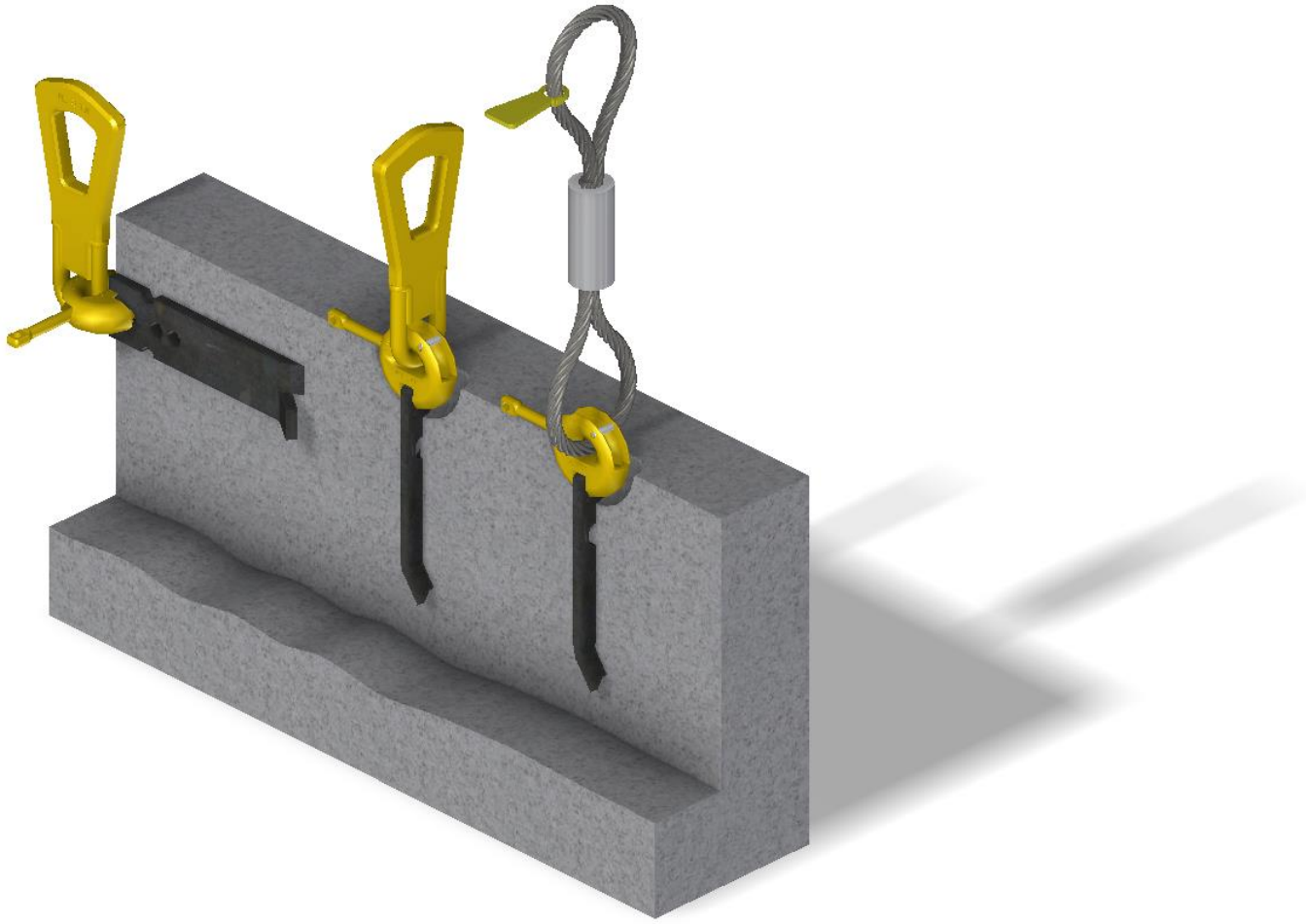
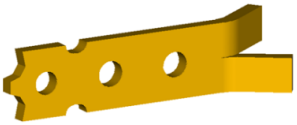
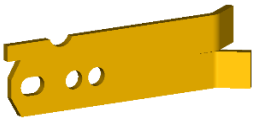
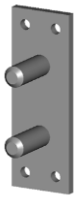
2D - STRIP ANCHOR LIFTING SYSTEM



PRODUCT RANGE

Table 1

LIFTING CLUTCHES AND TRANSPORT ANCHOR			
TF1  Page 4	**TF1-260**  Page 4	**TF2**  Page 4	**SA -B**  Page 17
SA -ST  Page 23	**SA -TTU**  Page 27	**SA -TTU – 12.5 kN**  Page 28	**SA -TU-HP**  Page 29
SA -FA  Page 31	**SA -FAW**  Page 33	**SA -SP**  Page 34	
RECESS FORMERS AND ACCESORIES			
RBF  Page 36	**TMP**  Page 36	**TDV**  Page 37	**TBV**  Page 37

CONTENTS:

INTRODUCTION

The Strip anchor lifting system manufactured by TERWA is safe and easy to handle. If it is used properly, strip anchor lifting system will guarantee that the precast concrete units can be handled in a simple and safe way.
Some of the important advantages of these systems are:

- different types of anchors,
- manual lifting systems,
- the lifting system engages and releases in a simple, safe and quick manner,
- loads allowed in any direction,
- this system can be used for many years.

Strip anchor lifting system combines a strip anchor pressed into the wet concrete and a lifting system. The precast concrete element is lifted and transported with a clutch witch locks into cast -in anchor.
With this system, the load can be pulled from any direction.
The lifting system can be locked and released by hand.
All components of the STRIP ANCHOR LIFTING SYSTEM are classified by load groups. Each load group corresponds to the load limits of a lifting system. A head clutch cannot be assembled with a strip anchor of a different load group.
It is not allowed to weld to the anchor head.
The design for Terwa Strip Anchors and technical instructions are according to the national German rule VDI/BV-BS 6205:2012 “Lifting inserts and lifting insert for precast concrete elements”. Also, based on this rule the lifting systems must ensure that they have enough strength to avoid the concrete failure.

Table 2

No.	Load group [kN]	Lifting system	Anchor group [kN]	Load range anchor [kN]
1	15 (12.5 kN – 15 kN)	TF1 012.5 - 015	12.5– 15	12.5 15
2	25 (7 kN – 25 kN)	TF1 - 025 TF2 - 025	7 – 25	7 14 20 25
3	50 (30 kN – 50 kN)	TF1 - 050 TF2 - 050	30 – 50	30 40 50
4	100 (53 kN – 100 kN)	TF1 - 100 TF2 - 100	53 – 100	53 75 100
5	260 (125 kN – 260 kN)	TF1 - 260 TF2 - 260	125– 260	125 140 220 260

LIFTING SYSTEM TF1 ZINC PLATED

LIFTING SYSTEM TF2 ZINC PLATED

Figure 1

TF1 -12.5 kN -15 kN

TF1 - 25 kN

TF1 - 50 kN

TF1 - 100 kN

Figure 2

TF1 - 260 kN

Figure 3

TF2 - 25 kN

TF2 - 50 kN

TF2 - 100 kN

TF2 - 260 kN

The lifting systems TF1 (figure 1 and figure 2) and TF2 (figure 3) are made of high quality steel and they are designed with a safety factor c= 5. When TF1 and TF2 system are assembled with the correspondent anchor, they have together a minimum safety factor c= 3.
All the lifting systems are tested before delivery under a test load three times the working load.
Each lifting system has an individual testing certificate, attached.
TF2's is different from TF1's due to the connection element (bracket) with the crane hook.TF1 system has the connection element made by wire cable.
The bracket is free to move in any direction.
The clutch head (shackle) in each load group matches the shape of the recess former RBF and incorporates a locker which enters the appropriate head anchor hole.
Only the same load group components can be assembled together (table 2). It is recommended not to mix with components from another manufacturer.
Six types of lifting system TF1 (figure 1 and figure 2) and four types of TF2 are available (figure 3).

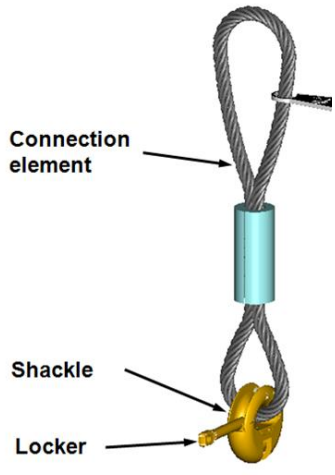
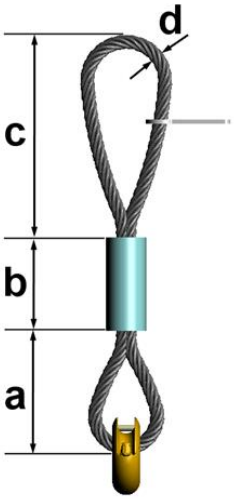


Figure 4



TF1-012.5 / TF1-015 / TF1-025 / TF1-050 / TF1-100

Figure 5

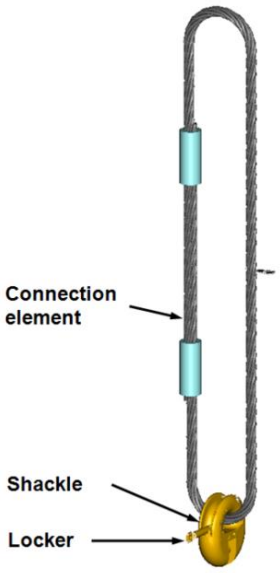
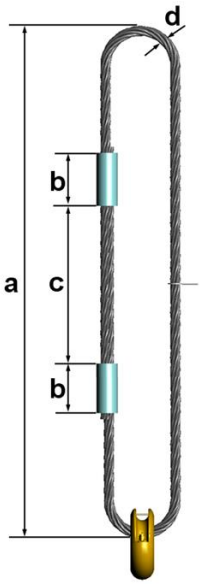


Figure 6



TF1-260

Figure 7

Table 3

TF1 Zinc plated		Maximum load	Load group	Dimensions				Weight
				a	b	c	d	
		[kN]	[kN]	[mm]	[mm]	[mm]	[mm]	Kg/pc.
TF1 -012.5	49524	12.5	12.5	100	54	176	9	0.56
TF1 -015	48983	15	15	100	54	176	9	0.56
TF1 -025	45948	25	7 – 25	120	90	195	14	1.6
TF1 -050	45949	50	30 – 50	200	100	295	18	3.8
TF1 -075/100	45950	100	53 – 100	240	140	325	22	8.2
TF1 -260	45951	260	125 – 260	1570	160	480	32	34.4

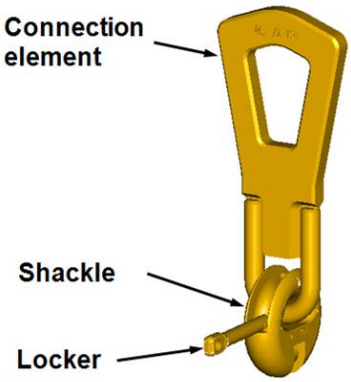


Figure 8

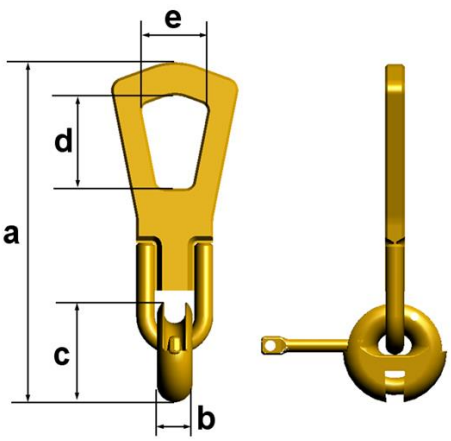


Figure 9

Table 4

TF2 Zinc plated		Maximum load	Load group	Dimensions					Weight
				a	b	c	d	e	
		[kN]	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	Kg/pc.
TF2 -025	44843	25	7– 25	259	27	78,5	70	50	1.7
TF2 -050	44844	50	30 – 50	325	36	105	86	58	3.9
TF2 -075/100	44845	100	53 – 100	431	50	146,7	107	75	9.5
TF2 -260	44846	260	125 – 260	620	72	216	154	110	29.7

LIFTING ANCHORS

SA-B

Figure 10

SA-ST

Figure 11

SA-TTU

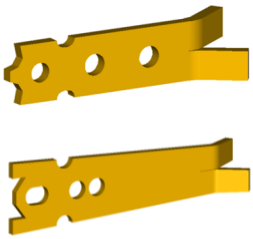


Figure 12

SA-TU-HP

Figure 13

SA-FA

Figure 14

SA-FAW

Figure 15

SA-SP

Figure 16

The anchors are manufactured from a special -grade steel plate S355JO, or equivalent.
The anchors are designed to resist at a minimum safety factor c= 3.
The hole in the anchor head is designed to match the appropriate lifting system. The extra holes are necessary for additional reinforcement.
Each anchor is clearly marked with the anchor load and the product brand (TERWA -TW – figure 17).

Figure 17

The **SA-B anchors "Spread Anchor"** (figure 10) are designed to a load range 7 kN to 220 kN. They are easy adaptable and they provide an efficient anchorage in thin panels and slabs. They are also used in columns, beams, trusses, double T -slabs. In special cases, it is necessary to add reinforcement in the extra hole.

The **SA-ST anchors** "**Strip Anchor"** (figure 11) are designed to load range 7 kN to 260 kN. They are used for pre -stressed concrete trusses, thin walls and low strength concrete. The anchorage in concrete is achieved by a reinforcement tail.

The **SA-TTU** "**Tilt Up Anchor"** (figure 12) are used to load range 12.5 kN to 220 kN. The main applications are: thin walled concrete elements, being lifted from a horizontal to a vertical position. The specially shaped anchor head prevents cracking of the concrete. Usually this type of anchor is used with additional reinforcement, which is required in the pitching and turning operation.

SA-TU-HP "Unilateral Tilt Up Anchor" (figure 13) are used to load range 14 kN to 100 kN. The main applications are: thin walled concrete elements, being lifted from a horizontal to a vertical position. The specially shaped anchor head prevents cracking of the concrete. Usually this type of anchor is used with additional reinforcement, which is required in the pitching and turning operation.

The **SA-FA "Flat Foot Anchor"** (figure 14) made by TERWA is designed to load range 7 kN to 50 kN. The main applications are: de -mould panel, lifting thin slabs, concrete pipes. These elements must have a concrete strength, at lifting, up to 20 MPa. Reinforcement tails, placed above the anchor leg, are strongly recommended.

The **SA-FAW "Plat Anchor"** (figure 15) made by TERWA is designed to load range 25 kN to 100 kN. The main applications are: de -mould panel, lifting thin slabs, concrete pipes. These elements must have a concrete strength, at lifting, up to 20 MPa. Reinforcement tails, placed above the anchor plate, are strongly recommended.

The **SA-SP "Sandwich Panel Anchor"** (figure 16) made by TERWA is designed to load range 25 kN to 100 kN. The main applications are: lifting and transport sandwich panels in an upright position. These prefab elements must have a concrete strength, at lifting, up to 20 MPa.

BASIC PRINCIPLES FOR THE ANCHOR SELECTION

THE SA-B AND SA-ST ANCHORS ARRANGEMENT FOR DIFFERENT TYPES OF PRECAST CONCRETE ELEMENTS

Large area precast unit such as slabs

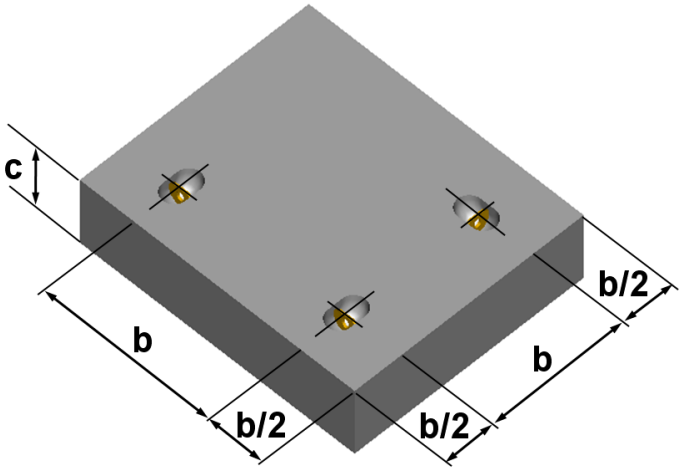


Figure 18

Thin walled precast units such as cladding panels

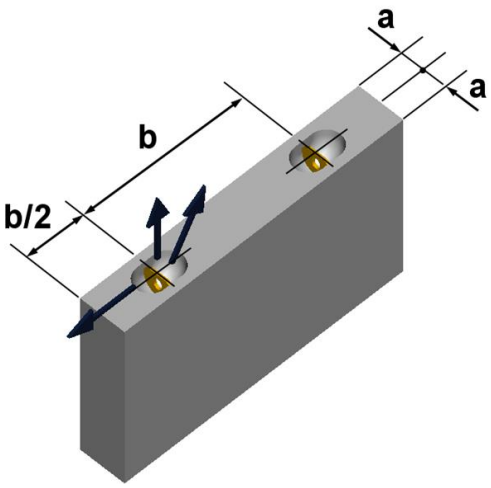


Figure 19

When the load is near to the narrow edge, reinforcement for angled pull is necessary.
In thin walled units, such as panels, the SA-B, SA-ST, SA-TTU, SA-TU anchors may only be installed with the flat steel at right - angles to the slab.

CORRECT INSTALLATION **INCORRECT INSTALLATION**

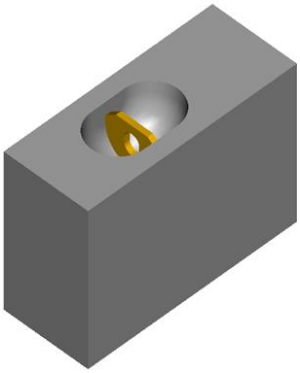


Figure 20

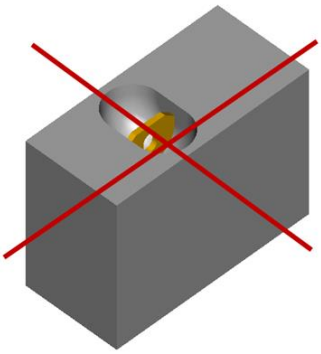


Figure 21

The length of the anchor depends on the minimum thickness of precast units.

c = L + h + e

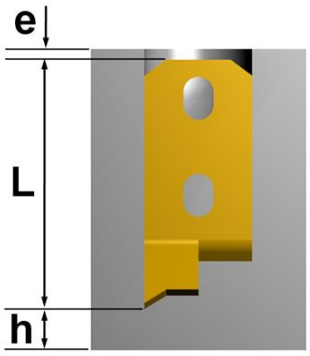


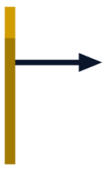
Figure 22

c = minimum thickness of precast unit
L = anchor length
e = cover to anchor head
h = concrete cover, h = 25mm minimum

LOAD DIRECTION

Axial pull in direction of anchor axis.

Transverse pull perpendicular to the anchor surface.



Transverse pull parallel to the anchor surface.

Angled pull, transverse component perpendicular to the anchor surface.

Angled pull, transverse component parallel to the anchor surface.

TECHNICAL INFORMATION – CHOOSING THE TYPE OF ANCHOR

INTRODUCTION

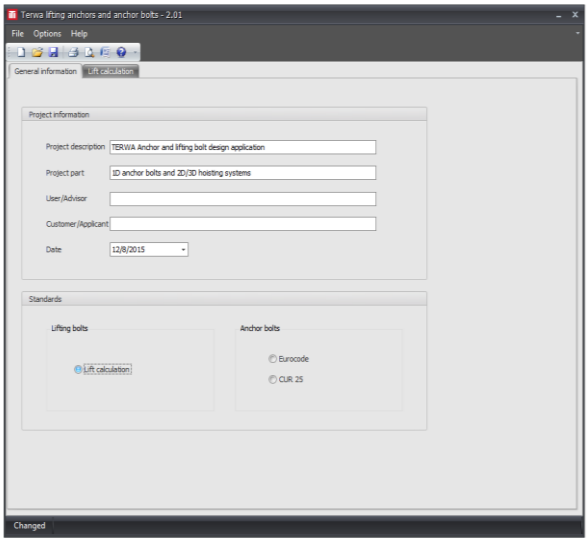
Terwa has 3 types of lifting systems:

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

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

The1D Threaded lifting system is mainly used when the hoisting angles are limited, while the 2D Strip anchor lifting system and the 3D T slot anchor lifting system can be used for all hoisting angles with a small limitation for the 2D Strip anchor lifting system. The difference between the 2D Strip anchor lifting system and the 3D T slot anchor lifting system is mainly caused by the experience in using the one or the other system.

For the calculation of the anchors Terwa also has software for this, with which calculations can be made:



SAFETY RULES

The 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 at least 15MPa strength before starting the lifting. These lifting systems are not suitable for severe re-use.
In designing the lifting system, it is essential to use the following safety factors against breaking:

- for steel component c = 3
- for concrete element c = 2.5
- for steel wires c = 4

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

LOAD CAPACITY

The load capacity of the anchor depends on multiple factors such as:

- The deadweight of the precast concrete element "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 at the time of operating: lifting or transporting
- The embedded depth of the anchor
- Dynamic forces
- The reinforcement arrangement

WEIGHT OF PRECAST UNIT

The total weight "G" of the precast reinforced concrete element is determined using a specific weight of: **ρ = 25kN/m³.** For prefabricated elements are composed of a higher concentration of reinforcing elements in the calculation of weight will take this into account.

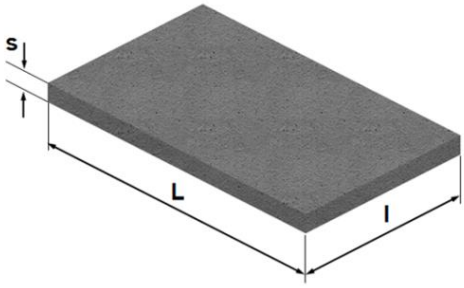


Figure 23

G = ρ x V
V = L x l x s

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

ADHESION TO FORMWORK COEFFICIENT

Adhesion forces between the formwork and the concrete depend on the type of formwork used. The value "H_a" of adhesion to the formwork is calculated through the following equation:

H_a = q x A [kN]

Where:

- q - the adhesion to formwork factor according with the material of the formwork
- y - the form factor (adhesion to formwork factor according with the form of the element)
- A - the area of contact between the formwork and the concrete unit when starting the lift.
  - for oiled steel formwork q = 1 kN/m²
  - for varnished timber formwork q = 2 kN/m²
  - for rough timber formwork oiled q = 3 kN/m²

- Double -T slabs (picture 24)

  H_a = 2 x G
- Ribbed elements

  H_a = 3 x G
- Coffered elements

  H_a = 4 x G

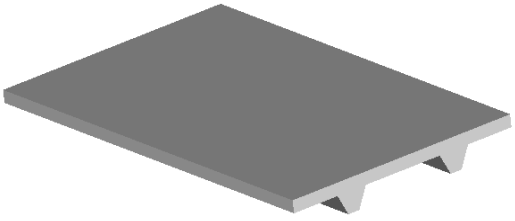


Figure 24

Table 5

Form of the element	Form factor “y”
Beam or pillar	1.0 to 1.10
Vertical plate	1.10 to 1.15
Horizontal plate	1.2 to 1.25
Floor plates with cassettes	> 2.0

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

DYNAMIC ACCELERATION COEFFICIENT (LIFTING LOAD COEFFICIENT)

When the movement of the precast units is performed by lifting gear, dynamic forces which depend on the lifting gear used appear. The lifting classes are described in DIN 15018 (table 6 and table 7).

Table 6

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

Table 7

Lifting equipment	Lifting load coefficient f
Tower crane and fixed crane	1.2 *)
Mobile crane	1.4 *)
Lifting and transporting on flat ground	2 ÷ 2.5
Lifting and transporting on uneven terrain	3 ÷ 4
*) lower values may be appropriate in precast plants if special arrangements are made.	

For cranes with precision lifting, such as those in manufacturing plants the lifting load coefficient is f = 1.1 ÷ 1.3.
The application of a lifting load coefficient for lifting out of the formwork at the manufacturing plant is unnecessary if suitable cautious approach is adopted (f = 1.0).

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

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

ASYMETRIC DISTRIBUTION OF THE LOAD

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

a) If the arrangement of the anchors is asymmetrical in relation to the center of gravity, the individual anchor supports different loads (picture 25). These loads are calculated through the following equations:

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

Note: To avoid tilting of the unit during transport, the load should be suspended from the lifting beam such that its center of gravity (Cg) is directly below the crane hook (figure 25).

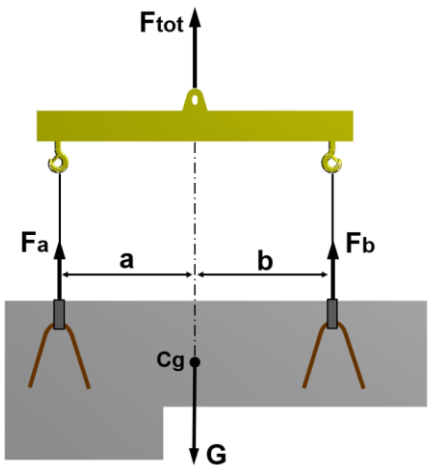


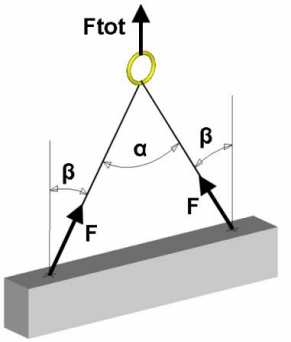
Figure 25

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

LIFTING AT AN ANGLE – CABLE ANGLE COEFFICIENT

The cable angle ß are determined by the length of the suspending cable. We recommend that, if possible, ß should be kept to ß ≤ 30° (picture 26). The tensile force on the anchor is increased with a cable angle coefficient z (table 8).

$F = z \times F_{tot} / n$ where**: z = 1/ cos ß cable angle coefficient, n = number of load bearing anchors**



α = 2 x ß

Figure 26

Table 8

Cable angle ß	Cable angle coefficient z
0°	1.00
7.5°	1.01
15.0°	1.04
22.5°	1.08
30.0°	1.16
*37.5°	1.26
*45.0°	1.41

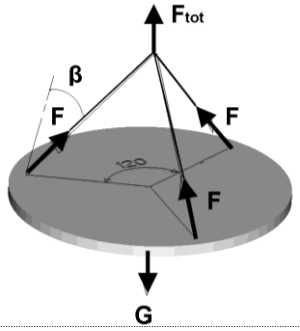
*** preferred ß ≤ 30°**

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

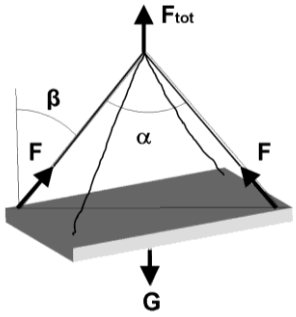
MULTIPLE SLINGS – THE NUMBER OF LOAD BEARING ANCHORS

Table 9

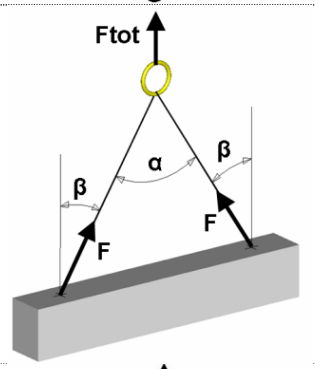
n = 3



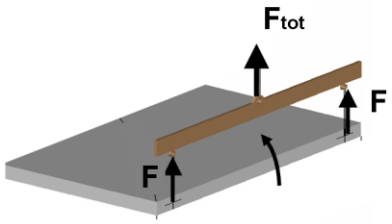
n = 2 – only two anchors can be assumed to be load bearing



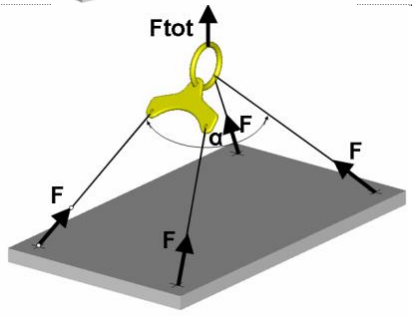
n = 2



n = 2

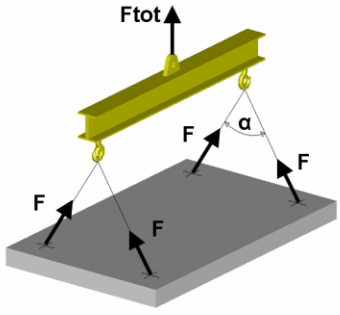


n = 4



-The compensated lifting slings ensure equal load distribution.

n = 4



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

DETERMINATION OF TOTAL LOAD

Total load of precast unit for calculating the anchor is determined through the following equation:

- **When de-mould** $F_{tot} = (G \times y + H_a)$
- **When pitching** $F_{tot} = G$
- **When transporting** $F_{tot} = G$

DETERMINATION OF ANCHOR LOAD

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

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

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

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

CALCULATION EXAMPLE

SLAB UNIT

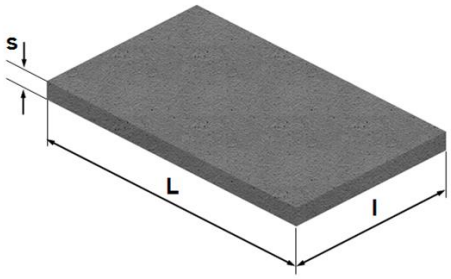


Figure 27

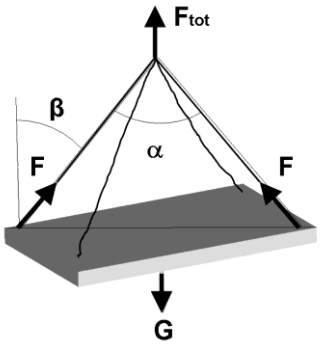


Figure 28

The slab unit has the following dimensions: L = 5 m, l = 2 m, s = 0.2 m
Mass G = 25 x (5 x 2 x 0.2) = 50 kN (~5t)
Formwork area A = 5 x 2 = 10 m²
Anchor number n = 2

Table 10

General dates:	**Symbol**	**De-mould**	**Transport**	**Mount**
Concrete strength at de-mould [MPa]		15	15	
Concrete strength on site [MPa]				35
Weight for element [kN]	**G**	50		
Formwork area [m²]	**A**	10		
Cable angle factor at de-mould (ß = 15.0°)	**z**	1.04	1.04	
Cable angle factor on site (ß = 30.0°)	**z**			1.16
Lifting load coefficient at de-mould	**f**	1.1		
Lifting load coefficient at transport	**f**		1.3	
Lifting load coefficient on site	**f**			1.5
Form factor	**y**	1.2		
Adhesion to formwork factor [kN/m²]	**q**	2.0		
Anchor number for de-mould	**n**	2		
Anchor number for transport at the plant	**n**		2	
Anchor number for transport on site	**n**			2

DE-MOULD AT THE PLANT:

Adhesion to formwork factor	q = 2 kN/m^2	
Form factor	y = 1.2	(table 5, page 10)
Lifting load coefficient	f = 1.1	(page 11)
Cable angle factor	z = 1.04 (ß = 15.0°)	(table 8, page 12)
Concrete strength	15 MPa	

F = [(G x y + q x A) x f x z] / n = [(50 x 1.2 + 2 x 10) x 1.1 x 1.04] / 2 = 45.76 kN

TRANSPORT AT THE PLANT:

Lifting load coefficient	f = 1.3	(page 11)
Cable angle factor	z = 1.04 (ß = 15.0°)	(table 8, page 12)
Concrete strength	15 MPa	

F = (G x f x z) / n = (50 x 1.3 x 1.04) / 2 = 33.8 kN

TRANSPORT AT SITE:

Lifting load coefficient	f = 1.5	(page 11)
Cable angle factor	z = 1.16 (ß = 30.0°)	(table 8, page 12)
Concrete strength	35 MPa	

F = (G x f x z) / n = (50 x 1.5 x 1.16) / 2 = 43.5 kN

An anchor in the 50 kN range is required.

IF ALL FACTORS WERE APPLIED, THE RESULT WOULD BE:

F = [(G x y + q x A) x f x z] / n = [(50 x 1.2 + 2 x 10) x 1.5 x 1.16]/2 = 69.6 kN

The loads occurring on site are often greater than those in the plant as cable angle and lifting load coefficient may be greater. At this stage the concrete strength is usually higher resulting in a greater load capacity of the anchor.

DOUBLE-T BEAM

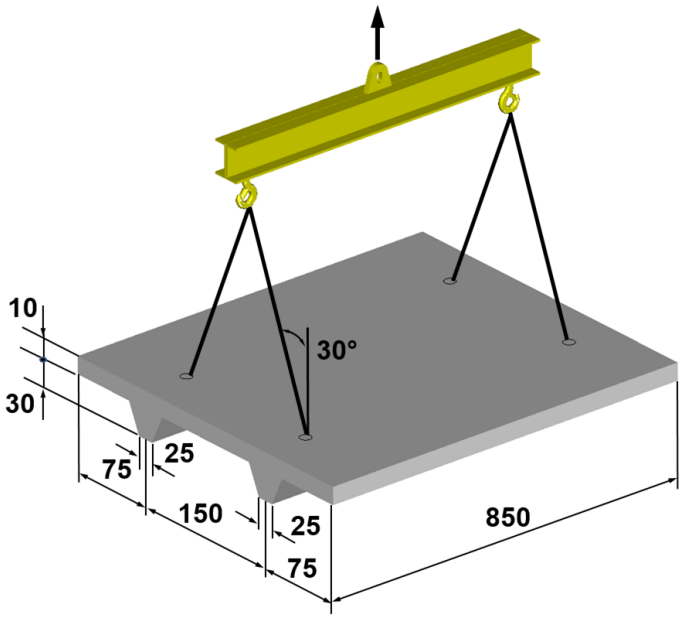


Figure 29

NOTE: Dimensions are in cm

Table 11

General dates:	Symbol	De-mould	Transport
Concrete strength at de-mould and transport [MPa]		25	25
Weight for element [kN]	**G**	102	
Formwork area [m²]	**A**	30.7	
Cable angle factor at de-mould (ß = 30.0°)	**z**	1.16	
Cable angle factor on site (ß = 30.0°)	**z**		1.16
Lifting load coefficient at de-mould	**f**	1.0	
Lifting load coefficient at transport	**f**		1.3
Form factor	**y**	2	
Anchor number for de-mould and transport	**n**	4	4

Load capacity when lifting and transporting at the manufacturing plant.

Concrete strength when de-mould	≥ 25 MPa	
Cable angle	ß = 30,0°	
Cable angle factor	z = 1.16	(table 8, page 12)
Form factor	y = 2	(table 5, page 10)
Lifting load coefficient when transporting	f = 1.3	(page 11)
Lifting load coefficient when de-mould	f = 1.0	(page 11)
Anchor number	n = 4	

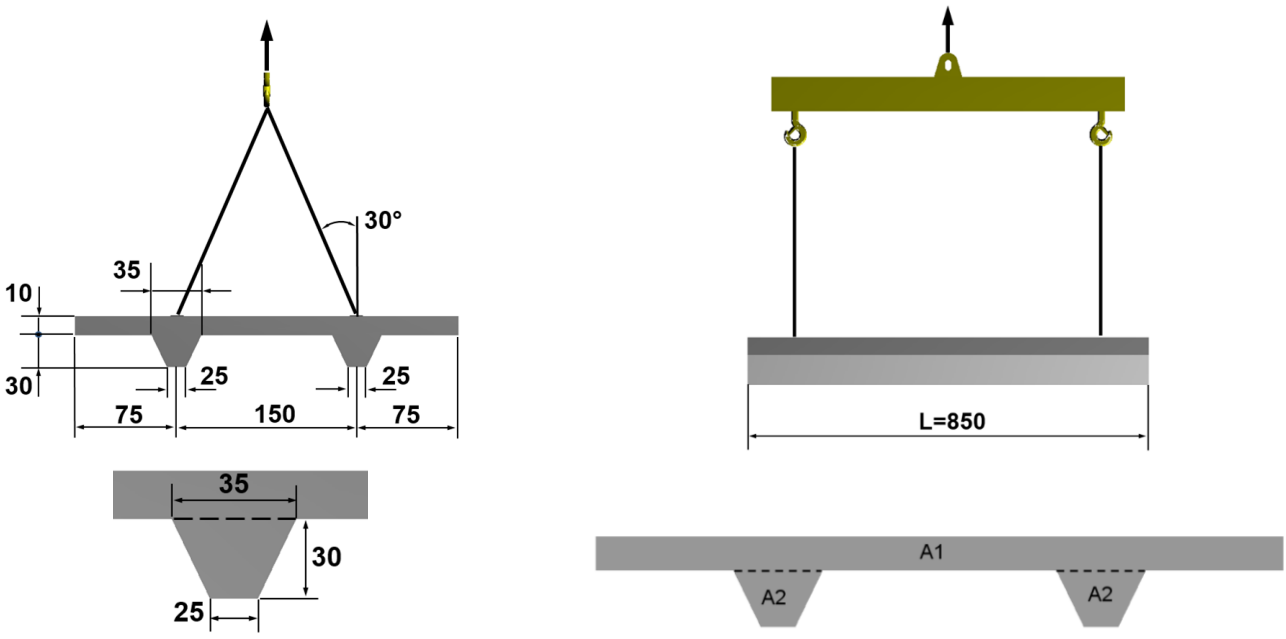


Figure 30

ρ = 25 kN/m³
G= V x ρ = (A x L) x ρ= (A1 + A2 x 2) x L x ρ = (0.1 x 3 + 0.3² x 2) x 8.5 x 25 = 102 kN
L = 850 cm L = 8.5 m
A1 = 10 x 300 (cm²)
A1 = 0.1 x 3 (m²)
A2 = [(35+25) x 30]/2 (cm²)
A2 = [(0.35+0.25) x 0.3]/2 (m²) = (0.6 x 0.3)/2 = 0.3 x 0.3 = 0.3² (m²)

Weight:	G = (0.1 x 3.0 + 0.3² x 2) x 8.5 x 25 = 102 kN
Adhesion to mould	Ha = 2 x G = 204 kN
Total load	F_{tot} = G x y + Ha = 102 x 2 + 204 = 408 kN

LOAD PER ANCHOR WHEN DE-MOULD:

F = (F_{tot} x f x z) / n = [(G x y + H_a) x f x z]/n = (408 x 1.0 x 1.16) / 4 = 118.32 kN

LOAD PER ANCHOR WHEN TRANSPORTING:

$F = (F_{tot} \times f \times z) / n = (G \times f \times z)/ n = (102 \times 1.3 \times 1.16) / 4 = 38.45$ kN

An anchor in the 125 kN range is required.

WALL PANEL

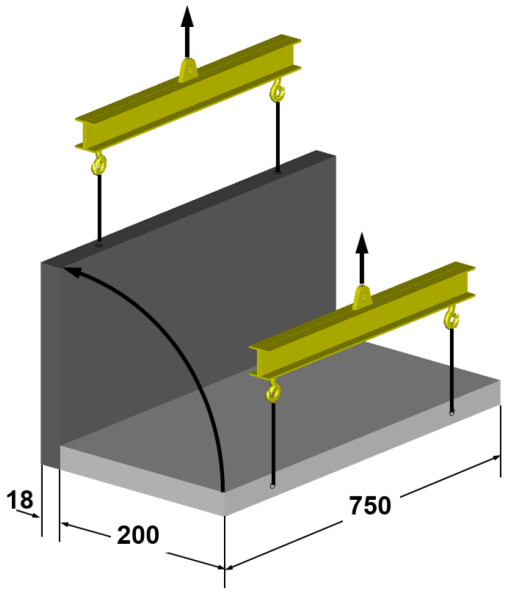


Figure 31

NOTE: Dimensions are in cm

Table 12

General dates:	Symbol	De-mould	Pitching	Mount
Concrete strength at de-mould [MPa]		15	15	
Concrete strength on site [MPa]				45
Weight for element [kN]	**G**	67.5		
Mould area [m²]	**A**	15		
Cable angle factor at de-mould (ß = 0,0°)	**z**	1.0		
Cable angle factor at pitching (ß = 0.0°)	**z**		1.0	
Cable angle factor on site (ß = 0.0°)	**z**			1.0
Lifting load coefficient at de-mould	**f**	1.1		
Lifting load coefficient at pitching	**f**		1.3	
Lifting load coefficient on site	**f**			1.5
Form factor	**y**	1.2		
Adhesion to mould factor [kN/m²]	**q**	1.0		
Anchor number for de-mould	**n**	4		
Anchor number at pitching	**n**		2	
Anchor number for transport on site	**n**			2

Load capacity when pitching and transporting at the construction site.

Concrete strength when pitching	≥ 15 MPa	
Form factor	y = 1.2	(table 5, page 10)
Lifting load coefficient of the crane when de-mould	f = 1.1	(page 11)
Lifting load coefficient of the crane when pitching	f = 1.3	(page 11)
Lifting load coefficient of the crane when transporting on site	f = 1.5	(page 11)
Cable angle coefficient	z = 1 (ß = 0°)	(table 8, page 12)
Anchor number for de-mould	n = 4	
Anchor number for pitching	n = 2	
For oiled steel formwork	q = 1 kN/m²	

Weight:	G = 0.18 x 2.0 x 7.5 x 25 = 67.5 kN
Adhesion to formwork	H_a = q x A = 1 x 2 x 7.5 = 15.0 kN
Total load at de-mould	F_{tot} = G x y + Ha = 67.5 x 1.2 + 15 = 96 kN
Total load at transporting	F_{tot} = G = 67.5 kN

LOAD PER ANCHOR WHEN DE-MOULD:

F = (F_{tot} x f x z) / n = (96 x 1.1 x 1.0) / 4 = 26.4 kN

Four anchors in the 30 kN range are required.

LOAD PER ANCHOR WHEN PITCHING:

Ground reaction balances half the full load.

F = (F_{tot}/2 x f x z) / n = (67.5/2 x 1.3 x 1.0) / 2 = 21.94 kN (When pitching 50% $F_{perm.}$)

LOAD PER ANCHOR WHEN TRANSPORTING ON SITE:

F = (F_{tot} x f x z) / n = (67.5 x 1.5 x 1.0) / 2 = 50.63 kN < 53 kN

Two anchors embedded on lateral side, SA-TTU type in the 75 kN range are required.
Usually for this type of anchor reinforcement tail and pitching reinforcement are added.
It is advisable to de-mould before pitching.

LOAD PER ANCHOR WHEN PITCHING AFTER DE-MOULD

In this case for de-mould, pitching and transport are used the same anchors.

F = (F_{tot}/2 x f x z) / n = (96/2 x 1.3 x 1.0) / 2 = 31.2 kN

STRIP ANCHORS

SPREAD ANCHOR SA -B

The **SA -B anchors "Spread Anchor"** (figure 32) are designed to load range 7 kN to 220 kN (table 14). They are easy adaptable and they provide an efficient anchorage in thin panels and slabs. They are also used in columns, beams, trusses, double T -slabs. In special cases, it is necessary to add reinforcement in the extra hole.

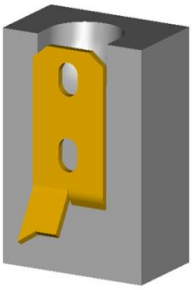


Figure 32

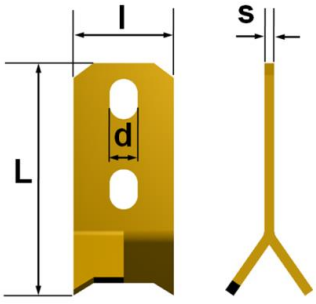


Figure 33

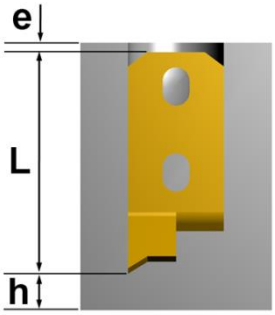


Figure 34

Table 13

Load group	25 kN	50 kN	100 kN	260 kN
Cover to anchor head "e" [mm]	10	10	15	15

Table 14

Designation	Product number		L	l	s	d	Load range	Weight
	black	Zinc plated	[mm]	[mm]	[mm]	[mm]	[kN]	Kg/pc
Load group 25 kN (7 kN – 25 kN)								
SA -B 7 kN – 110	44991	45022	110	30	5	14	7	0.106
SA -B 14 kN – 110	44992	45023	110	30	6	14	14	0.126
SA -B 14 kN – 160	44993	45024	160	30	6	14	14	0.197
SA -B 20 kN – 130	44994	45025	130	30	8	14	20	0.205
SA -B 20 kN – 160	44995	45026	160	30	8	14	20	0.262
SA -B 20 kN – 210	44996	45027	210	30	8	14	20	0.356
SA -B 25 kN – 120	46272	46273	120	30	10	14	25	0.233
SA -B 25 kN – 150	44997	45028	150	30	10	14	25	0.304
SA -B 25 kN – 200	44998	45029	200	30	10	14	25	0.422
SA -B 25 kN – 250	44999	45030	250	30	10	14	25	0.540
Load group 50 kN (30 kN - 50 kN)								
SA -B 30 kN – 160	45000	45031	160	40	10	18	30	0.432
SA -B 30 kN – 220	45001	45032	220	40	10	18	30	0.558
SA -B 30 kN – 280	45002	45033	280	40	10	18	30	0.809
SA -B 40 kN – 140	46301	46302	140	40	12	18	40	0.446
SA -B 40 kN – 180	45003	45034	180	40	12	18	40	0.597
SA -B 40 kN – 240	45004	45035	240	40	12	18	40	0.823
SA -B 40 kN – 320	45005	45036	320	40	12	18	40	1.124
SA -B 50 kN – 180	45006	45037	180	40	15	18	50	0.745
SA -B 50 kN – 240	45007	45038	240	40	15	18	50	1.028
SA -B 50 kN – 400	45008	45039	400	40	15	18	50	1.781
Load group 100 kN (53 kN - 100 kN)								
SA -B 53 kN – 220	45009	45040	220	60	12	26	53	1.081
SA -B 53 kN – 260	45010	45041	260	60	12	26	53	1.307
SA -B 53 kN – 340	45011	45042	340	60	12	26	53	1.759
SA -B 75 kN – 260	45012	45043	260	60	15	26	75	1.633
SA -B 75 kN – 300	45013	45044	300	60	15	26	75	1.916
SA -B 75 kN – 420	45014	45045	420	60	15	26	75	2.764
SA -B 100 kN – 300	45015	45046	300	60	20	27	100	2.537
SA -B 100 kN – 370	45016	45047	370	60	20	27	100	3.197
SA -B 100 kN – 520	45017	45048	520	60	20	27	100	4.610
Load group 260 kN (125 kN - 260 kN)								
SA -B 140 kN – 370	45018	45049	370	80	20	35	140	4.074
SA -B 140 kN – 460	45019	45050	460	80	20	35	140	5.217
SA -B 220 kN – 500	45020	45051	500	80	25	35	220	7.127
SA -B 220 kN – 620	45021	45052	620	80	25	35	220	9.026

LOAD CAPACITY, INSTALLATION DIMENSIONS FOR LARGE -AREA PRECAST ELEMENTS OR CONCRETE BEAMS

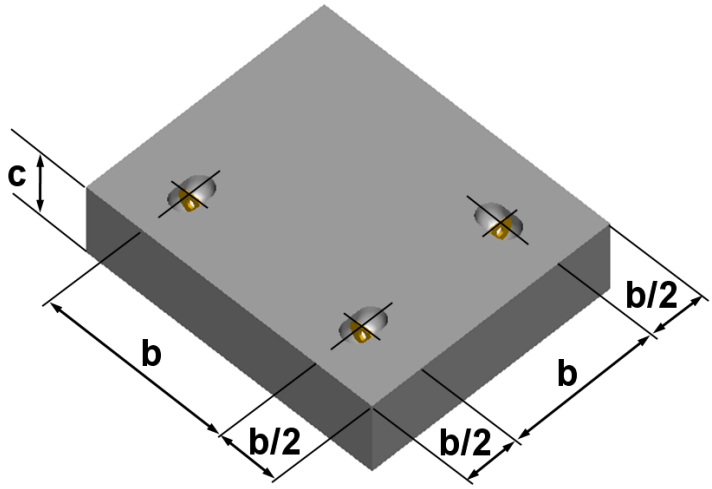


Figure 35

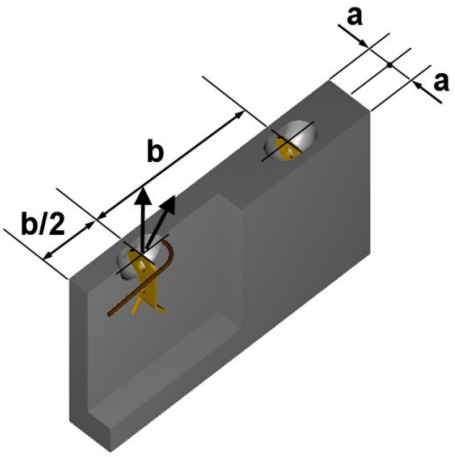


Figure 36

When the load is near to the narrow edge, reinforcement for angled pull is necessary.

Table 15

Designation	Anchor length „L"	Load range	Minimum thickness of precast unit „c"	Minimum spacing between center „b"			Minimum thickness of beam „2 x a"		
				$f_{cu} \geq 15$ MPa	$f_{cu} \geq 25$ MPa	$f_{cu} \geq 35$ MPa	$f_{cu} \geq 15$ MPa	$f_{cu} \geq 25$ MPa	$f_{cu} \geq 35$ MPa
	[mm]	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
Load group 25 kN (7 kN – 25 kN)									
SA -B 7 kN – 110	110	7	145	390	280	280	70	70	70
SA -B 14 kN – 110	110	14	145	390	380	380	110	80	70
SA -B 20 kN – 130	130	20	165	460	460	460	150	110	90
SA -B 20 kN – 160	160	20	195	660	660	660	120	80	80
SA -B 25 kN – 150	150	25	185	530	530	530	180	130	100
SA -B 25 kN – 200	200	25	235	730	700	700	130	90	70
Load group 50 kN (30 kN - 50 kN)									
SA -B 30 kN – 160	160	30	195	560	560	560	210	150	120
SA -B 30 kN – 220	220	30	255	700	700	700	160	120	100
SA -B 40 kN – 180	180	40	215	630	630	630	280	200	160
SA -B 40 kN – 240	240	40	275	840	840	840	200	140	110
SA -B 50 kN – 180	180	50	215	630	630	630	380	270	220
SA -B 50 kN – 240	240	50	275	840	840	840	270	190	150
Load group 100 kN (53 kN - 100 kN)									
SA -B 53 kN – 220	220	53	260	770	770	770	280	200	160
SA -B 53 kN – 260	260	53	300	880	880	880	240	180	140
SA -B 75 kN – 260	260	75	300	910	910	910	420	300	240
SA -B 75 kN – 300	300	75	340	1050	1050	1050	360	250	200
SA -B 100 kN – 300	300	100	340	1050	1050	1050	540	380	300
SA -B 100 kN – 370	370	100	410	1300	1300	1300	420	300	240
Load group 260 kN (125 kN - 260 kN)									
SA -B 140 kN – 370	370	140	410	1300	1300	1300	700	500	400
SA -B 140 kN – 460	460	140	500	1610	1610	1610	530	380	300
SA -B 220 kN – 500	500	220	540	1750	1750	1750	900	640	520
SA -B 220 kN – 620	620	220	660	2170	2170	2170	700	500	400

LOAD CAPACITY, INSTALLATION DIMENSIONS FOR THIN -WALLED PRECAST ELEMENTS

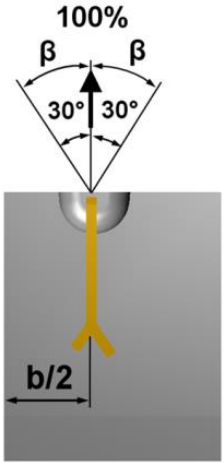


Figure 37

Without reinforcement tails

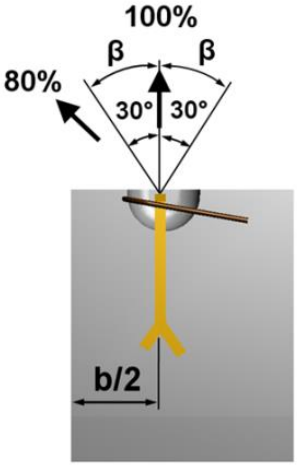


Figure 38

With reinforcement tails placed as close to the recess former as possible

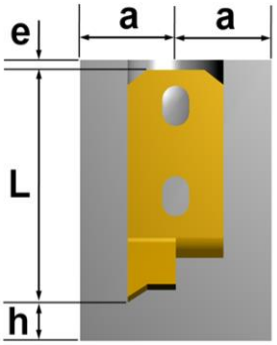


Figure 39

Table 16

Designation	L	Spacing between anchor center " b "	Minimum thickness of precast unit "2 x a"			100% F perm Pull (β≤30°)	80% F perm Angled pull (β>30°)
			f_{cu}≥ 15 MPa	f_{cu}≥ 25 MPa	f_{cu}≥ 35 MPa		
	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]
Load group 25 kN (7 kN – 25 kN)							
SA -B 7 kN – 110	110	330	70	60	60	7	5.6
SA -B 14 kN – 110	110	330	80	70	70	14	11.2
SA -B 14 kN – 160	160	480	80	70	70	14	11.2
SA -B 20 kN – 130	130	390	110	90	80	20	16
SA -B 20 kN – 160	160	480	110	90	80	20	16
SA -B 20 kN – 210	210	630	110	90	80	20	16
SA -B 25 kN – 150	150	450	120	90	80	25	20
SA -B 25 kN – 200	200	600	120	90	80	25	20
SA -B 25 kN – 250	250	750	120	90	80	25	20
Load group 50 kN (30 kN - 50 kN)							
SA -B 30 kN – 160	160	480	160	100	90	30	24
SA -B 30 kN – 220	220	600	120	100	90	30	24
SA -B 30 kN – 280	280	840	120	100	90	30	24
SA -B 40 kN – 180	180	540	210	130	100	40	32
SA -B 40 kN – 240	240	720	150	120	100	40	32
SA -B 40 kN – 320	320	960	150	120	100	40	32
SA -B 50 kN – 180	180	540	350	210	150	50	40
SA -B 50 kN – 240	240	720	180	150	120	50	40
SA -B 50 kN – 400	400	1200	180	150	120	50	40
Load group 100 kN (53 kN - 100 kN)							
SA -B 53 kN – 220	220	660	350	210	150	53	42.4
SA -B 53 kN – 260	260	780	180	150	120	53	42.4
SA -B 53 kN – 340	340	1020	180	150	120	53	42.4
SA -B 75 kN – 260	260	780	340	200	150	75	60
SA -B 75 kN – 300	300	900	240	160	140	75	60

Designation	L	Spacing between anchor center " b "	Minimum thickness of precast unit "2 x a"			100% F perm Pull (β≤30°)	80% F perm Angled pull (β>30°)
			f_{cu}≥ 15 MPa	f_{cu}≥ 25 MPa	f_{cu}≥ 35 MPa		
	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]
SA -B 75 kN – 420	420	1260	200	160	140	75	60
SA -B 100 kN – 300	300	900	450	270	190	100	80
SA -B 100 kN – 370	370	1110	270	190	160	100	80
SA -B 100 kN – 520	520	1560	250	190	160	100	80
Load group 260 kN (125 kN - 260 kN)							
SA -B 140 kN – 370	370	1110	610	360	260	140	112
SA -B 140 kN – 460	460	1380	350	210	170	140	112
SA -B 220 kN – 500	500	1500	760	460	340	220	176
SA -B 220 kN – 620	620	1860	450	280	240	220	176

REINFORCEMENT TYPES AT ANCHOR ZONE FOR THIN -WALLED PRECAST ELEMENTS

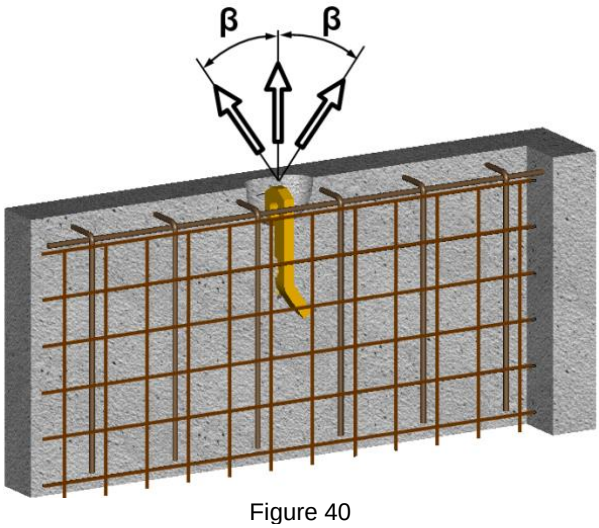
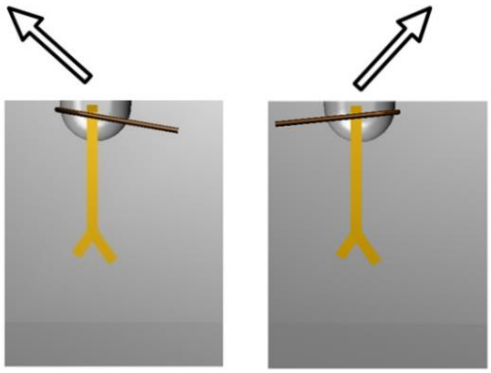
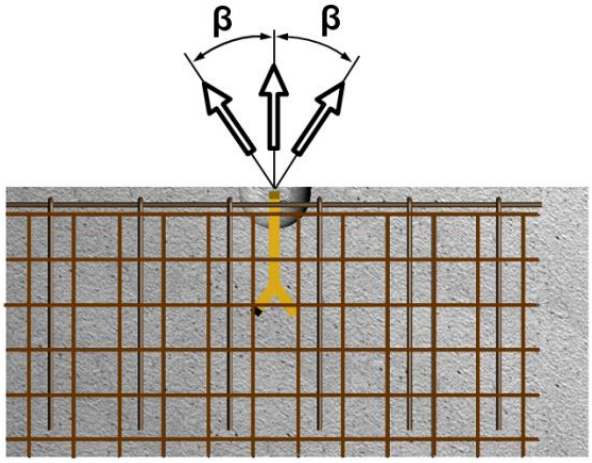


Figure 40



Angled pull reinforcement is inserted in the opposite direction to the load.

Figure 41



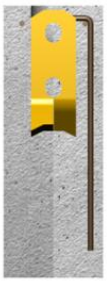
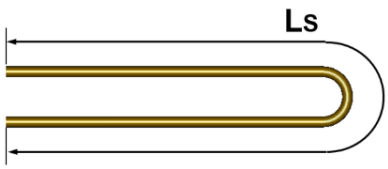


Figure 42

Angled pull reinforcement



Ls (overall length) = 2 x length of leg

Figure 43

Concrete strength f_{cu} ≥ 15 MPa

Table 17

Designation	Load range	Pull (β≤30°)		Angled pull (β>30°)		
		Slot -in -link n x Ø x L	Edge reinforcement	Slot -in -link n x Ø x L	Edge reinforcement	Angled pull reinforcement Ø x L_s
	[kN]	[mm]	[mm]	[mm]	[mm]	[mm]
Load group 25 kN (7 kN – 25 kN)						
SA -B 7 kN	7	2 x Ø 6 x 400	Ø 6	4 x Ø 6 x 300	Ø 8	Ø 6 x 450
SA -B 14 kN	14	2 x Ø 6 x 400	Ø 6	4 x Ø 6 x 400	Ø 8	Ø 6 x 900
SA -B 20 kN	20	2 x Ø 6 x 500	Ø 6	4 x Ø 6 x 500	Ø 8	Ø 8 x 950
SA -B 25 kN	25	2 x Ø 8 x 600	Ø 8	4 x Ø 8 x 600	Ø10	Ø 8 x 1200
Load group 50 kN (30 kN - 50 kN)						
SA -B 30 kN	30	2 x Ø 8 x 700	Ø 8	4 x Ø 8 x 700	Ø10	Ø10 x 1150
SA -B 40 kN	40	2 x Ø 8 x 800	Ø 8	4 x Ø 8 x 800	Ø12	Ø10 x 1500
SA -B 50 kN	50	2 x Ø10 x 800	Ø10	4 x Ø10 x 800	Ø12	Ø12 x 1550
Load group 100 kN (53 kN - 100 kN)						
SA -B 53 kN	53	2 x Ø10 x 800	Ø10	4 x Ø10 x 800	Ø12	Ø12 x 1650
SA -B 75 kN	75	4 x Ø10 x 800	Ø10	4 x Ø10 x 800	Ø12	Ø14 x 2000
SA -B 100 kN	100	6 x Ø10 x1000	Ø12	6 x Ø10 x1000	Ø14	Ø16 x 2300
Load group 260 kN (125 kN - 260 kN)						
SA -B 140 kN	140	6 x Ø10 x1000	Ø14	8 x Ø10 x1000	Ø14	Ø20 x 2600
SA -B 220 kN	220	8 x Ø10 x1200	Ø14	8 x Ø10 x1200	Ø16	Ø28 x 3550

For thin -walled precast elements, additional to mesh reinforcement, a slot -in -link reinforcement (figure 40) and an angled pull reinforcement (figure 41) is used in the anchor zone. The angled pull reinforcement is inserted in opposite direction to the load. The type of mesh reinforcement is determined by a specialist.

Panels and beams containing only basic reinforcements such as wire mesh, stirrups and edge reinforcement must only be lifted in the axial direction or at an angle not exceeding 30 °.

The stirrups will be installed on both sides of the anchor on an area equal to 3 x length of anchor. Those two stirrups near the anchor should be installed as close as to the recess former.

LOAD CAPACITY, INSTALLATION DIMENSIONS FOR ERECTING AND PITCHING

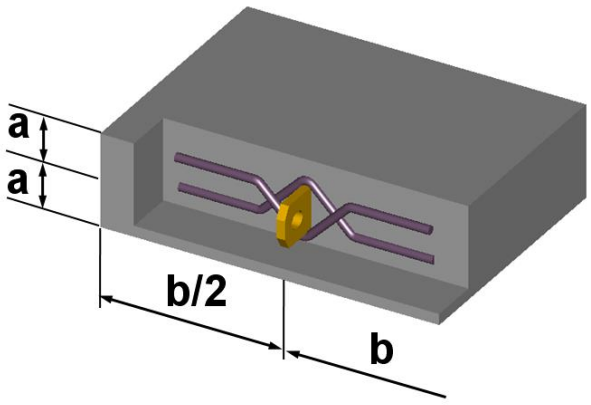


Figure 44

Erecting and pitching reinforcement

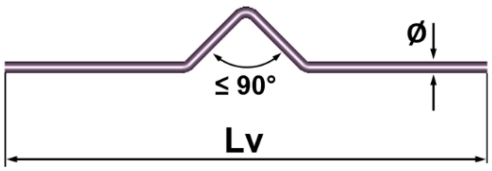


Figure 45

L_V = length before bending. The height of bend depends on the element thickness (2 x a)

Concrete strength f_{cu} ≥ 15 MPa

Table 18

Designation	L	Minimum thickness	Minimum spacing between center	Erecting and pitching reinforcement		Axial pull	Angled pull and transverse pull	Parallel transverse pulls and Angled pull
		"2 x a"	"b"	Ø	L_v	Transport	Transport	Erecting
	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
Load group 25 kN (7 kN – 25 kN)								
SA -B 7 kN – 110	110	100	700	8	600	7.0	5.6	3.5
SA -B 14 kN – 160	160	100	700	10	700	14	11.2	7.0
SA -B 20 kN – 210	210	100	800	10	750	20	16	10
SA -B 25 kN – 250	250	120	875	12	800	25	20	125
Load group 50 kN (30 kN - 50 kN)								
SA -B 30 kN – 280	280	150	950	12	850	30	24	15
SA -B 40 kN – 320	320	150	1050	14	950	40	32	20
SA -B 50 kN – 400	400	160	1450	16	1000	50	40	25
Load group 100 kN (53 kN - 100 kN)								
SA -B 53 kN – 340	340	180	1200	16	1000	53	42.4	26.5
SA -B 75 kN – 420	420	200	1470	20	1200	75	60	37.5
SA -B 100 kN – 520	520	200	1820	20	1500	100	80	50
Load group 260 kN (125 kN - 260 kN)								
SA -B 140 kN – 460	460	300	1800	25	1800	140	112	70
SA -B 220 kN – 620	620	360	2200	28	1800	220	176	110

STRIP ANCHOR SA -ST

The **SA -ST anchors** "**Strip Anchor"** (figure 46) are designed to load range 7 kN to 260 kN (table 20). They are used for pre - stressed concrete trusses, thin walls and low strength concrete. The anchorage in concrete is achieved by a reinforcement tail.

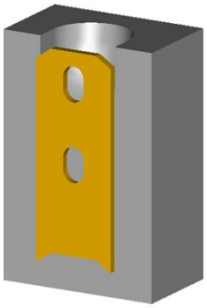


Figure 46

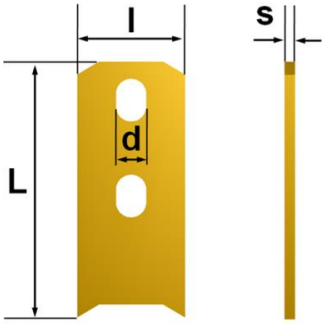


Figure 47

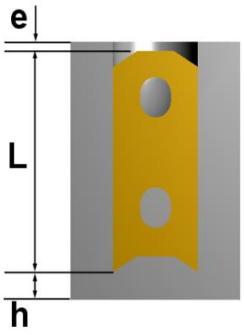


Figure 48

Table 19

Load group	25 kN	50 kN	100 kN	260 kN
Cover to anchor head "e" [mm]	10	10	15	15

Table 20

Designation	Product number		L	l	s	d	Load range	Weight
	black	Zinc plated	[mm]	[mm]	[mm]	[mm]	[kN]	Kg/pc
Load group 25 kN (7 kN – 25 kN)								
SA -ST 7 kN – 90	45053	45066	90	30	5	14	7	0.078
SA -ST 14 kN – 90	45054	45067	90	30	6	14	14	0.094
SA -ST 20 kN – 90	45055	45068	90	30	8	14	20	0.126
SA -ST 25 kN – 90	45056	45069	90	30	10	14	25	0.157
Load group 50 kN (30 kN - 50 kN)								
SA -ST 30 kN – 120	45057	45070	120	40	10	18	30	0.300
SA -ST 40 kN – 120	45058	45071	120	40	12	18	40	0.360
SA -ST 50 kN – 120	45059	45072	120	40	15	18	50	0.448
Load group 100 kN (53 kN - 100 kN)								
SA -ST 53 kN – 160	45060	45073	160	60	12	26	53	0.723
SA -ST 75 kN – 160	45061	45074	160	60	15	26	75	0.904
SA -ST 100 kN – 170	45062	45075	170	60	20	27	100	1.300
Load group 260 kN (125 kN - 260 kN)								
SA -ST 140 kN – 240	45063	45076	240	80	20	35	140	2.414
SA -ST 220 kN – 300	45064	45077	300	80	25	35	220	3.960
SA -ST 260 kN – 300	45065	45078	300	120	30	35	260	7.238

LOAD CAPACITY, INSTALLATION DIMENSIONS

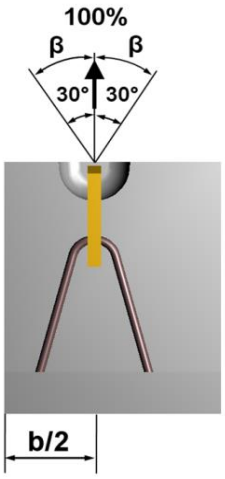


Figure 49

Without reinforcement tails

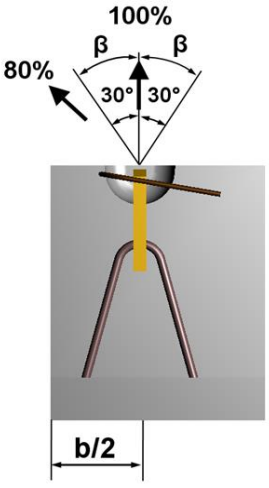


Figure 50

With reinforcement tails placed as close to the recess former as possible

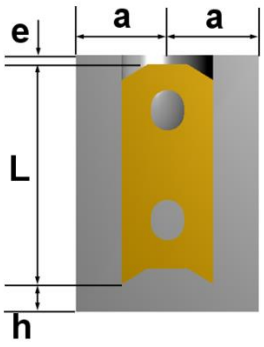


Figure 51

Table 21

Designation	L	Minimum spacing between center "b"	Minimum thickness of precast unit "2 x a"	100% F perm Pull (β≤30°)	80% F perm Angled pull (β>30°)
	[mm]	[mm]	[mm]	[kN]	[kN]
Load group 25 kN (7 kN – 25 kN)					
SA -ST 7 kN – 90	90	400	80	7.0	5.6
SA -ST 14 kN – 90	90	500	80	14	11.2
SA -ST 20 kN – 90	90	600	90	20	16
SA -ST 25 kN – 90	90	600	100	25	20

Designation	L	Minimum spacing between center "b"	Minimum thickness of precast unit "2 x a"	100% F perm Pull (β≤30°)	80% F perm Angled pull (β>30°)
	[mm]	[mm]	[mm]	[kN]	[kN]
Load group 50 kN (30 kN - 50 kN)					
SA -ST 30 kN – 120	120	650	100	30	24
SA -ST 40 kN – 120	120	700	110	40	32
SA -ST 50 kN – 120	120	750	120	50	40
Load group 100 kN (53 kN - 100 kN)					
SA -ST 53 kN – 160	160	800	120	53	42.4
SA -ST 75 kN – 160	160	1200	130	75	60
SA -ST 100 kN – 170	170	1200	140	100	80
Load group 260 kN (125 kN - 260 kN)					
SA -ST 140 kN – 240	240	1500	160	140	112
SA -ST 220 kN – 300	300	1500	180	220	176
SA -ST 260 kN – 300	300	1500	200	260	208

REINFORCEMENT TYPE USED IN ANCHOR ZONE

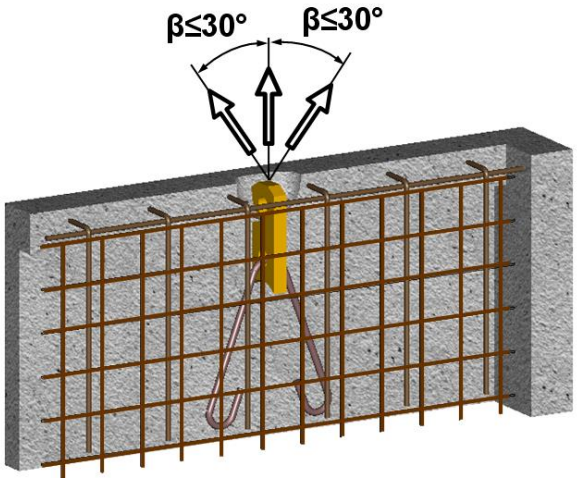


Figure 52

Reinforcement tail for lifting

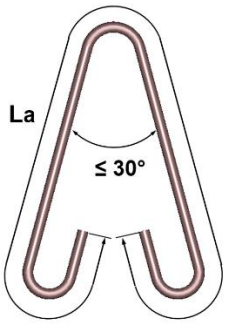


Figure 53

L_a = overall length.
The bending angle must be ≤ 30 °

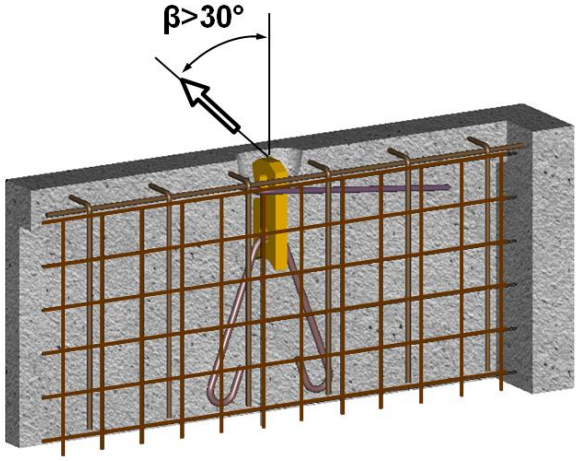


Figure 54-a

Figure 54-b

Angled pull reinforcement

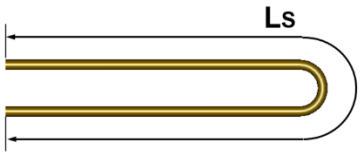


Figure 55

L_S (overall length) = 2 x length of leg

Table 22

Designation	Load range	Pull (β≤30°)		
		Slot -in -link n x Ø x L	Edge reinforcement	Reinforcement tail n x Ø x L_a
	[kN]	[mm]	[mm]	[mm]
Load group 25 kN (7 kN - 25 kN)				
SA -ST 14 kN	14	2 x Ø 6 x 400	Ø 6	1 x Ø10 x 650
SA -ST 20 kN	20	2 x Ø 6 x 500	Ø 6	1 x Ø12 x 800
SA -ST 25 kN	25	2 x Ø 8 x 600	Ø 6	1 x Ø12 x1000
Load group 50 kN (30 kN - 50 kN)				
SA -ST 30 kN	30	2 x Ø 8 x 700	Ø 8	1 x Ø14 x1000
SA -ST 40 kN	40	2 x Ø 8 x 700	Ø 8	1 x Ø16 x1200
SA -ST 50 kN	50	2 x Ø 8 x 800	Ø 8	1 x Ø16 x1500
Load group 100 kN (53 kN - 100 kN)				
SA -ST 53 kN	53	2 x Ø 8 x 800	Ø 8	1 x Ø16 x1750
SA -ST 75 kN	75	2 x Ø10 x 800	Ø10	1 x Ø20 x1750
SA -ST 100 kN	10	4 x Ø10 x 800	Ø12	1 x Ø25 x1850
Load group 260 kN (125 kN - 260 kN)				
SA -ST 140 kN	140	4 x Ø10 x1000	Ø14	1 x Ø28 x2350
SA -ST 220 kN	220	4 x Ø12 x1200	Ø14	1 x Ø28 x3000

Table 23

Designation	Load range	Angled pull (β>30°)			
		Slot -in -link n x Ø x L	Edge reinforcement	Reinforcement tail n x Ø x L_a	Angled pull reinforcement Ø x L_s
	[kN]	[mm]	[mm]	[mm]	[mm]
Load group 25 kN (7 kN – 25 kN)					
SA -ST 14 kN	14	4 x Ø 6 x 400	Ø 8	1 x Ø10 x 650	Ø 6 x 900
SA -ST 20 kN	20	4 x Ø 6 x 500	Ø 8	1 x Ø12 x 800	Ø 8 x 950
SA -ST 25 kN	25	4 x Ø 8 x 600	Ø10	1 x Ø12 x1000	Ø 8 x 1200
Load group 50 kN (30 kN - 50 kN)					
SA -ST 30 kN	30	4 x Ø 8 x 700	Ø10	1 x Ø14 x1000	Ø10 x 1150
SA -ST 40 kN	40	4 x Ø 8 x 800	Ø12	1 x Ø16 x1200	Ø10 x 1500
SA -ST 50 kN	50	4 x Ø10 x 800	Ø12	1 x Ø16 x1500	Ø12 x 1550
Load group 100 kN (53 kN - 100 kN)					
SA -ST 53 kN	53	4 x Ø10 x 800	Ø12	1 x Ø16 x1750	Ø12 x 1650
SA -ST 75 kN	75	4 x Ø10 x 800	Ø12	1 x Ø20 x1750	Ø14 x 2000
SA -ST 100 kN	100	6 x Ø10 x1000	Ø12	1 x Ø25 x1850	Ø16 x 2300
Load group 260 kN (125 kN - 260 kN)					
SA -ST 140 kN	140	8 x Ø10 x1000	Ø14	1 x Ø28 x2350	Ø20 x 2600
SA -ST 220 kN	220	8 x Ø10 x1200	Ø16	1 x Ø28 x3000	Ø25 x 3000

Note: Concrete strength $f_{cu} \geq 15$ MPa
For concrete strength f_{cu} = 25 MPa the length "L_a" of the reinforcement tail may be reduced in relation to the permissible bond stress with 0.8 and for concrete strength f_{cu} = 35 MPa with 0.65

The type of mesh reinforcement is determined by a specialist.
Panels and beams containing only basic reinforcements such as wire mesh, stirrups, edge reinforcement and reinforcing tail must only be lifted in the axial direction or at an angle not exceeding 30° (figure 52). For angled pull it is required an additional reinforcement installed in opposite direction of the load (figure 54). It is recommended to install this angle pull reinforcement as close as possible to the recess former.
Pitching reinforcement on both sides also acts as angled pull reinforcement. No additional angled pull reinforcement is required.

The stirrups will be installed on both sides of the anchor on an area equal to 3 x length of anchor. Those two stirrups in the vicinity of the anchor should be installed as close as possible to the recess former.

TILT UP ANCHOR SA -TTU

The **SA -TTU** (figure 56, figure 59 and 61) are used to load range 12.5 kN to 220 kN (table 25 and table 26). The main applications are: thin walled concrete elements, being lifted from a horizontal to a vertical position. The specially shaped anchor head prevents cracking of the concrete. Usually this type of anchor is used with additional reinforcement, which is required in the pitching and turning operation (figure 70). For lifting are used a reinforcement tail (figure 71). For handling, very thin precast concrete units a special anchor is required – SA -TTU -12.5 kN.

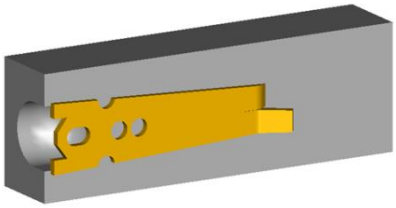


Figure 56

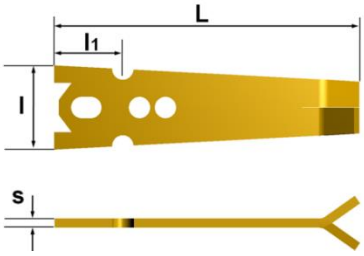


Figure 57

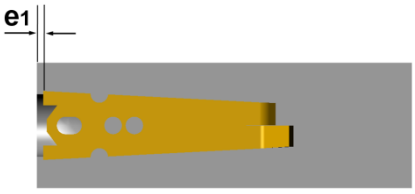


Figure 58

For load group 260 kN (125-220 kN) see figure 59 and 60.

Figure 59

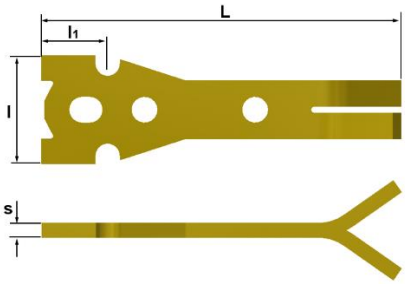


Figure 60

Table24

Load group	25 kN	50 kN	100 kN	260 kN
Cover to anchor head “e1” [mm]	5	5	6	15

Table 25

Designation	Product number		L	l	s	l_1	Load range	Weight
	black	Zinc plated	[mm]	[mm]	[mm]	[mm]	[kN]	Kg/pc
Load group 25 kN (7 kN – 25 kN)								
SA -TTU 14 kN – 200	46887	46888	200	55	6	45	14	0.382
SA -TTU 25 kN – 150	46889	46890	150	55	10	45	25	0.492
SA -TTU 25 kN – 230	46885	46886	230	55	10	45	25	0.711
Load group 50 kN (30 kN - 50 kN)								
SA -TTU 40 kN – 270	46883	46884	270	70	12	70	40	1.308
SA -TTU 50 kN – 290	46881	46882	290	70	15	70	50	1.906
Load group 100 kN (53 kN - 100 kN)								
SA -TTU 75 kN – 320	46879	46880	320	95	18	90	75	3.453
SA -TTU 100 kN – 390	46877	46878	390	95	20	90	100	4.610
Load group 260 kN (125 kN - 260 kN)								
SA -TTU 125 kN – 500	62454	62455	500	148	20	90	125	6.800
SA -TTU 170 kN – 500	62456	62457	500	148	25	90	170	8.500
SA -TTU 220 kN – 500	62458	62459	500	148	30	90	220	10.170

For handling (pitching, turning and lifting) very thin precast concrete units a special anchor is required – SA -TTU -12.5 kN (figure 61 – table 26).

Figure 61

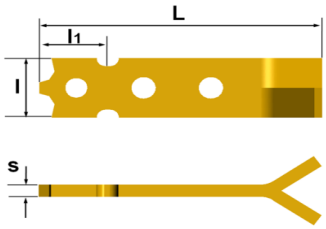


Figure 62

Table 26

Designation	Product number		L	l	s	l_1	Load range	Weight
	black	Zinc plated	[mm]	[mm]	[mm]	[mm]	[kN]	Kg/pc
Load group 12.5 kN								
SA -TTU – 12.5 kN – 120	49094	49095	120	30	6	25	12.5	0.160

LOAD CAPACITY, INSTALLATION DIMENSIONS SA-TTU

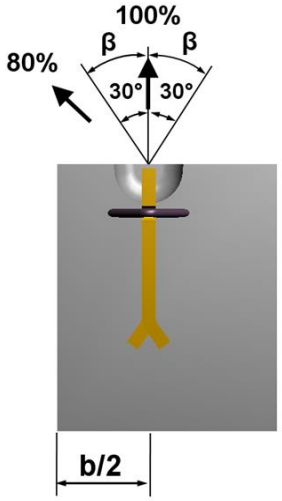


Figure 63

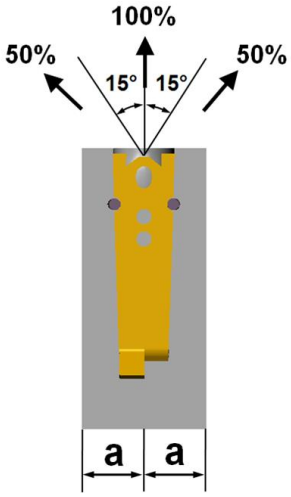


Figure 64

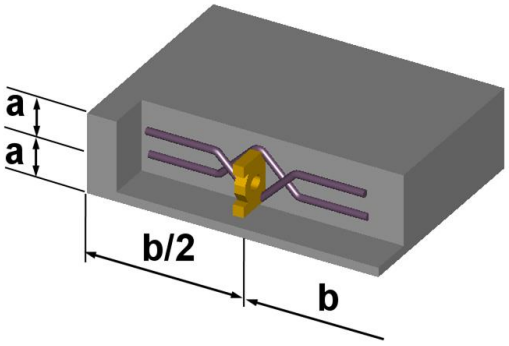


Figure 65

Table 27

Designation	L	Spacing between anchor center "b"	Minimum thickness of precast unit with reinforcement for pull "2 x a"	Transport 100% F perm Axial pull (β≤30°) 25 N/mm²	Transport 80% F perm Angled pull (β>30°)	Pitching 50% F perm 25 N/mm²
	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
Load group 12.5 kN						
SA -TTU 12.5 kN - 120	120	240	90	12.5	10.0	6.25
Load group 25 kN (7 kN - 25 kN)						
SA -TTU 14 kN – 200	200	700	100	14	11.2	7
SA -TTU 25 kN – 150	150	550	120	25	20	12.5
SA -TTU 25 kN – 230	230	800	120	25	20	12.5

Designation	L	Spacing between anchor center "b"	Minimum thickness of precast unit with reinforcement for pull "2 x a"	Transport 100% F perm Axial pull (β≤30°) 25 N/mm²	Transport 80% F perm Angled pull (β>30°)	Pitching 50% F perm 25 N/mm²
	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
Load group 50 kN (30 kN - 50 kN)						
SA -TTU 40 kN – 270	270	950	150	40	32	20
SA -TTU 50 kN – 290	290	1000	160	50	40	25
Load group 100 kN (53 kN - 100 kN)						
SA -TTU 75 kN – 320	320	1200	175	75	60	37.5
SA -TTU 100 kN – 390	390	1500	240	100	80	50
Load group 260 kN (125 kN - 260 kN)						
SA -TTU 125 kN – 500	500	1500	240	125	96	62
SA -TTU 170 kN – 500	500	1500	300	170	112	85
SA -TTU 220 kN – 500	500	1500	300	220	160	110

TILT UP ANCHOR SA-TU-HP

The **SA-TU-HP** "**Tilt Up Anchor"** (picture 66) are used to load range 14kN to 100kN (table 29). The main applications are: thin walled concrete elements, being lifted from a horizontal to a vertical position. The specially shaped anchor head prevents cracking of the concrete. Usually this type of anchor is used with additional reinforcement, which is required in the pitching and turning operation (picture 72). For lifting are used a reinforcement tail (picture 73).

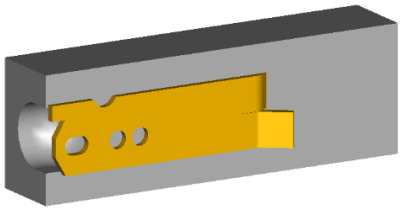


Figure 66

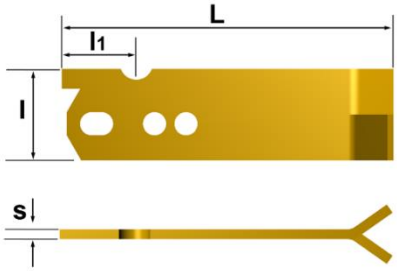


Figure 67

Figure 68

Table 28

Load group	25 kN	50 kN	100 kN
Cover to anchor head "e1" [mm]	5	5	6

Table 29

Designation	Product number		L	l	s	l_1	Load range	Weight
	black	Zinc plated	[mm]	[mm]	[mm]	[mm]	[kN]	Kg/pc
Load group 25 kN (7 kN - 25 kN)								
SA-TU-HP 14 kN – 200	61625	61626	200	40	6	42.5	14	0,350
SA-TU-HP 25 kN – 230	61190	61385	230	40	10	42.5	25	0,650
Load group 50 kN (30 kN - 50 kN)								
SA-TU-HP 40 kN – 270	61627	61628	270	55	12	50.5	40	1,260
SA-TU-HP 50 kN – 290	61301	61386	290	55	15	50.5	50	1,810
Load group 100 kN (53 kN - 100 kN)								
SA-TU-HP 75 kN – 320	61302	61387	320	80	18	78	75	2,800
SA-TU-HP 100 kN – 390	61303	61388	390	80	20	78	100	4,470

LOAD CAPACITY, INSTALLATION DIMENSIONS SA-TU-HP

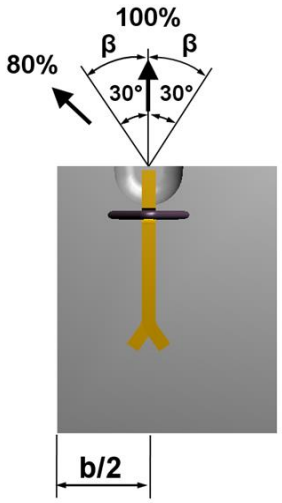


Figure 69

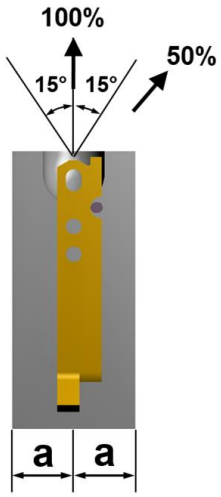


Figure 70

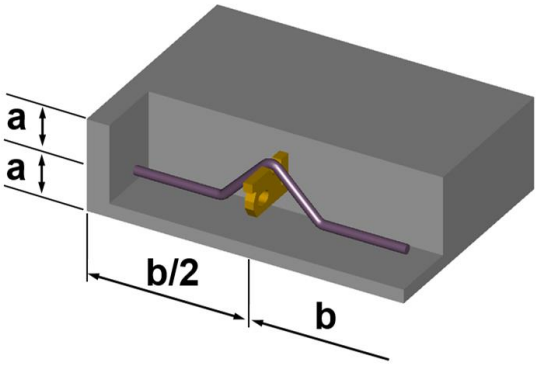


Figure 71

Table 30

Designation	L	Spacing between anchor center "b"	Minimum thickness of precast unit "2 x a"	Transport 100% F perm Axial pull (β≤30°)	Transport 80% F perm Angled pull (β>30°)	Pitching 50% F perm
	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
Load group 25 kN (7 kN - 25 kN)						
SA -TU-HP 14 kN – 200	200	700	90	14	11	7
SA -TU-HP 25 kN – 230	230	800	120	25	20	12.5
Load group 50 kN (30 kN - 50 kN)						
SA -TU-HP 40 kN – 270	270	950	140	40	32	20
SA -TU-HP 50 kN – 290	290	1000	140	50	40	25
Load group 100 kN (53 kN - 100 kN)						
SA -TU-HP 75 kN – 320	320	1200	160	75	60	37.5
SA -TU-HP 100 kN – 390	390	1500	200	100	80	50

REINFORCEMENT IN ANCHOR ZONE (SA-TTU, SA-TU-HP)

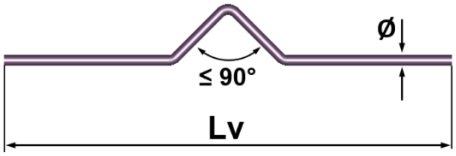


Figure 72

Erecting and pitching reinforcement

L_V = length before bending. The height of bend depends on the element thickness (2 x a)

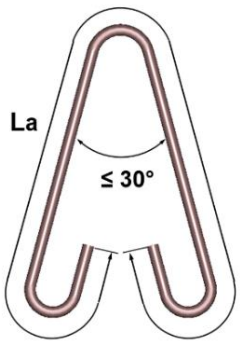


Figure 73

Reinforcement tail for lifting

L_a = overall length.
The bending angle must be ≤ 30°

Table 31

Load group	Load range	Erecting and pitching reinforcement Ø x L_v	Reinforcement tail Ø x L_a
	[kN]	[mm]	[mm]
Load group 12.5 kN - 15 kN	12.5– 15	Ø 8 x 600	Ø 8 x 700
Load group 25 kN (7 kN – 25 kN)	14	Ø10 x 700	Ø10 x 650
	25	Ø12 x 800	Ø12 x 1000
Load group 50 kN (30 kN - 50 kN)	40	Ø14 x 950	Ø16 x 1200
	50	Ø16 x 1000	Ø16 x 1500
Load group 100 kN (53 kN - 100 kN)	75	Ø20 x 1200	Ø20 x 1750
	100	Ø20 x 1500	Ø20 x 1900
Load group 260 kN (125 kN - 260 kN)	125	Ø25 x 1500	Ø25 x 2200
	170	Ø25 x 1800	Ø28 x 2500
	220	Ø25 x 1800	Ø28 x 3000

Note: Concrete strength $f_{cu} \geq 15$ MPa
For concrete strength f_{cu} = 25 MPa, the length "L_v" of the reinforcement tail may be reduced in relation to the permissible bond stress with and for concrete strength f_{cu} = 35 MPa with 0.65
Pitching reinforcement on both sides also acts as angled pull reinforcement. No additional angled pull reinforcement is required.

FLAT FOOT ANCHOR SA -FA

The **SA -FA "Flat Foot Anchor"** (figure 74) made by TERWA is designed to load range 7 kN to 50 kN (table 33). The main applications are: de -mould panel, lifting thin slabs, concrete pipes. These elements must have a concrete strength, at lifting, up to 20 MPa. Reinforcement tails, placed above the anchor leg, are strongly recommended (figure 78).

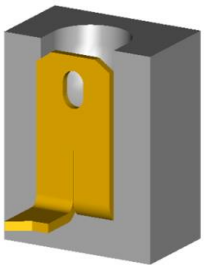


Figure 74

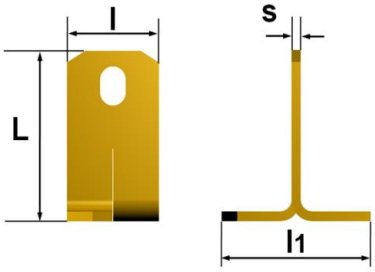


Figure 75

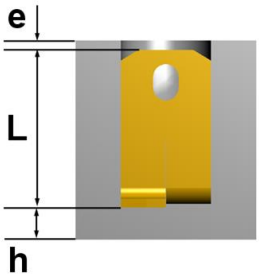


Figure 76

Table 32

Load group	25 kN	50 kN
Cover to anchor head "e" [mm]	10	10

Table 33

Designation	Product number		L	l	s	l_1	Load range	Weight
	black	Zinc plated	[mm]	[mm]	[mm]	[mm]	[kN]	Kg/pc
Load group 25 kN (7 kN – 25 kN)								
SA -FA 7 kN – 65	45924	45925	65	30	5	100	7	0.110
SA -FA 14 kN – 68	45922	45923	68	30	6	100	14	0.134
SA -FA 20 kN – 70	45926	45927	70	30	8	100	20	0.178
SA -FA 20 kN – 100	48362		100	30	8	100	20	0.190
SA -FA 25 kN – 75	45928	45929	75	30	10	100	25	0.230
Load group 50 kN (30 kN - 50 kN)								
SA -FA 30 kN – 90	45930	45931	90	40	10	120	30	0.380
SA -FA 40 kN – 110	45932	45933	110	40	12	120	40	0.520
SA -FA 50 kN – 125	45934	45935	125	40	15	120	50	0.705

REINFORCEMENTS TYPE USED IN ANCHOR ZONE

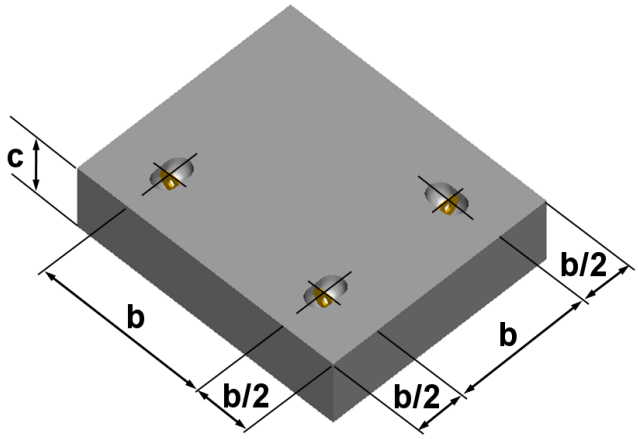


Figure 77

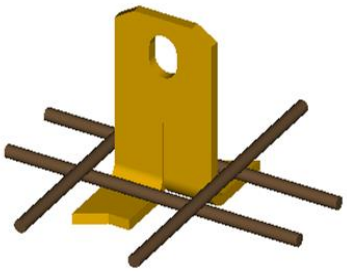


Figure 78

Note:
Reinforcement tails placed as close to the anchor as possible.

Table 34

Designation	L	Minimum thickness of precast unit	Minimum distances from edge	Minimum spacing between center	Permitted load Axial angled and transversal pull		
		"c"	"b/2"	"b"	$f_{cu} \geq 15$ MPa	$f_{cu} \geq 25$ MPa	$f_{cu} \geq 35$ MPa
	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
Load group 25 kN (7 kN – 25 kN)							
SA -FA 7 kN – 65	65	80	140	280	7	7	7
SA -FA 14 kN – 68	68	80	140	280	14	14	14
SA -FA 20 kN – 70	70	90	150	300	18	20	20
SA -FA 25 kN – 75	75	100	160	320	20	25	25
Load group 50 kN (30 kN - 50 kN)							
SA -FA 30 kN – 90	90	120	190	380	28	30	30
SA -FA 40 kN – 110	110	140	230	460	37	40	40
SA -FA 50 kN – 125	125	160	260	520	44	50	50

Table 35

Designation	Reinforcement bar	
	Ø	L
	[mm]	[mm]
Load group 25 kN (7 kN – 25 kN)		
SA -FA 7 kN	8	200
SA -FA 14 kN	8	250
SA -FA 20 kN	8	300
SA -FA 25 kN	8	300
Load group 10 kN (53 kN - 100 kN)		
SA -FA 30 kN	10	400
SA -FA 40 kN	12	450
SA -FA 50 kN	12	500

PLATE ANCHOR SA -FAW

The **SA -FAW "Plat Anchor"** (figure 79) made by TERWA is designed to load range 14 kN to 100 kN (table 37). The main applications are: de -mould panel, lifting thin slabs, concrete pipes. These elements must have a concrete strength, at lifting, up to 20 MPa. Reinforcement tails, placed above the anchor plate, are strongly recommended (figure 82).

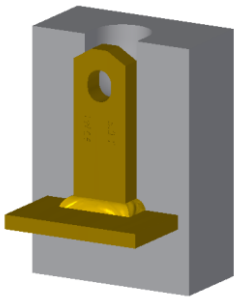


Figure 79

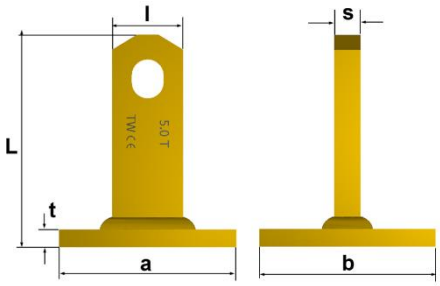


Figure 80

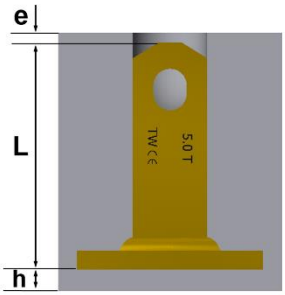


Figure 81

Table 36

Load group	25 kN	50 kN	100 kN
Cover to anchor head "e" [mm]	10	10	15

Table 37

Designation	Product number		L	l	s	a	b	Load range	Weight
	black	Zinc plated	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	Kg/pc
Load group 25 kN (7 kN – 25 kN)									
SA -FAW 14 kN – 55	62094	61580	55	30	6	80	80	14	0.430
SA -FAW 25 kN – 80	62095	61581	80	30	10	80	80	25	0.750
Load group 50 kN (30 kN - 50 kN)									
SA -FAW 50 kN – 120	62096	61582	120	40	15	100	100	50	1.230
Load group 100 kN (53 kN - 100 kN)									
SA -FAW 100 kN – 160	62097	61583	160	60	20	140	140	100	2.250

Figure 82

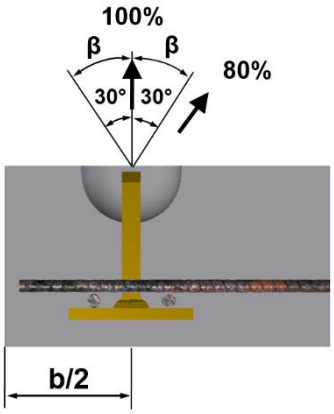


Figure 83

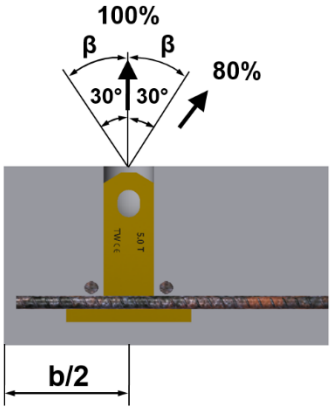


Figure 84

Table 38

Designation	Reinforcement bar	
	Ø	L
	[mm]	[mm]
Load group 25 kN (7 kN – 25 kN)		
SA -FAW 14 kN – 55	8	200
SA -FAW 25 kN – 80	10	300
Load group 50 kN (30 kN - 50 kN)		
SA -FAW 50 kN – 120	12	450
Load group 100 kN (53 kN - 100 kN)		
SA -FAW 100 kN – 160	16	600

Table 39

Designation	L	Minimum thickness of precast unit	Minimum distances from edge	Minimum spacing between center	Permitted load Axial and angled pull $f_{cu} \geq 15$ MPa	
		"c"	"b/2"	"b"	β ≤ 30°	30° < β < 45°
	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]
Load group 25 kN (7 kN – 25 kN)						
SA -FAW 14 kN – 55	55	85	140	280	14	11.2
SA -FAW 25 kN – 80	80	115	170	340	25	20
Load group 50 kN (30 kN - 50 kN)						
SA -FAW 50 kN – 120	120	155	250	500	50	40
Load group 100 kN (53 kN - 100 kN)						
SA -FAW 100 kN – 160	160	210	340	680	100	80

SANDWICH PANEL ANCHOR SA -SP

The **SA -SP "Sandwich Panel Anchor"** (figure 85) made by TERWA is designed to load range 25 kN to 100 kN (table 41). The main applications are: lifting and transport sandwich panels in an upright position. These prefab elements must have a concrete strength, at lifting, up to 20 MPa. Usually this type of anchor is used with additional reinforcement, which is required in the pitching and turning operation (picture 88). For lifting are used a reinforcement tail (picture 89).

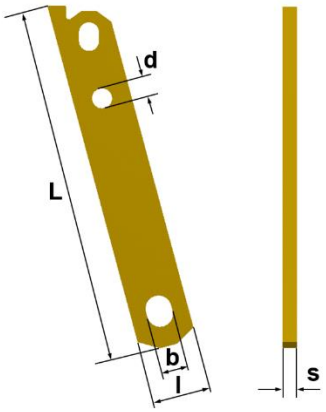


Figure 85

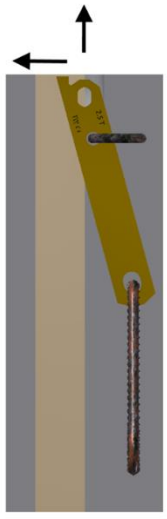


Figure 86

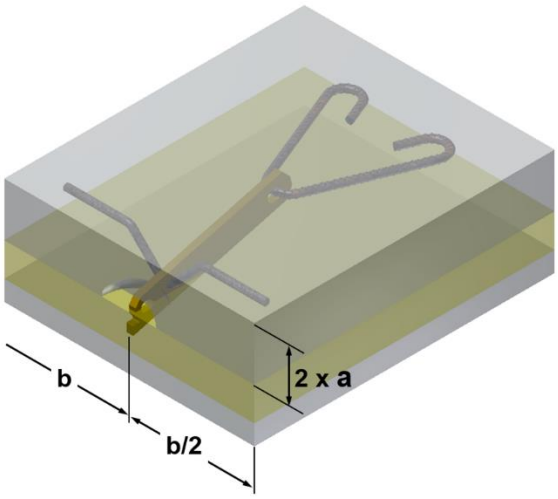


Figure 87

Table 40

Load group	25 kN	50 kN	100 kN
Cover to anchor head "e" [mm]	10	10	15

Table 41

Designation	Product number		L	l	s	d	b	Load range	Weight
	black	Zinc plated	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	Kg/pc
Load group 25 kN (7 kN – 25 kN)									
SA -SP 25 kN – 250	61461	61462	250	40	10	Ø14	18	25	0.690
Load group 50 kN (30 kN - 50 kN)									
SA -SP 50 kN – 300	61463	61464	300	60	16	Ø17.5	26	50	1.980
Load group 100 kN (53 kN - 100 kN)									
SA -SP 75 kN – 350	61465	61466	350	80	16	Ø25	35	75	2.950
SA -SP 100 kN – 350	61467	61468	350	80	20	Ø25	35	100	3.690

Table 42

Designation	Load range	Reinforcements - Concrete strength f_{cu} ≥ 15 MPa		
		Slot -in -link n x Ø x L	Erecting and pitching reinforcement Ø x L_v	Reinforcement tail for lifting Ø x L_a
	[kN]	[mm]	[mm]	[mm]
Load group 25 kN (7 kN – 25 kN)				
SA -SP 25 kN – 250	25	2 x Ø 8 x 600	Ø 10 x 600	Ø 14 x 800
Load group 50 kN (30 kN - 50 kN)				
SA -SP 50 kN – 300	50	2 x Ø8 x 800	Ø14 x 700	Ø16 x 1200
Load group 100 kN (53 kN - 100 kN)				
SA -SP 75 kN – 350	75	2 x Ø10 x 800	Ø16 x 800	Ø25 x 1400
SA -SP 100 kN – 350	100	4 x Ø10 x 800	Ø20 x 900	Ø25 x 1400

REINFORCEMENT IN ANCHOR ZONE (SA-SP)

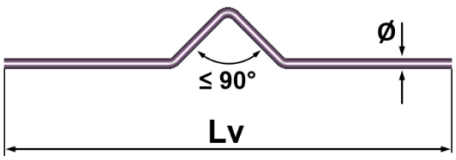


Figure 88

Erecting and pitching reinforcement

L_V = length before bending. The height of bend depends on the element thickness (2 x a)

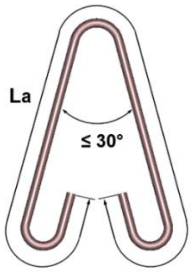


Figure 89

Reinforcement tail for lifting

L_a = overall length.
The bending angle must be ≤ 30°

Table 43

Designation	L	Minimum thickness of precast unit	Minimum distances from edge	Minimum spacing between center	Permitted load Axial and angled pull f_{cu} ≥ 15 MPa		Permitted load Transversal pull f_{cu} ≥ 15 MPa
		"2 x a"	"b/2"	"b"	β ≤ 30°	30° < β < 45°	
	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]
Load group 25 kN (7 kN – 25 kN)							
SA -SP 25 kN – 250	250	100	300	600	25	20	8
Load group 50 kN (30 kN - 50 kN)							
SA -SP 50 kN – 300	300	120	375	750	50	40	18
Load group 100 kN (53 kN - 100 kN)							
SA -SP 75 kN – 350	350	130	600	1200	75	60	26
SA -SP 100 kN – 350	350	140	600	1200	100	80	35

RECESS FORMER "RBF"

The recess former RBF is made of rubber (figure 90). It is used to create cavities in concrete round the anchor head. The recess formers are available for load range 12.5 kN - 260 kN (table 44).

Figure 90

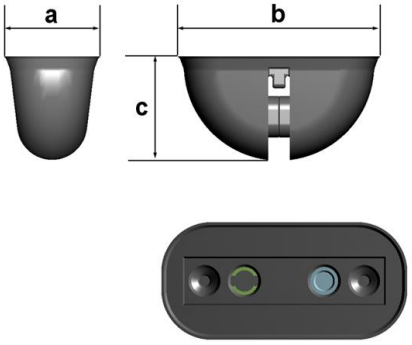


Figure 91

Table 44

TYPE	Product number	Load group	Dimensions			
			"a"	"b"	"c"	Thread
		[kN]	[mm]	[mm]	[mm]	[Metric]
RBF -015	49098	12.5 - 15	29	62	35	M 8
RBF -025	45131	7– 25	43	104	45	M 8
RBF -050	45132	30 – 50	49	126	59	M 8
RBF -100	45433	75 – 100	67	188	85	M 12
RBF -260	45134	125– 260	112	233	121	M 16

HOLDING PLATE "TMP"

The holding plate TMP (figure 92) consists of a plate with two studs and four holes for nails. The plate can be nailed or welded on the formwork. For assembly, the recess former is fitted on the studs (figure 94). The mould can then be easily removed without taking the plate off.

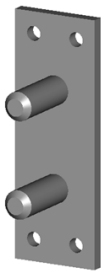


Figure 92

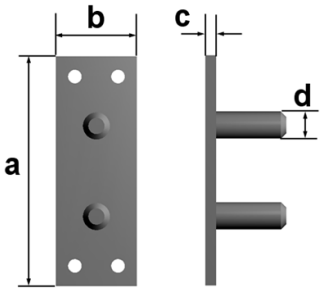


Figure 93

Table 45

TYPE	Product number	Load group	Dimensions			
			"a"	"b"	"c"	"d"
		[kN]	[mm]	[mm]	[mm]	[mm]
TMP -015	49096	12.5– 15	45	15	3	6
TMP -025	45213	7– 25	73	15	4	10
TMP -050	45169	30 – 50	85	30	4	10
TMP -100	45170	75 – 100	128	40	6	12
TMP -260	45171	125– 260	178	65	8	16

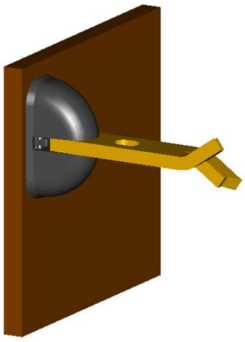


Figure 94

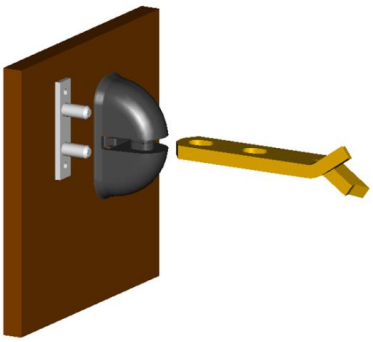
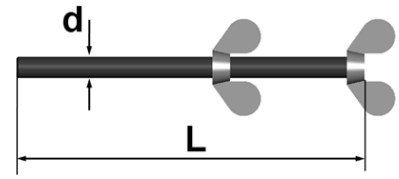


Figure 95

THREADED HOLDING BOLT "TDV"

The threaded holding bolt TDV is used for fixing the recess former on the steel formwork. It has a locked wing nut at its upper end. On the thread, there is another one, loose.

Table 46

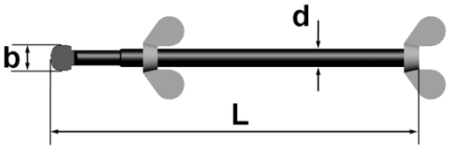


TYPE	Product number	Load group	Dimensions	
			"L"	"diameter"
		[kN]	[mm]	[Metric]
TDV - 025	44575	7- 25	160	M 8
TDV - 050	44576	30 - 50	160	M 8
TDV - 100	44577	75 - 100	160	M 12
TDV - 200	44578	125 - 260	180	M 16

THREADED HOLDING BOLT "TBV" WITH BAYONET END

The threaded holding bolt TBV consists of a threaded bolt with a pressed bayonet end. It is inserted in the bayonet fitting of the recess former and turned to 90° to lock. The upper (locked) wing nut must be at right angles to the longitudinal direction of the recess former. The recess former is secured to the mould by tightening the second wing nut (figure 96 and figure 97).

Table 47



TYPE	Product number	Load group	Dimensions		
			"L"	"b"	"diameter"
		[kN]	[mm]	[mm]	[Metric]
TBV - 025	48299	7 - 25	160	11	M 8
TBV - 050	48300	30 - 50	160	11	M 8
TBV - 100	48301	75 - 100	180	16	M 12
TBV - 200	48302	125 - 260	180	16	M 16

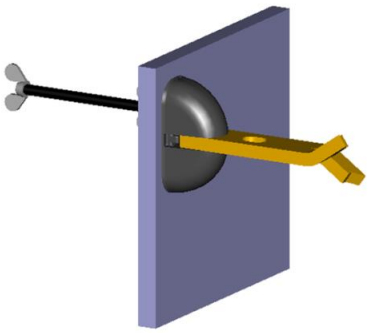


Figure 96

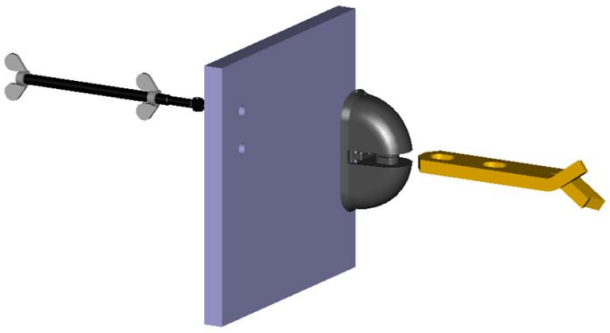


Figure 97

GENERAL INSTRUCTIONS FOR INSTALLATION AND USE

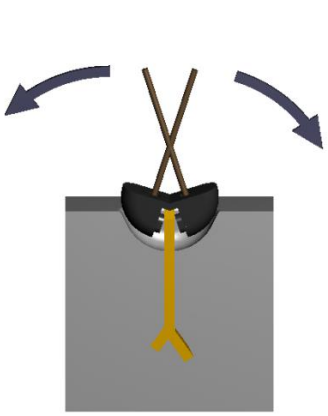


Figure 98

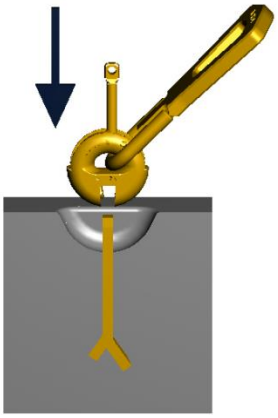


Figure 99

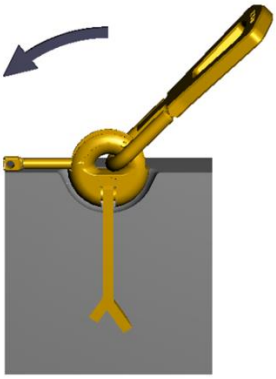


Figure 100

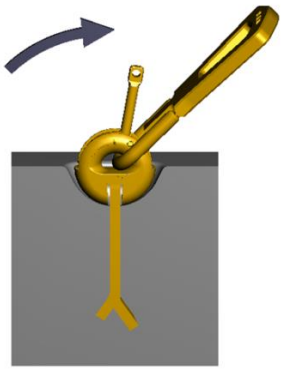


Figure 101

1) De -mould

Before lifting the precast concrete element, it is recommended to remove as many parts of the mould as possible to minimize adhesion to the mould. In the de-mould process, the forces acting on the lift system are considerable greater than the actual weight of the precast element. In the opposite case the precast concrete unit is possible to flake.

2) Removing the recess former

To remove the recess former, two rods are inserted in the holes in the recess former, after that they are levered out by scissors action. Do not use a hammer to remove the recess former; in this case the former can be destroyed (figure 98).

3) Fitting the lifting system

To transport the concrete units, the appropriate lifting system for the load group is inserted over the anchor head (figure 99). Only matching components will fit together.

4) Locking the lifting system

The lifting system is locked by a simple handle on the locker (figure 100). Now, the lifting system is free to move in any direction. From this moment, the precast concrete unit can be lifted out of the mould and transported to the point of storage.
The lifting angle, normally must be 30°, but up to 60° is possible.

5) Releasing the lifting system

The lifting system can be easily released by pushing back the locker after the system is off load (figure 101). The lifting system remains attached to the crane hook till another use.

6) Erecting slabs from a horizontal to a vertical position

The flat precast concrete units can be moved from a horizontal to a vertical position by using TILT UP anchor SA -TU or SA -TTU with additional reinforcement, embedded in concrete (figure 102). The direction of pull is at right angles to the cast -in anchor. For lifting it is recommended to use a cross -beam to avoid angular and torsion forces (figure 103).

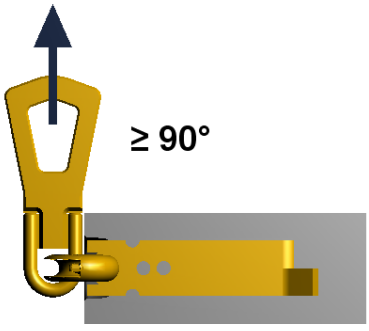


Figure 102

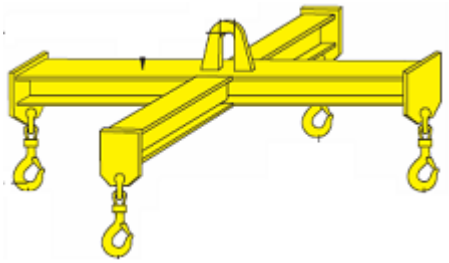


Figure 103

MISUSE OF THE LIFTING SYSTEM

DIRECTION OF FORCE

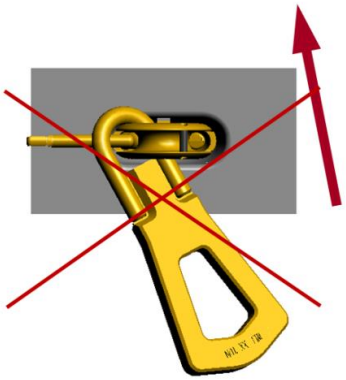
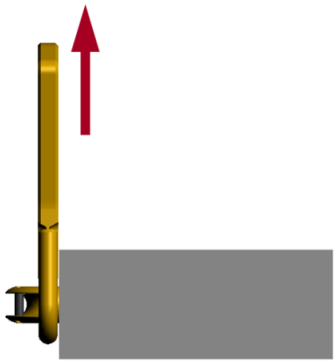
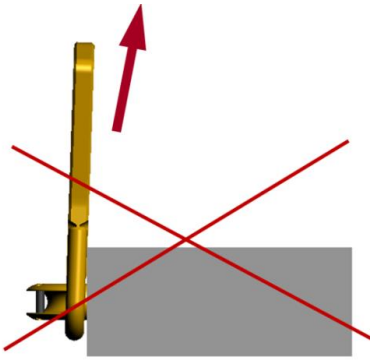


Figure 104

If the connection element (bracket) is beneath the shackle when subjected to the load, it may lock in the position illustrated (figure 104). When the load is lifted, the bracket will bend.

YES	NO	
		If the connection element (bracket) is pulled towards the top surface of the slab when subjected to the load, it may become bent on the edge of the slab, damaging the anchor or slab (figure 106).
Figure 105	Figure 106	

In this position, the connection element cannot lock (figure 107).		In this position, the connection element may lock within the shackle. A narrow lifting cable angle will determine the connection element to become bent (figure 108). The problem can be overcome by turning the connection element like in figure 107

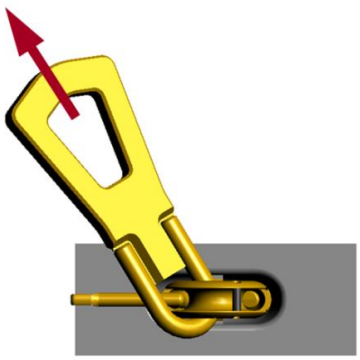
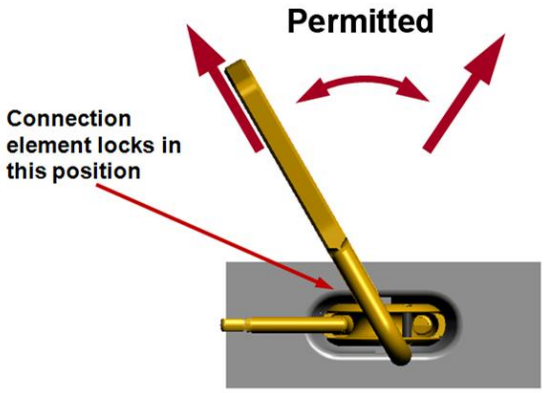

		

Figure 107		Figure 108

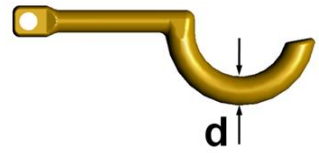
CHECKING THE LIFTING SYSTEM

In common with all lifting devices, the lifting system TF1, TF2 must be checked at least twice a year by trained personnel. Any deformation of a locker means that an overload of the permitted load has occurred at least three times. The damaged locker can be replaced. No other repairs are permitted. We strongly recommend not combining products of different companies'.

- **The locker**

The lifting system with worn or bent locker must be taken out of use. The wear on the locker must be lower than the limits showed in the table below (table 48).

Table 48



Load group	Nominal dimension d	Minimum dimension d
[kN]	[mm]	[mm]
12.5– 15	Ø 8 +0.3/0	7.5
25	Ø 13 +0.5/0	12
50	Ø 17 +0.5/0	16
100	Ø 22 +0.5/0	21
260	Ø 32 +0.5/0	31

- **The shackle**

If the shackle is deformed or the opening "e" is enlarged, the lifting system must be taken out of use and cannot be repaired. The wear on the shackle must be lower than the limits showed in the table below (table 49).

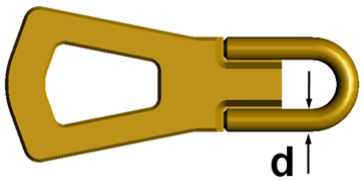
Table 49

Load group	Nominal dimension e	Maximum dimension e
[kN]	[mm]	[mm]
12.5– 15	7 +0.5/0	8
25	13 +0.5/0	14
50	20 +0.5/0	21
100	22 +0.5/0	23
260	33 +1.0/0	35

- **The connection element**

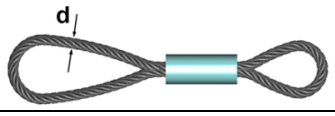
The connection elements (bracket) to the crane hook, with visible mark of damage or excessive wear must be withdrawn immediately. The wear on the bracket must be lower than the limits showed in the table below (table 50 and table 51).

Table 50



Load group	Nominal dimension d	Minimum dimension d
[kN]	[mm]	[mm]
25	14	13
50	20	19
100	26	25
260	40	38,5

Table 51



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

d = cable diameter

WIRE CABLES SHOULD BE CHECKED FOR THE FOLLOWING FLAWS:

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

ALL SPECIFICATIONS CAN BE CHANGED WITHOUT PREVIOUS NOTICE.

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