Load capacity when lifting and transporting at the manufacturing plant.

| Concrete strength when de-mould | $\geq 25 \mathrm{MPa}$ |
| :--- | :--- |
| Cable angle factor | $\mathrm{z}=1.16\left(B=30.0^{\circ}\right)$ |
| Dynamic coefficient | $\Psi_{\text {dyn }}=1.3$ |
| Anchor number | $\mathrm{n}=4$ |

$F_{G}=V \times \rho=(A \times L) \times \rho=(A 1+A 2 \times 2) \times L \times \rho=(0.1 \times 3+0.09 \times 2) \times 8.5 \times 25=102 \mathrm{kN}$
$L=8.5 \mathrm{~m}$
$A 1=0.1 \times 3\left(\mathrm{~m}^{2}\right)$
$A 2=\frac{[(0.35+0.25) \times 0.3]}{2}=\frac{(0.6 \times 0.3)}{2}=0.09\left(\mathrm{~m}^{2}\right)$
Weight:
Adhesion to mould

$$
\begin{aligned}
& F_{G}=102 \mathrm{kN} \\
& F_{\text {adh }}=2 \times F_{G}=204 \mathrm{kN} \\
& F_{\text {tot }}=F_{G}+F_{\text {adh }}=102+204=306 \mathrm{kN}
\end{aligned}
$$

Total load
LOAD PER ANCHOR WHEN DE-MOULD:
$F=\frac{F_{t o t} \times z}{n}=\frac{\left[\left(F_{G}+F_{a d h}\right) \times z\right]}{n}=\frac{306 \times 1.16}{4}=88.74 \mathrm{kN}$

## LOAD PER ANCHOR WHEN TRANSPORTING:

$F=\frac{F_{t o t} \times \psi_{\text {dyn }} \times Z}{n}=\frac{F_{G} \times \psi_{\text {dyn }} \times z}{n}=\frac{102 \times 1.3 \times 1.16}{4}=38.46 \mathrm{kN}$
Four anchors in the 100 kN range are required (> 88.74 kN )

## HD - LIFTING ANCHORS

## LIFTING SOCKET ANCHOR - HBS-LONG

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


The HBS anchors are manufactured in three versions:

- Socket - steel S355J0 zinc-plated, foot - steel S355J2
- Socket - steel S355J0 zinc-plated, foot - steel S355J2 zinc plated
- Socket - stainless steel- W 1.4571 [SS4], foot - steel S355J2
- $\quad$ Socket - stainless steel- W 1.4571 [SS4], foot - steel S355J2 zinc-plated

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

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

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

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

## LIFTING SOCKET ANCHOR - HBS WITH BARRIER



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

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

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

## LIFTING AND TRANSPORT - HBS LONG ANCHORS

Edge distance and spacing for lifting sockets.


| $\begin{gathered} \text { HBS- } \\ \text { SS2/SS4 } \end{gathered}$ | Load group | Thread | $\begin{gathered} \mathbf{a} \\ \text { min } \end{gathered}$ | Minimum element thickness $2 \times b$ | Axial load and diagonal load $\leq 30^{\circ}$ |  |  | Axial load and diagonal load $\leq 45^{\circ}$ |  |  | Transverse load |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \mathrm{f}_{\mathrm{cu}}>15 \\ \mathrm{MPa} \end{gathered}$ |  |  |  | 15 MPa | 25 MPa | 35 MPa | 15 MPa | 25 MPa | 35 MPa | 15 MPa | 25 MPa | 35 MPa |
|  | [t] | M(Rd) | [mm] | [mm] | [kN] | [kN] | [kN] | [kN] | [kN] | [kN] | [kN] | [kN] | [kN] |
| HBS- <br> M(Rd) ${ }^{12-}$ <br> 130 | 1.3 | 12 | 440 | 80 | 13.0 | 13.0 | 13.0 | 10.4 | 13.0 | 13.0 | 5.9 | 7.5 | 7.5 |
|  |  |  |  | 100 | 13.0 | 13.0 | 13.0 | 10.5 | 13.0 | 13.0 | 7.5 | 7.5 | 7.5 |
|  |  |  |  | 120 | 13.0 | 13.0 | 13.0 | 10.5 | 13.0 | 13.0 | 7.5 | 7.5 | 7.5 |
| HBS-M(Rd)16-$140$ | 2.5 | 16 | 450 | 100 | 13.5 | 17.4 | 20.6 | 10.8 | 17.4 | 20.6 | 6.8 | 8.8 | 10.4 |
|  |  |  |  | 120 | 15.5 | 20.0 | 23.7 | 12.4 | 20.0 | 23.7 | 9.9 | 12.7 | 14.0 |
|  |  |  |  | 140 | 17.4 | 22.4 | 25.0 | 13.9 | 22.4 | 25.0 | 11.6 | 14.0 | 14.0 |
| HBSM(Rd) 16200 | 2.5 | 16 | 640 | 80 | 18.7 | 24.1 | 25.0 | 15.0 | 24.1 | 25.0 | 4.2 | 5.4 | 6.4 |
|  |  |  |  | 100 | 22.7 | 25.0 | 25.0 | 18.2 | 25.0 | 25.0 | 6.8 | 8.8 | 10.4 |
|  |  |  |  | 120 | 25.0 | 25.0 | 25.0 | 18.9 | 25.0 | 25.0 | 9.9 | 12.7 | 14.0 |
| HBS M(Rd)20258 | 4.0 | 20 | 800 | 120 | 33.1 | 40.0 | 40.0 | 29.8 | 40.0 | 40.0 | 8.9 | 11.5 | 13.6 |
|  |  |  |  | 140 | 36.0 | 40.0 | 40.0 | 31.8 | 40.0 | 40.0 | 12.9 | 16.6 | 19.6 |
|  |  |  |  | 160 | 39.0 | 40.0 | 40.0 | 31.8 | 40.0 | 40.0 | 17.5 | 22.6 | 23.0 |
| HBS-$\begin{gathered} M(R d) 24- \\ 325 \end{gathered}$ | 5.0 | 24 | 1000 | 120 | 40.0 | 50.0 | 50.0 | 40.0 | 50.0 | 50.0 | 13.1 | 16.9 | 20.0 |
|  |  |  |  | 140 | 45.6 | 50.0 | 50.0 | 42.1 | 50.0 | 50.0 | 14.7 | 19.0 | 22.5 |
|  |  |  |  | 160 | 49.0 | 50.0 | 50.0 | 42.1 | 50.0 | 50.0 | 20.0 | 25.8 | 28.0 |
| $\begin{gathered} \text { HBS- } \\ \text { M(Rd)30- } \\ 400 \end{gathered}$ | 7.5 | 30 | 1240 | 160 | 66.8 | 75.0 | 75.0 | 66.8 | 75.0 | 75.0 | 24.2 | 31.2 | 36.9 |
|  |  |  |  | 180 | 71.8 | 75.0 | 75.0 | 67.7 | 75.0 | 75.0 | 31.1 | 40.1 | 42.5 |
|  |  |  |  | 200 | 75.0 | 75.0 | 75.0 | 67.7 | 75.0 | 75.0 | 39.1 | 42.5 | 42.5 |
| $\begin{gathered} \text { HBS- } \\ \text { M(Rd)36- } \\ 475 \end{gathered}$ | 10.0 | 36 | 1460 | 180 | 90.7 | 100.0 | 100.0 | 90.7 | 100.0 | 100.0 | 30.5 | 39.4 | 46.6 |
|  |  |  |  | 200 | 98.3 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | 38.1 | 49.1 | 57.0 |
|  |  |  |  | 220 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | 46.2 | 57.0 | 57.0 |
| $\begin{aligned} & \text { HBS- } \\ & \text { M(Rd) } 42- \\ & 550 \end{aligned}$ | 12.5 | 42 | 1700 | 200 | 125.0 | 125.0 | 125.0 | 120.2 | 125.0 | 125.0 | 40.1 | 51.7 | 61.1 |
|  |  |  |  | 220 | 125.0 | 125.0 | 125.0 | 120.2 | 125.0 | 125.0 | 48.4 | 62.4 | 71.0 |
|  |  |  |  | 240 | 125.0 | 125.0 | 125.0 | 120.2 | 125.0 | 125.0 | 57.9 | 71.0 | 71.0 |
| $\begin{aligned} & \text { HBS- } \\ & \text { M(Rd)52- } \\ & 575 \end{aligned}$ | 15.0 | 52 | 1760 | 200 | 126.8 | 150.0 | 150.0 | 126.8 | 150.0 | 150.0 | 36.2 | 46.7 | 55.2 |
|  |  |  |  | 220 | 139.5 | 150.0 | 150.0 | 139.5 | 150.0 | 150.0 | 44.3 | 57.2 | 66.7 |
|  |  |  |  | 240 | 150.0 | 150.0 | 150.0 | 144.8 | 150.0 | 150.0 | 53.0 | 68.5 | 81.0 |
|  |  |  |  | 280 | 150.0 | 150.0 | 150.0 | 144.8 | 150.0 | 150.0 | 72.5 | 85.5 | 85.5 |

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

## REINFORCEMENT AND LOAD CAPACITY - DIAGONAL LOAD UP TO $10^{\circ}$

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


| HBS-M(Rd) | Load group | Minimum unit thickness | Axial spacing | Mesh reinforcement | Edge reinforcement (2) | Load capacity |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $2 \times \mathrm{b}$ | a |  | $\mathrm{d}_{\text {s1 }}$ | $\mathrm{f}_{\mathrm{cu}}>15 \mathrm{MPa}$ | $\mathrm{f}_{\text {cu }}>\mathbf{2 5} \mathrm{MPa}$ |
|  | [t] | [mm] | [mm] | [ $\mathrm{mm}^{2} / \mathrm{m}$ ] | [mm] | [kN] | [kN] |
| M(Rd) 12-130 | 1.3 | 80/100/120 | 440 | $2 \times 188$ | - | 13 | 13 |
| M(Rd) 16-140 | 2.5 | 100/120/140 | 450 | $2 \times 188$ | - | 25 | 25 |
| M(Rd) 16-200 | 2.5 | 80/100/120 | 640 | $2 \times 188$ | - | 25 | 25 |
| M(Rd)20-258 | 4.0 | 120/140/160 | 800 | $2 \times 188$ | - | 40 | 40 |
| M(Rd)24-325 | 5.0 | 120/140/160 | 1000 | $2 \times 188$ | - | 50 | 50 |
| M(Rd)30-400 | 7.5 | 160/180/200 | 1240 | $2 \times 188$ | $2 \times \varnothing 12$ | 75 | 75 |
| M(Rd)36-475 | 10.0 | 180/200/220 | 1460 | $2 \times 188$ | $2 \times \varnothing 14$ | 100 | 100 |
| M (Rd) 42-550 | 12.5 | 200/220/240 | 1700 | $2 \times 188$ | $2 \times \varnothing 14$ | 125 | 125 |
| M(Rd) 52-575 | 15.0 | 200/220/240/280 | 1760 | $2 \times 188$ | $2 \times \varnothing 14$ | 150 | 150 |

## REINFORCEMENT AND LOAD CAPACITY - DIAGONAL LOAD UP TO 45º

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


| HBS-M(Rd) | Load group | Minimum unit thickness | Axial spacing | Mesh reinforcement | Edge reinforcement (2) | Diagonal reinforcement$\boldsymbol{\beta} \leq \mathbf{3 0}^{\circ}$ |  | Diagonal reinforcement$\beta \leq 45^{\circ}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $2 \times \mathrm{b}$ | a |  | $\mathrm{d}_{\text {s1 }}$ | $\mathrm{d}_{\mathbf{s}}$ | $\mathrm{L}_{\mathrm{s}}$ | $\mathrm{d}_{\text {s }}$ | $\mathrm{L}_{\mathrm{s}}$ |  |
|  | [t] | [mm] | [mm] | [ $\mathrm{mm}^{2} / \mathrm{m}$ ] | [mm] | [mm] | [mm] | [mm] | [mm] | [kN] |
| M(Rd) 12-130 | 1.3 | 80/100/120 | 440 | $2 \times 188$ | - | Ø8 | 850 | Ø8 | 1000 | 13 |
| M(Rd) 16-140 | 2.5 | 100/120/140 | 450 | $2 \times 188$ | - | $\varnothing 10$ | 1200 | $\varnothing 10$ | 1400 | 25 |
| M(Rd) $16-200$ | 2.5 | 80/100/120 | 640 | $2 \times 188$ | - | $\varnothing 8$ | 1000 | $\varnothing 10$ | 1200 | 25 |
| M(Rd)20-258 | 4.0 | 120/140/160 | 800 | $2 \times 188$ | - | 010 | 1200 | $\varnothing 12$ | 1750 | 40 |
| M(Rd)24-325 | 5.0 | 120/140/160 | 1000 | $2 \times 188$ | - | 012 | 1750 | 014 | 2000 | 50 |
| M(Rd)30-400 | 7.5 | 160/180/200 | 1240 | $2 \times 188$ | $2 \times \varnothing 12$ | 014 | 1750 | $\varnothing 16$ | 2000 | 75 |
| M(Rd)36-475 | 10.0 | 180/200/220 | 1460 | $2 \times 188$ | $2 \times \varnothing 14$ | $\varnothing 16$ | 2000 | 020 | 2050 | 100 |
| M(Rd)42-550 | 12.5 | 200/220/240 | 1700 | $2 \times 188$ | $2 \times \varnothing 14$ | $\varnothing 20$ | 2050 | Ø20 | 2200 | 125 |
| M(Rd)52-575 | 15.0 | 200/220/240/280 | 1760 | $2 \times 188$ | $2 \times \varnothing 14$ | $\varnothing 20$ | 2200 | Ø25 | 2200 | 150 |



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

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

## REINFORCEMENT AND LOAD CAPACITY - DIAGONAL LOAD AND TILTING UP TO 90º

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



Tilt reinforcement

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

There must be two layers of mesh reinforcement.

| $\begin{aligned} & \text { HBS- } \\ & \text { SS2/SS4 } \end{aligned}$ | Load | Thread | Overall length | Minimum element thickness | Mesh reinforcement | Transverse reinforcement |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{f}_{\text {cu }}>15 \mathrm{MPa}$ |  |  |  |  | Dia. ds | High h | Length before bending |
|  | [t] | M(Rd) | [mm] | [mm] | [ $\mathrm{mm}^{2} / \mathrm{m}$ ] | [mm] | [mm] | [mm] |
| $\begin{gathered} \text { HBS-M(Rd)12- } \\ 130 \end{gathered}$ | 1.3 | 12 | 130 | $\begin{gathered} \hline 80 \\ 100 \\ 120 \end{gathered}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \text { Ø8 } \\ & \varnothing 8 \\ & \varnothing 8 \end{aligned}$ | $\begin{array}{r} \hline 33 \\ 43 \\ 53 \\ \hline \end{array}$ | $\begin{aligned} & \hline 550 \\ & 550 \\ & 550 \end{aligned}$ |
| $\begin{gathered} \text { HBS- M(Rd) } 16- \\ 140 \end{gathered}$ | 2.5 | 16 | 140 | $\begin{aligned} & 100 \\ & 120 \\ & 140 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing \varnothing 12 \\ & \varnothing 12 \\ & \varnothing 12 \end{aligned}$ | $\begin{aligned} & \hline 47 \\ & 57 \\ & 67 \end{aligned}$ | $\begin{aligned} & 750 \\ & 750 \\ & 750 \end{aligned}$ |
| $\begin{gathered} \text { HBS-M(Rd)16- } \\ 200 \end{gathered}$ | 2.5 | 16 | 200 | $\begin{gathered} 80 \\ 100 \\ 120 \end{gathered}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing \\ & \varnothing \\ & \varnothing \\ & \varnothing \\ & \varnothing \end{aligned} 2$ | $\begin{aligned} & 37 \\ & 47 \\ & 57 \end{aligned}$ | $\begin{aligned} & 750 \\ & 750 \\ & 750 \end{aligned}$ |
| $\begin{gathered} \text { HBS- M(Rd)20- } \\ 258 \end{gathered}$ | 4.0 | 20 | 258 | $\begin{aligned} & 120 \\ & 140 \\ & 160 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 16 \\ & \varnothing 16 \\ & \varnothing 16 \end{aligned}$ | $\begin{aligned} & 62 \\ & 72 \\ & 82 \end{aligned}$ | $\begin{aligned} & 900 \\ & 900 \\ & 900 \end{aligned}$ |
| $\begin{gathered} \text { HBS- M(Rd)24- } \\ 325 \end{gathered}$ | 5.0 | 24 | 325 | $\begin{aligned} & 120 \\ & 140 \\ & 160 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 16 \\ & \varnothing 16 \\ & \varnothing 16 \end{aligned}$ | $\begin{aligned} & 66 \\ & 76 \\ & 86 \end{aligned}$ | $\begin{aligned} & 1100 \\ & 1100 \\ & 1100 \end{aligned}$ |
| $\begin{gathered} \text { HBS }-M(R d) 30- \\ 400 \end{gathered}$ | 7.5 | 30 | 400 | $\begin{aligned} & \hline 160 \\ & 180 \\ & 200 \\ & \hline \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 20 \\ & \varnothing 20 \\ & \varnothing 20 \\ & \hline \end{aligned}$ | $\begin{gathered} 94 \\ 104 \\ 114 \\ \hline \end{gathered}$ | $\begin{aligned} & 1300 \\ & 1300 \\ & 1300 \end{aligned}$ |
| $\begin{gathered} \text { HBS }-\mathrm{M}(\mathrm{Rd}) 36- \\ 475 \end{gathered}$ | 10.0 | 36 | 475 | $\begin{aligned} & 180 \\ & 200 \\ & 220 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 20 \\ & \varnothing 20 \\ & \varnothing 20 \end{aligned}$ | $\begin{aligned} & 108 \\ & 118 \\ & 128 \end{aligned}$ | $\begin{aligned} & 1700 \\ & 1700 \\ & 1700 \end{aligned}$ |
| $\begin{gathered} \text { HBS- M(Rd)42- } \\ 550 \end{gathered}$ | 12.5 | 42 | 550 | $\begin{aligned} & 200 \\ & 220 \\ & 240 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 25 \\ & \varnothing 25 \\ & \varnothing 25 \end{aligned}$ | $\begin{aligned} & 127 \\ & 137 \\ & 147 \end{aligned}$ | $\begin{aligned} & 1650 \\ & 1650 \\ & 1650 \end{aligned}$ |
| $\begin{gathered} \text { HBS }-M(R d) 52- \\ 575 \end{gathered}$ | 15.0 | 52 | 575 | $\begin{aligned} & 200 \\ & 220 \\ & 240 \\ & 280 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 25 \\ & \varnothing 25 \\ & \varnothing 25 \\ & \varnothing 25 \end{aligned}$ | $\begin{aligned} & 133 \\ & 143 \\ & 153 \\ & 173 \end{aligned}$ | $\begin{aligned} & 1950 \\ & 1950 \\ & 1950 \\ & 1950 \end{aligned}$ |

## LIFTING SOCKET ANCHOR - HBS-SHORT

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


The HBS anchors are manufactured in different versions:

- Socket - steel S355J0 zinc-plated, foot - steel S355J2
- Socket - steel S355J0 zinc-plated, foot - steel S355J2 zinc plated
- $\quad$ Socket - stainless steel- W 1.4571 [SS4], foot - steel S355J2
- $\quad$ Socket - stainless steel- W 1.4571 [SS4], foot - steel S355J2 zinc-plated

| HBS-Rd-SHORT | Zinc galvanizing socket | Zinc galvanizing socket and foot | Stainless steel SS4 socket | Stainless steel SS4 <br> socket and foot | Load group | Thread | Overall length | $\mathrm{I}_{1}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Product no. | Product no. | Product no. | Product no. | $\mathrm{f}_{\mathrm{cu}}>15 \mathrm{MPa}$ |  | L |  |
|  |  |  |  |  | [t] | Rd | [mm] | [mm] |
| HBS-Rd12-70 | 47337 | 64091 | 47338 | 64251 | 1.3 | 12 | 70 | 22 |
| HBS-Rd16-90 | 46637 | 64092 | 47340 | 64252 | 2.5 | 16 | 90 | 30 |
| HBS-Rd20-125 | 46638 | 64096 | 47339 | 64236 | 4.0 | 20 | 125 | 35 |
| HBS-Rd24-140 | 46639 | 64100 | 47342 | 64253 | 5.0 | 24 | 140 | 41 |
| HBS-Rd30-185 | 46640 | 64104 | 47466 | 64255 | 7.5 | 30 | 185 | 55 |


| HBS-M-SHORT | Zinc galvanizing socket | Stainless steel SS4 socket | Load group | Thread | Overall length | $\mathrm{I}_{1}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Product no. | Product no. | $\mathrm{f}_{\mathrm{cu}}>15 \mathrm{MPa}$ |  | L |  |
|  |  |  | [t] | M | [mm] | [mm] |
| HBS-M12-70 | 61046 | 61047 | 1.3 | 12 | 70 | 22 |
| HBS-M16-90 | 61049 | 61050 | 2.5 | 16 | 90 | 30 |
| HBS-M20-125 | 61070 | 61071 | 4.0 | 20 | 125 | 35 |
| HBS-M24-140 | 61077 | 61078 | 5.0 | 24 | 140 | 41 |
| HBS-M30-185 | 61088 | 61089 | 7.5 | 30 | 185 | 55 |

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

## LIFTING AND TRANSPORT - HBS SHORT ANCHORS

Edge distance and spacing for lifting sockets.

| HBS-M(Rd) | $\underset{\text { minimum }}{\mathbf{S}}$ | a minimum | b minimum |  |
| :---: | :---: | :---: | :---: | :---: |
|  | [mm] | [mm] | [mm] | 2 |
| $\mathrm{M}(\mathrm{Rd}) 12-70$ | 120 | 220 | 140 |  |
| $\mathrm{M}(\mathrm{Rd}) 16-90$ | 160 | 280 | 180 | $\bigcirc$ |
| M(Rd)20-125 | 220 | 400 | 250 | - |
| $\mathrm{M}(\mathrm{Rd}) 24-140$ | 280 | 450 | 300 | $\square$ |
| $\mathrm{M}(\mathrm{Rd}) 30-185$ | 360 | 560 | 370 |  |

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

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


| HBS-M(Rd) short | Thread | Two layers of mesh | Diagonal reinforcement |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Diameter <br> d | Length before bending |  |  |  |
|  |  |  |  | 15 MPa | 25 MPa | 35 MPa |  |
|  | M(Rd) | $\mathrm{mm}^{2} / \mathrm{m}$ | [mm] | [mm] | [mm] | [mm] |  |
| HBS -M(Rd) $12-70$ | 12 | $2 \times 188$ | $\varnothing 10$ | 800 | 700 | 600 | Note: The bend radius $R$ will be determined according to EN 1992. <br> There must be two layers of mesh reinforcement. <br> Diagonal reinforcement must be placed in direct contact with the socket anchor. <br> Always install diagonal reinforcement opposite the load direction. |
| HBS -M(Rd) $16-90$ | 16 | $2 \times 188$ | $\varnothing 12$ | 900 | 850 | 750 |  |
| HBS -M(Rd)20-125 | 20 | $2 \times 188$ | $\varnothing 14$ | 1020 | 850 | 750 |  |
| HBS -M(Rd)24-140 | 24 | $2 \times 188$ | $\varnothing 14$ | 1650 | 1400 | 1200 |  |
| HBS -M(Rd)30-185 | 30 | $2 \times 188$ | $\varnothing 16$ | 2000 | 1600 | 1400 |  |



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

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


## LIFTING SOCKET - STRAIGHT END REINFORCING STEEL - TRL-HD

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


The TRL-HD anchors are manufactured in two versions:

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

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

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

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

## LIFTING AND TRANSPORT - TRL-HD ANCHORS

Edge distance and spacing for TRL-HD anchors.


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

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

## REINFORCEMENT AND LOAD CAPACITY - AXIAL LOAD UP TO 10º

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


| TRL HD-M(Rd) | Load group | Minimum unit thickness | Axial spacing | Mesh reinforcement | Edge reinforcement (2) | Load capacity |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $2 \times \mathrm{b}$ | a |  | $\mathrm{d}_{\text {s1 }}$ | $\mathrm{f}_{\text {cu }}>15 \mathrm{MPa}$ | $\mathrm{f}_{\mathrm{cu}}>\mathbf{2 5} \mathbf{~ M P a}$ |
|  | [t] | [mm] | [mm] | [ $\mathrm{mm}^{2} / \mathrm{m}$ ] | [mm] | [kN] | [kN] |
| M(Rd) 12-300 | 1.3 | 60/80/100 | 620 | $2 \times 188$ | - | 13 | 13 |
| M(Rd) 16-400 | 2.5 | 80/100/120 | 820 | $2 \times 188$ | - | 25 | 25 |
| $\mathrm{M}(\mathrm{Rd}) 20-520$ | 4.0 | 120/140/160 | 980 | $2 \times 188$ | $2 \times \varnothing 12$ | 40 | 40 |
| M(Rd)24-540 | 5.0 | 120/140/160 | 1100 | $2 \times 188$ | $2 \times \varnothing 12$ | 50 | 50 |
| $\mathrm{M}(\mathrm{Rd}) 30-700$ | 7.5 | 140/160/180 | 1420 | $2 \times 188$ | $2 \times \varnothing 14$ | 75 | 75 |
| $\mathrm{M}(\mathrm{Rd}) 36-800$ | 10.0 | 160/180/200 | 1620 | $2 \times 188$ | $2 \times \varnothing 14$ | 100 | 100 |
| $\mathrm{M}(\mathrm{Rd}) 42-920$ | 12.5 | 160/180/200 | 1870 | $2 \times 188$ | $2 \times \varnothing 14$ | 125 | 125 |
| $\mathrm{M}(\mathrm{Rd}) 52-1100$ | 15.0 | 200/220/240 | 2230 | $2 \times 188$ | $2 \times \varnothing 14$ | 150 | 150 |

## REINFORCEMENT AND LOAD CAPACITY - DIAGONAL LOAD UP TO 45º

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


(3)

| TRL HD-M(Rd) | Load group | Minimum unit thickness | Axial spacing | Mesh reinforcement | Edge reinforcement (2) | Diagonal reinforcement $\boldsymbol{\beta} \leq \mathbf{3 0}^{\circ}$ <br> (3) |  | Diagonal reinforcement$\beta \leq 45^{\circ}$ |  | Load capacity$\mathrm{f}_{\mathrm{cu}}>25 \mathrm{MPa}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $2 \times \mathrm{b}$ | a |  | $\mathrm{d}_{\text {s1 }}$ | $\mathrm{d}_{\text {s }}$ | $\mathrm{L}_{\mathrm{s}}$ | $\mathrm{d}_{\text {s }}$ | $\mathrm{L}_{\mathrm{s}}$ |  |
|  | [t] | [mm] | [mm] | [ $\mathrm{mm}^{2} / \mathrm{m}$ ] | [mm] | [mm] | [mm] | [mm] | [mm] | [kN] |
| M(Rd) 12-300 | 1.3 | 60/80/100 | 620 | $2 \times 188$ | - | Ø8 | 850 | $\varnothing 8$ | 1000 | 13 |
| M(Rd) 16-400 | 2.5 | 80/100/120 | 820 | $2 \times 188$ | - | $\varnothing 8$ | 1000 | $\varnothing 10$ | 1200 | 25 |
| M(Rd)20-520 | 4.0 | 120/140/160 | 980 | $2 \times 188$ | $2 \times \varnothing 12$ | $\varnothing 10$ | 1200 | $\varnothing 12$ | 1750 | 40 |
| M(Rd)24-540 | 5.0 | 120/140/160 | 1100 | $2 \times 188$ | $2 \times \varnothing 12$ | 012 | 1750 | 014 | 2000 | 50 |
| M(Rd)30-700 | 7.5 | 140/160/180 | 1420 | $2 \times 188$ | $2 \times \varnothing 14$ | 014 | 1750 | $\varnothing 16$ | 2000 | 75 |
| M(Rd)36-800 | 10.0 | 160/180/200 | 1620 | $2 \times 188$ | $2 \times \varnothing 14$ | $\varnothing 16$ | 2000 | $\varnothing 20$ | 2050 | 100 |
| M(Rd)42-920 | 12.5 | 160/180/200 | 1870 | $2 \times 188$ | $2 \times \varnothing 14$ | $\varnothing 20$ | 2050 | $\varnothing 20$ | 2200 | 125 |
| M (Rd) 52-1100 | 15.0 | 200/220/240 | 2230 | $2 \times 188$ | $2 \times \varnothing 14$ | $\varnothing 20$ | 2200 | $\varnothing 25$ | 2200 | 150 |



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

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

## REINFORCEMENT AND LOAD CAPACITY - DIAGONAL LOAD AND TILTING UP TO 90º

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



Tilt reinforcement

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

There must be two layers of mesh reinforcement.

| TRL HD-M(Rd) | Load group | Thread | Overall length | Minimum element thickness | Mesh reinforcement | Transverse reinforcement |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{f}_{\mathrm{cu}}>15 \mathrm{MPa}$ |  |  |  |  | Dia. ds | High h | Length before bending |
|  | [t] | M(Rd) | [mm] | [mm] | [ $\mathrm{mm}^{2} / \mathrm{m}$ ] | [mm] | [mm] | [mm] |
| $\begin{gathered} \text { TRL HD-M(Rd) } 12- \\ 300 \end{gathered}$ | 1.3 | 12 | 300 | $\begin{gathered} 60 \\ 80 \\ 100 \end{gathered}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 8 \\ & \varnothing 8 \\ & \varnothing 8 \end{aligned}$ | $\begin{aligned} & 23 \\ & 33 \\ & 43 \end{aligned}$ | $\begin{aligned} & 550 \\ & 550 \\ & 550 \end{aligned}$ |
| TRL HD-M(Rd) $16-100$ 400 | 2.5 | 16 | 400 | $\begin{gathered} 80 \\ 100 \\ 120 \end{gathered}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 12 \\ & \varnothing 12 \\ & \varnothing 12 \end{aligned}$ | $\begin{aligned} & 37 \\ & 47 \\ & 57 \\ & \hline \end{aligned}$ | $\begin{aligned} & 750 \\ & 750 \\ & 750 \end{aligned}$ |
| $\underset{520}{\text { TRL HD }} \mathrm{M}(\mathrm{Rd}) 20-$ 520 | 4.0 | 20 | 520 | $\begin{aligned} & 120 \\ & 140 \\ & 160 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 16 \\ & \varnothing 16 \\ & \varnothing 16 \end{aligned}$ | $\begin{aligned} & 62 \\ & 72 \\ & 82 \end{aligned}$ | $\begin{aligned} & 910 \\ & 910 \\ & 910 \end{aligned}$ |
| TRL HD- M(Rd)24540 | 5.0 | 24 | 540 | $\begin{aligned} & 120 \\ & 140 \\ & 160 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\varnothing 16$ <br> $\varnothing 16$ <br> $\varnothing 16$ | $\begin{aligned} & 66 \\ & 76 \\ & 86 \end{aligned}$ | $\begin{aligned} & 1100 \\ & 1100 \\ & 1100 \end{aligned}$ |
| TRL HD- M(Rd) $30-$ 700 | 7.5 | 30 | 700 | $\begin{aligned} & 140 \\ & 160 \\ & 180 \\ & \hline \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 20 \\ & \varnothing 20 \\ & \varnothing 20 \end{aligned}$ | $\begin{gathered} \hline 84 \\ 94 \\ 104 \\ \hline \end{gathered}$ | $\begin{aligned} & 1300 \\ & 1300 \\ & 1300 \end{aligned}$ |
| TRL HD- M(Rd) $36-$ 800 | 10.0 | 36 | 800 | $\begin{aligned} & \hline 160 \\ & 180 \\ & 200 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 20 \\ & \varnothing 20 \\ & \varnothing 20 \end{aligned}$ | $\begin{gathered} 98 \\ 108 \\ 118 \end{gathered}$ | $\begin{aligned} & 1700 \\ & 1700 \\ & 1700 \end{aligned}$ |
| TRL HD- M(Rd) $42-1$ 920 | 12.5 | 42 | 920 | $\begin{aligned} & 160 \\ & 180 \\ & 200 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \\ & \hline \end{aligned}$ | $\begin{aligned} & \varnothing 25 \\ & \varnothing 25 \\ & \varnothing 25 \end{aligned}$ | $\begin{aligned} & 107 \\ & 117 \\ & 127 \end{aligned}$ | $\begin{aligned} & 1650 \\ & 1650 \\ & 1650 \end{aligned}$ |
| TRL HD- M(Rd) $52-$ 1100 | 15.0 | 52 | 1100 | $\begin{aligned} & 200 \\ & 220 \\ & 240 \end{aligned}$ | $\begin{aligned} & 2 \times 188 \\ & 2 \times 188 \\ & 2 \times 188 \end{aligned}$ | $\begin{aligned} & \varnothing 25 \\ & \varnothing 25 \\ & \varnothing 25 \end{aligned}$ | $\begin{aligned} & 133 \\ & 143 \\ & 153 \end{aligned}$ | $\begin{aligned} & 1950 \\ & 1950 \\ & 1950 \end{aligned}$ |

## LIFTING SOCKET WITH FOOTPLATE - HSP-HD

The low-profile lifting socket with footplate is suitable for the face of thin panels or top slabs, which are lifted perpendicular to their largest surface. The footplate and the socket are fully welded, so the insert is effectively sealed. The threaded bush is made of S355J0 steel and the plate is manufactured from steel sheet. On special request, the product can be produced from stainless steel.
The preferred lift angle is $B \leq 30^{\circ}$.
The safe working loads presented are after the application of a safety factor on test loads of 2 for 15 MPa concrete and 3 for steel.



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

## LIFTING SOCKETS HSP - INSTALLATION AND REINFORCEMENTS



| $\begin{aligned} & \text { HSP-HD } \\ & \text { M(Rd) } \end{aligned}$ | Load group | Minimum unit thickness | Anchor spacing | Edge distance | Mesh reinforcement |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Smin | a | b |  |  |
|  | [t] | [mm] | [mm] | [mm] | [mm2/m] |  |
| 12 | 1.3 | 100 | 500 | 250 | $2 \times 188$ | Is |
| 16 | 2.5 | 120 | 820 | 410 | $2 \times 188$ |  |
| 20 | 4.0 | 150 | 1020 | 510 | $2 \times 188$ | Note: The bend radius $R$ will be determined according to EN 1992. |
| 24 | 5.0 | 160 | 1300 | 650 | $2 \times 188$ | top of the plate anchor and in direct contact with the plate. |
| 30 | 7.5 | 200 | 1300 | 650 | $2 \times 260$ | Additional reinforcement must be placed crosswise in pairs. |


| HSP-HDM(Rd) | Additional reinforcement |  |  |  |  |  | Axial load B $\leq 10^{\circ}$ | Diagonal load $10^{\circ} \leq \beta \leq 45^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  | Load capacity $\mathrm{f}_{\mathrm{cu}}>15 \mathrm{MPa}$ | Load capacity $\mathrm{f}_{\mathrm{cu}}>15 \mathrm{MPa}$ | Angled pull reinforcement $\varnothing \mathrm{x} \mathrm{I}_{\text {s }}$ |
|  | number | $\mathrm{d}_{\mathrm{s}}$ | $\mathrm{L}_{1}$ | $\mathrm{L}_{2}$ | h | L |  |  |  |
|  | [pcs] | [mm] | [mm] | [mm] | [mm] | [mm] | [kN] | [kN] | [mm] |
| 12 | 4 | 8 | 60 | 80 | 40 | 400 | 13 | 10.4 | $\varnothing 10 \times 750$ |
| 16 | 4 | 10 | 90 | 110 | 55 | 620 | 25 | 20.0 | $\varnothing 12 \times 1300$ |
| 20 | 4 | 12 | 110 | 110 | 55 | 800 | 40 | 32.0 | $\varnothing 12 \times 1400$ |
| 24 | 4 | 16 | 140 | 120 | 60 | 1120 | 50 | 40.0 | $\varnothing 16 \times 1500$ |
| 30 | 4 | 16 | 140 | 120 | 60 | 1220 | 75 | 60.0 | $\varnothing 16 \times 1750$ |



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

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


## LIFTING SYSTEMS

## LIFTING SLING - THS1

The threaded lifting sling is made of high-grade steel wire rope according EN 12385-4, swaged in a ferrule made of AIMg1.8 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 $90^{\circ}$ 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 15 MPa .


| THS1-M | Product no. | Thread | THS1-Rd | Product no. | Thread | Load group | Axial load | L | d | $\mathrm{I}_{1}$ | 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 and requirements, see chapter Checking the lifting system. These lifting systems are not recommended for intensive reuse conditions.


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


Diagonal or shear load is not permitted in this case.

## THS1 - APPLICATIONS

## SCREWING DETAILS

Ensure that the thread is fully bottomed out in the socket before lifting. A back rotation up to a maximum $90^{\circ}$ 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 ( $\beta$ ) should not be greater than $30^{\circ}$. Pulling back towards the unit is not permitted.

## ADMISSIBLE LOAD DIRECTION



Note: Minimum radius of the crane hook for the wire loop must be $R=\mathbf{2 x} d$ for cable with $d \leq 19 \mathrm{~mm}$ and $R=5 \mathrm{x}$ d for cable with $d \geq 20 \mathrm{~mm}$.


| Number of pieces | 1 | 1 | 2 | 2 | 2 | 2 | 3 or 4 | 3 or 4 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Type of attachment |  |  |  |  |  |  |  | $28$ |
| Angle of inclination | $0^{\circ}$ | $90^{\circ}$ | $0^{\circ}$ | $90^{\circ}$ | $0^{\circ}-45^{\circ}$ | $45^{\circ}-60^{\circ}$ | $0^{\circ}-45^{\circ}$ | $45^{\circ}-60^{\circ}$ |
|  | WLL group | Axial load | Load group | Axial load | Load group | Axial load | Load group | Axial load |
| THST-M/Rd | [kN] | [kN] | [kN] | [kN] | [kN] | [kN] | [kN] | [kN] |
| THS1-M/Rd12 | 13 | 6.5 | 26 | 13 | 9.1 | 6.5 | 13 | 9.1 |
| THS1-M/Rd16 | 25 | 12.5 | 50 | 25 | 17.5 | 12.5 | 25 | 17.5 |
| THS1-M/Rd20 | 40 | 20.0 | 80 | 40 | 28.0 | 20.0 | 40 | 28.0 |
| THS1-M/Rd24 | 50 | 25.0 | 100 | 50 | 35.0 | 25.0 | 50 | 35.0 |
| THS1-M/Rd30 | 75 | 37.5 | 150 | 75 | 52.5 | 37.5 | 75 | 52.5 |
| THS1-M/Rd36 | 100 | 50.0 | 200 | 100 | 70.0 | 50.0 | 100 | 70.0 |
| THS1-M/Rd42 | 125 | 62.5 | 250 | 125 | 84.0 | 62.5 | 125 | 84.0 |
| THS1-M/Rd52 | 150 | 75.0 | 300 | 150 | 105.0 | 75.0 | 150 | 105.0 |

## GENERAL GUIDANCE FOR LIFTING SLING THS1

Ensure that the concrete has MPa strength of at least 15 before beginning lifting.
For positioning the inserts, always check the permitted edge distances and spacing between inserts.
We recommend restricting the lift angle to a maximum of $30^{\circ}$ when angled lifting is necessary.
To choose the proper lifting system, take into consideration how frequently the precast unit is going to be lifted.
The cast-in threaded elements (anchors or fixing inserts) can be flush or recessed for corrosion protection.
This recess is filled with fine concrete after use.
All the HD lifting systems are tested before delivery under a test load three times the working load (individual test for THS1).

## CHECKING THE LIFTING SYSTEM THS1

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

- Any deformation to the wire rope (see the type of damages mentioned on the following page), thread, or metal structural elements causes a weakening of the lifting device with the risk of falling of the precast element. Do not perform any repair work. The lifting device must be discarded. Lifting loops with broken strands or other signs of damage, kinking, bird caging, corrosion that require discarding according EN 13414-1 must not be used for any further lifting.

Damage, distortions, cracks, and extensive corrosion can reduce the load-carrying capacity and lead to failure. This causes a hazard to life and limb. If necessary, any affected parts must be taken out of service immediately.

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

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

[^0]Wire cables should be inspected and discarded according EN 13414-1 when the following flaws occur:
Kinking

- One strand is broken
- Separation of the outer layer of braids
- Crushed strands
- Crushing at the shackle contact point with more than 4 ruptured wires on braided cables or more than 10 ruptured wires on cable-laid rope

Signs of corrosion

- Damage to or severe wear of the closing bush.
- $\quad$ 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 |  |
| Broken wire |  |

## THREADED SWIVEL EYE - THS3

The threaded swivel eye can be used for anchors with threaded sockets and are suitable for most lifting situations, particularly for turning and tilting. They are more suitable for turning and tilting than the lifting systems manufactured from steel wire and can be reused provided they are inspected regularly. If kept in storage for reuse, they must be inspected in accordance with local requirements. The threaded swivel eye THS3 anchors are made of high-quality steel and are designed with a safety factor of 5. Every lifting system is individually tested at 3 times the working load and comes with its own unique certificate.
The threaded swivel eye should only be attached to the concrete unit and used after the concrete strength has reached 15 MPa . It is usually removed after the concrete elements have been installed. This lifting system is suitable for use with threaded socket cast that is flush with the surface of the unit or recessed using (KU-10, TPM) recess formers.
Ensure that the thread is engaged all the way to the bottom of the socket before lifting.


| THS3-M | Product <br> no. | Thread | Load <br> group | Axial <br> $\mathbf{l o a d}$ | $\mathbf{L}$ | $\mathbf{a}$ | $\mathbf{d}$ | $\mathbf{D}$ | $\mathbf{I}_{\mathbf{1}}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 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 | $\mathrm{I}_{1}$ | 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 ( $\beta$ ) should not be greater than $30^{\circ}$. 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 | $0^{\circ}$ | $90^{\circ}$ | $0^{\circ}$ | $90^{\circ}$ | $0^{\circ}-45^{\circ}$ | $45^{\circ}-60^{\circ}$ | $0^{\circ}-45^{\circ}$ | $45^{\circ}-60^{\circ}$ |
|  | WLL group | Axial load | Load group | Axial load | Load group | Axial load | Load group | Axial load |
| THS3-M/Rd | [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 $90^{\circ}$.
The preferred option is the vertical lift. Normally, the angle of lift ( $\boldsymbol{\beta}$ ) should not be greater than $30^{\circ}$. Pulling back towards the unit is not permitted.

## GENERAL GUIDANCE FOR LIFTING SYSTEM THS3

Ensure that the concrete has MPa strength of at least 15 before beginning lifting.
For positioning the inserts, always check the permitted edge distances and spacing between inserts.
We recommend restricting the lift angle to a maximum of $30^{\circ}$ when an angled lift is necessary.
To choose the proper lifting system, take into consideration how frequently the precast unit is going to be lifted.
The cast-in threaded elements (anchors or fixing inserts) can be flush or recessed for corrosion protection.
This recess is filled with fine concrete after use.
All the HD lifting systems are tested before delivery under a test load three times the working load (individual test for THS3).

## CHECKING THE LIFTING SYSTEM THS3

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

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

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


## SAFETY INSTRUCTIONS

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

Obligatory instructions for safe working:

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

Respect local regulations for safe lifting and hoisting at all times.
Incorrect use may result in safety hazards and reduced load-carrying capacity. This may cause the lifted object to fall and pose a hazard to life and limb. Lifting anchor systems must be used only by suitable trained personnel.

## STORAGE REQUIREMENTS

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


## SPECIAL THREAD DESCRIPTION

Terwa special thread Rd is a mix of a standard Rd thread and a metric thread according to DIN 13. It has metric screw pitches and the round thread geometry of thread flanks with a double angle of $60^{\circ}$ and $30^{\circ}$. 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 <br> bolt | Rd thread bush and Rd thread bolt |
| :---: | :---: | :---: |
| ANCHOR BUSH M |  |  |

## ACCESSORIES

DOUBLE METRIC MOUNTING PLUG-SN

|  |  | SN | Productno. | Thread | Thread | L |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | M1 | M2 | [mm] |
|  |  | SN M12-M6 | 45214 | 12 | 6 | 16 |
|  |  | SN M16-M8 | 45215 | 16 | 8 | 16 |
|  |  | SN M20-M8 | 45216 | 20 | 8 | 16 |
|  |  | SN M24-M8 | 46303 | 24 | 8 | 16 |
|  |  | SN M24-M10 | 45217 | 24 | 10 | 16 |
|  |  | SN M30-M10 | 45218 | 30 | 10 | 16 |
|  |  | SN M30-M8 | 46079 | 30 | 8 | 16 |
|  |  | SN M36-M10 | 45219 | 36 | 10 | 25 |
|  |  | SN M42-M10 | 45220 | 42 | 10 | 30 |
|  |  | SN M48-M10 | 45464 | 48 | 10 | 36 |
|  |  | SN M48-M12 | 46525 | 48 | 12 | 36 |
|  |  | SN M48-M16 | 46524 | 48 | 16 | 36 |

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


## PLASTIC NAILING PLATE KU-10

The nailing plates $\mathrm{KU}-10$ 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 | $\mathbf{s}$ | Colour |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\mathbf{M}$ | $[\mathbf{m m}]$ | [mm] |  |
| KU-10-M12 | 63246 | 12 | 47 | 10 | Red RAL 3020 |
| KU-10-M16 | 63256 | 16 | 47 | 10 | Grey RAL 7043 |
| KU-10-M20 | 63257 | 20 | 60 | 10 | Green RAL 6024 |
| KU-10-M24 | 63258 | 24 | 60 | 10 | Blue RAL 5017 |
| KU-10-M30 | 63259 | 63260 | 36 | 73 | 10 |
| KU-10-M36 | 63261 | 63262 | 52 | 96 | 10 |
| KU-10-M42 |  | 96 | 12 | Orange RAL 2009 |  |
| KU-10-M52 |  |  | Yellow RAL 1023 |  |  |

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


## STEEL MAGNETIC PLATE - TPM

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


| TPM-10 | Product no. | Thread | Diam. D | s |
| :---: | :---: | :---: | :---: | :---: |
|  |  | $\mathbf{M}$ | [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 |

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 | $\mathbf{D}$ | $\mathbf{h}$ | $\mathbf{a}$ | $\mathbf{d}$ | Colour |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\mathbf{M}$ | $[\mathbf{m m}]$ | $[\mathbf{m m}]$ | $[\mathbf{m m}]$ | [mm] |  |
| DATA CLIP -M12 | 62651 | 12 | 20.5 | 4 | 6.5 | 9 | Dark grey RAL 7043 |
| DATA CLIP -M16 | 62652 | 16 | 26.5 | 5 | 7.5 | 11 | Green RAL 6024 |
| DATA CLIP -M20 | 62653 | 20 | 31.5 | 6 | 10 | 13 | Blue RAL 5017 |
| DATA CLIP -M24 | 62654 | 24 | 36.5 | 6 | 10 | 15 | Light grey RAL 7004 |
| DATA CLIP -M30 | 62655 | 30 | 43.5 | 6 | 15 | 17 | Orange RAL 2009 |
| DATA CLIP -M36 | 62656 | 36 | 52.5 | 8 | 18 | 21 | Yellow RAL 1023 |
| DATA CLIP -M42 | 62657 | 42 | 60.5 | 8 | 19.5 | 21 | Black RAL 9017 |
| DATA CLIP -M52 | 62658 | 52 | 73.5 | 9 | 22 | 26 |  |


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

## PLASTIC PLUG - TPP

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


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



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

## COVER SEALING CAP TP-02

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


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



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

## COVER SEALING CAP TP-10

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


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



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

## KU CAP DIE

KU CAP DIE is a polyurethane mould used to produce concrete recess sealers. The recess made by the plastic nailing plates $\mathrm{KU}-10$ 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 | $\begin{aligned} & 12 \\ & 16 \end{aligned}$ | 45 | 9 | 16 |
| KU CAP DIE M20-M24 | 64150 | $\begin{aligned} & 20 \\ & 24 \end{aligned}$ | 58 | 9 | 16 |
| KU CAP DIE M30-M36 | 63101 | $\begin{aligned} & 30 \\ & 36 \end{aligned}$ | 70 | 8 | 16 |
| KU CAP DIE M42-M52 | 63103 | $\begin{aligned} & 42 \\ & 52 \end{aligned}$ | 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



## CONTACT



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

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[^0]:    $\mathrm{d}=$ cable diameter

