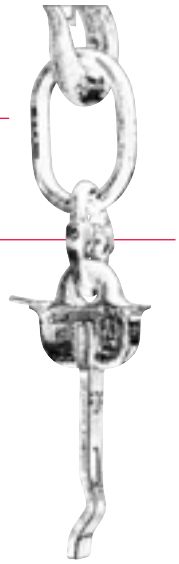
TORRE



User manual

2005

B.S.Italia®
Styl-Comp Group
innovazione basata sull'esperienza
innovation based on experience

PLEASE READ ALL THE INFORMATION AND INSTRUCTIONS IN THIS MANUAL CAREFULLY BEFORE USING ANY COMPONENT IN THE TORRE SYSTEM, COVERED BY INTERNATIONAL PATENT.

If you have any queries about the correct use of the components described in this manual, please contact B.S.Italia:

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B.S.Italia is ISO 9001 certified and the TORRE system is designed and built in accordance with:

B.S.Italia Certification

Product certification

- European machine directives:
  89/392/EEC;
  91/368/EEC;
  93/44/EEC.

- Safety in the workplace standards:
  Examples in Italy:
  Legislative Decree 626;
  Legislative Decree 494 and subsequent amendments

- Safety rules for transport anchorage and anchorage systems of Berufsgenossenschaft in Germany (Sicherheitsregeln für Transportanker und - systeme von Betonfertigteilen ZH 1/17)

- Wind effect:
  Norwegian technical standards;
  Direct research and technical literature.

- Dynamic effect:
  Italian Ministerial Decree 1987;
  DIN 15018.

- General parts:
  Eurocodes and state of the art.

- Standard products:
  ISO, EN, DIN and UNO standards.

- Material checks:
  SINAL accredited laboratories - SINAL is part of EA (European Accreditation).

- Quality System:
  ISO 9001 - IGQ (certified SINCERT body);
  IGQ is part of CISQ, which in turn is part of IQNet;
  Reg. B.S.Italia N° IT-0188.

Contents

All drawings in this Manual are purely indicative.

ADVANTAGES

Fast: plate/shackle coupling

The shackle and plate are extremely fast to couple thanks to the special plastic box: simply remove the lid and the plate is ready for hooking-up.

Double safety

The shackle has a double safety mechanism based on the concept of a joint which prevents translation and rotation of the shackle closing bolt.

Versatile

The TORRE system is suitable for edge lift stripping and for on end tipping of various sizes and types of reinforced concrete elements.

No cracks

The plate is specially shaped to counter the risk of it coming away from the concrete. In fact, the front has been carefully designed to create a double recess for coupling with the shackle in order to distribute the stress on the steel, without creating any pressure on the concrete. The TORRE plate lets you lift the concrete elements without generating any cracks or flaking during stripping.

System description

TORRE lifting system

Shackle

TORRE plate

Box

The TORRE lifting system is designed for fast handling of precast reinforced concrete elements (such as panels, columns, beams, etc.). It consists of:

Shackle

This is the device that sits between the reinforced concrete element and the crane hook with connected cables/chains system. It has a double safety mechanism based on a joint concept, ideal for dissipating shocks and dynamic stress. Thanks to its three-part articulation, where the middle part is a double "C" link, it allows for the concrete elements to be tipped on end and overturned, guaranteeing stress absorption.

Plate

This is the lifting device sunk into the precast concrete elements, bracketed and caged. It has marked 2 - 12 ton load capacity and comes in the following versions:

TG **Big**

Designed for edge lift stripping of panels.

TP **Small**

Designed for edge lift stripping of elements with forms tipped on end. Especially for tiles thanks to its compact size.

TS **S and Long S**

Designed for tipping on end and flat stripping of reinforced concrete elements, such as panels, columns, trusses, beams, etc.

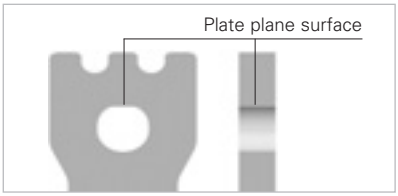
TB **With base**

Designed for flat stripping of thin concrete elements.

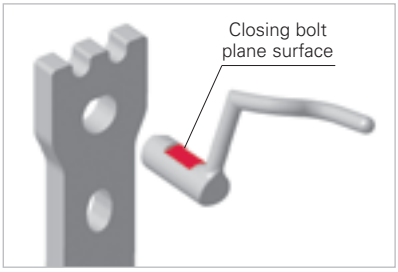
Box

This creates the recess needed to house the shackle. It also helps keep the plates at right angles to the form.

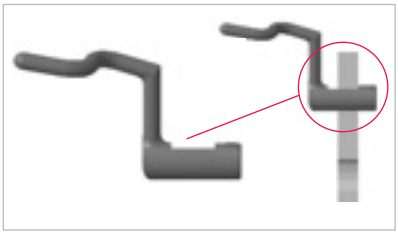
SAFETY SYSTEM



The TORRE lifting system has a double safety device that prevents rotation and translation of the shackle closing bolt.



ANTI-ROTATION: the coupling between the plane surface on the closing bolt (for special housing/slotting) and the plane surface on the plate coupling hole makes it impossible for the closing bolt to rotate once the loads are applied.



ANTI-TRANSLATION: the closing bolt is specially designed with the relief parts that prevents the closing bolt from translating on the shackle.

Safe coupling is further guaranteed by the fact that the safety spring on the shackle cannot be released accidentally: in fact, you need to apply pressure to this to release it.

❶ Closing bolt in start position.

❷ Closing bolt completely turned and translated to its final working position.

B.S.Italia does NOT authorise the use of any other shackles, as these will reduce the safety level and may create abnormal stress on the system, which in turn will lead to strain.

LOAD CAPACITY GROUPS

Shackle	TORRE plate	Box

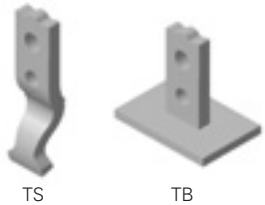
2-6 ton

2-6 ton

2-6 ton

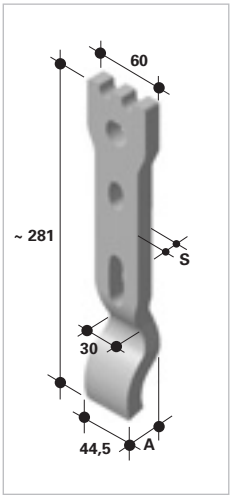
7,5-12 ton

7,5-12 ton

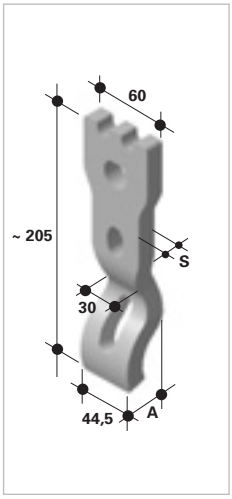


7,5-12 ton

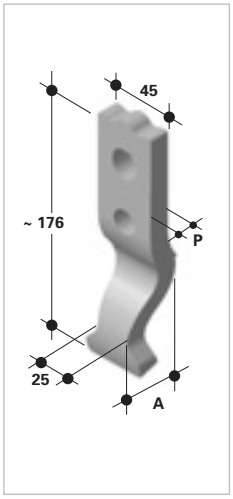
TG - 2 to 6 ton



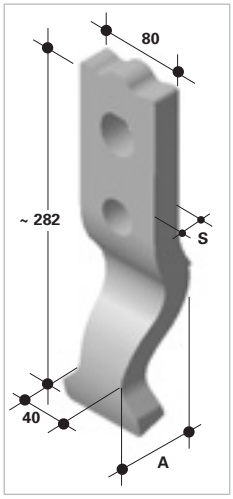
TP - 2 to 6 ton



TS - 3 to 6 ton



TS - 7,5 to 12 ton



TG - Big TORRE

Load capacity (tons)	2	3	4	5	6
S	6	9	11	13	15
A	28	31	33	35	37

TP - Small TORRE

Load capacity (tons)	2	3	4	5	6
S	6	9	11	13	15
A	28	31	33	35	37

TS - "S" TORRE

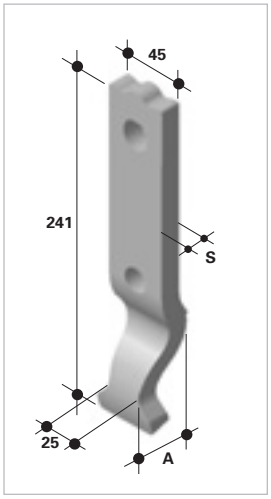
Load capacity (tons)	3	4	5	6	7,5	9	12
S	9	11	13	15	12	15	20
A	31	33	35	37	34	37	42

TS - Long "S" TORRE

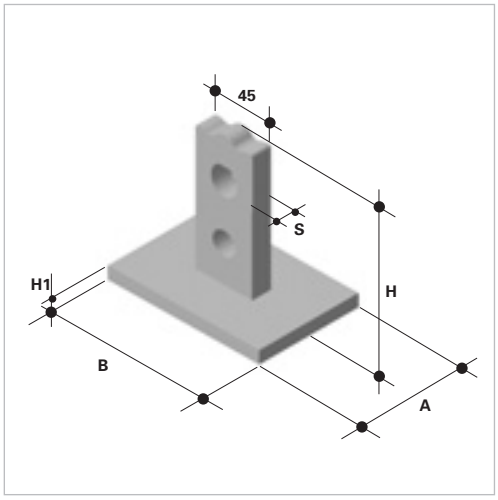
Load capacity (tons)	2	3	4	5	6
S	6	9	11	13	15
A	28	31	33	35	37

N.B.: The Long "S" TORRE is only made to order.

TS Lunga - 2 to 6 ton

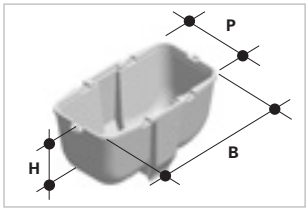


TB - 2 to 12 ton



TB - TORRE with base

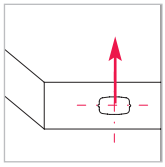
Load capacity (tons)	2	3	4	5	6	7,5	9	12
S	6	9	11	13	15	12	15	20
H1	6	8	8	10	10	12	12	15
H	110	112	112	114	114	160	160	180
A	80	80	80	80	80	80	80	80
B	120	120	120	120	120	160	180	200



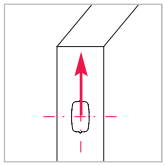
Plastic box

Load capacity (tons)	2-6	7,5-12
H	64	103
A	75	90
B	129	192

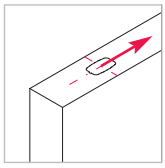
POSITIONING



Edge lift



Tipping on end

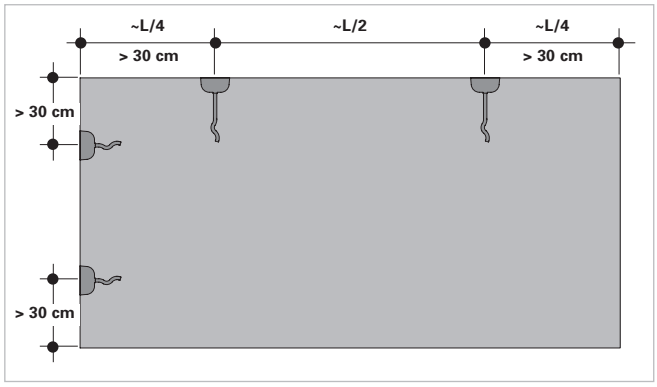


Angled lift

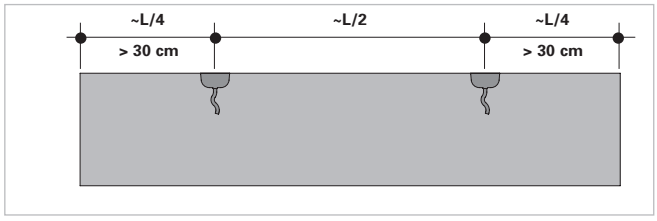
Position the TORRE plates so that the longest side opposes the direction of lift and is parallel with the thickness of the concrete elements. Position the TORRE plates parallel with the thickness of the concrete element for the being on end panels.

Position the TORRE plates symmetrically around the centre of gravity of the precast element, observing the minimum distances from the edge: L/4 and L/2 below refer to a linear precast element with a constant cross-section. Of course, these distances can vary to suit changes in the position of the centre of gravity (see page 24).

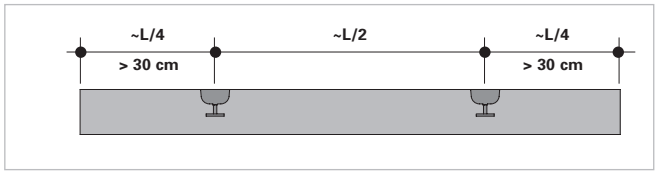
Positioning the TORRE plate in panels



Positioning the TORRE plate in columns, trusses and beams



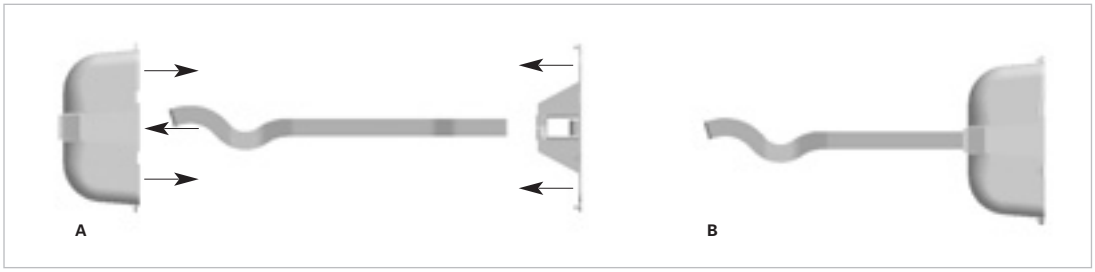
Positioning the TORRE plate in thin concrete elements



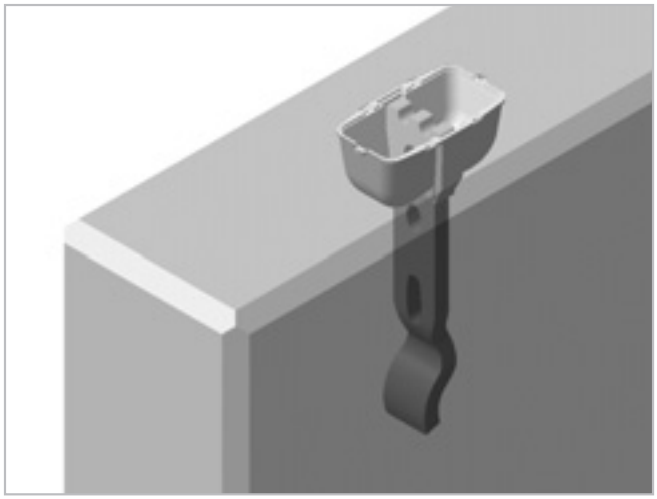
The TORRE plate should be positioned in the forms using the special plastic box.

FIXING AND POSITIONING PROCEDURE:

❶ remove the lid from the box;
❷ insert the plate inside the box (A) and then close the lid (B).

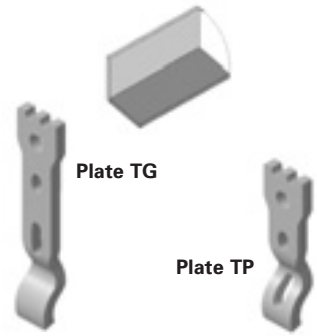


❸ fix to the form, securing the box to the reinforcement in the concrete elements.

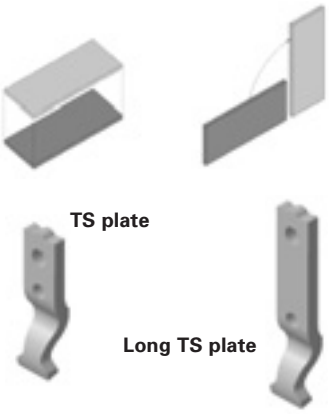


❹ remove the box lid: the plates has no built-up dirt or traces of concrete and so is immediately ready for hooking-up.

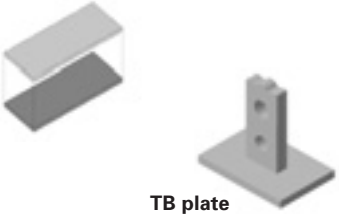
Acceptable movement



Acceptable movement



Acceptable movement



METHOD

With this lifting insert B.S.Italia wants to promote **maximum safety**, not just in terms of **accident prevention**, but also in terms of the **quality** of the precast concrete element.
Bracketing of the insert plays a fundamental role here and must be carefully considered each time to suit the forces present during the entire construction process. Reinforcement must be prepared around the edges of the panel in order to cage the concrete around the plates. The concrete elements can be considered suitably caged when the metal reinforcement absorbs the tensile stress (see the Eurocode for further details).

B.S.Italia does not authorise the use of the TORRE plates without bracketing. The user is responsible for bracketing the TORRE system.

DEFINITIONS

SL - safety load

This is the maximum loads there can be applied to a lifting insert.

UL - Ultimate load

This is the load that will cause the system to fail.

SF - safety factor

SF = UL : SL

Product	SF
Lifting inserts	3 dry 2,5 in concrete
Hook shackle	5

The loads marked on the plates should be seen as the maximum stress that may be applied to each insert (SL), but only where these have been suitably bracketed and caged and then embedded in concrete of sufficient strength. Without bracketing, **the actual load capacity of the stronger plates is halved.**
It is only with suitable bracketing that one can be sure of maximum safety in the insert/concrete assembly, thus increasing the guarantee against the risk of cracks appearing during the various intermediate stages: a simple accidental knock when moving the concrete elements could fracture the concrete cone and so adversely affect safety.

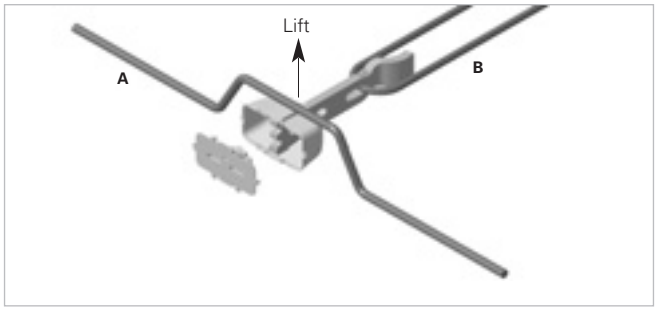
This should be borne in mind when reading the following pages on insert bracketing. In order to guarantee safe and effective construction, B.S.Italia always recommends using appropriate reinforcement to suit the stresses and strain in question and the insertion of brackets capable of guaranteeing the transfer of all stress to the concrete itself.

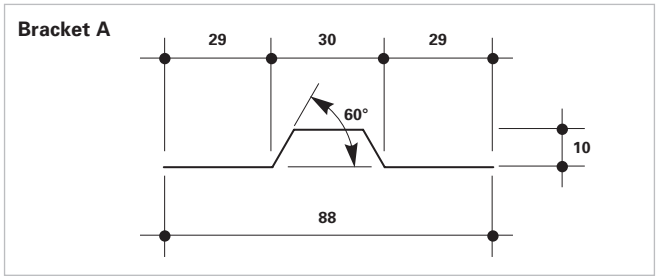
BRACKETING FOR THE TG PLATE

Dimensions in mm

Panel edge lift

Minimum concrete strength on stripping > 150 kg/cm².



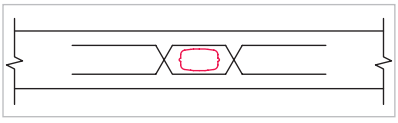


Bracket A Feb44k steel or higher (e.g. BSt500S) - **Opposing the direction of lift**

Load capacity (tons)	2	3	4	5	6
Ø	12	12	12	14	14
Development	1000	1000	1000	1000	1000

Bracket B Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	2	3	4	5	6
Ø	10	10	12	12	12
Development	1000	1200	1200	1500	1800



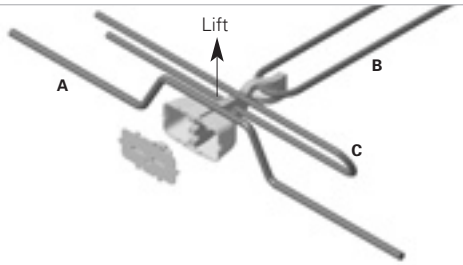
If there are to be two opposing directions of lift (e.g. in the case of bush-hammered panels that are edge lifted twice for finishing), two type **A** brackets must be inserted.

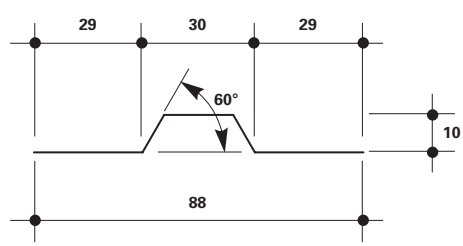
BRACKETING FOR THE TP PLATE

Dimensions in mm

Panel edge lift

Minimum concrete strength on stripping > 150 kg/cm^2.





Bracket A Feb44k steel or higher (e.g. BSt500S) - **Opposing the direction of lift**

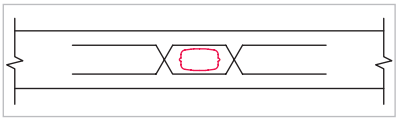
Load capacity (tons)	2	3	4	5	6
Ø	12	12	12	14	14
Development	1000	1000	1000	1000	1000

Staffa B Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	2	3	4	5	6
Ø	10	10	12	12	12
Development	1000	1200	1200	1500	1800

Staffa C Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	2	3	4	5	6
Ø	10	10	10	12	12
Development	1000	1000	1000	1200	1200



If there are to be two opposing directions of lift (e.g. in the case of bush-hammered panels that are edge lifted twice for finishing), two type **A** brackets must be inserted.

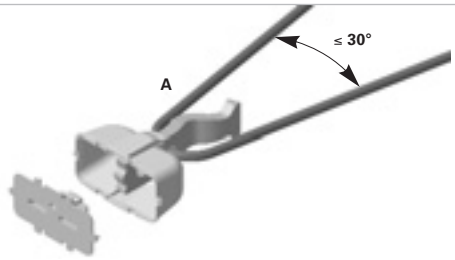
BRACKETING FOR THE TS AND LONG TS PLATES

Dimensions in mm

Tipping on end

Flat lifting

Minimum concrete strength for moving > 250 kg/cm².
Minimum concrete strength for tipping on end > 350 kg/cm².



TS plate

Bracket A Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	3	4	5	6	7,5	9	12
Ø	10	12	12	12	14	16	18
Development	800	900	1200	1400	1500	1500	1800

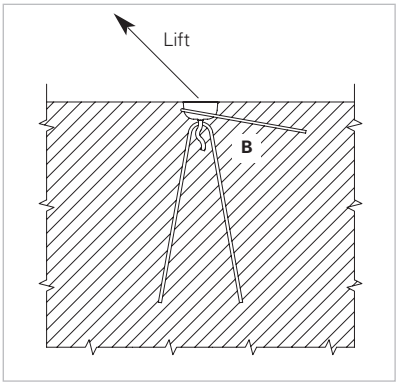
Long TS plate

Bracket A Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	2	3	4	5	6
Ø	10	10	12	12	12
Development	800	800	900	1200	1400

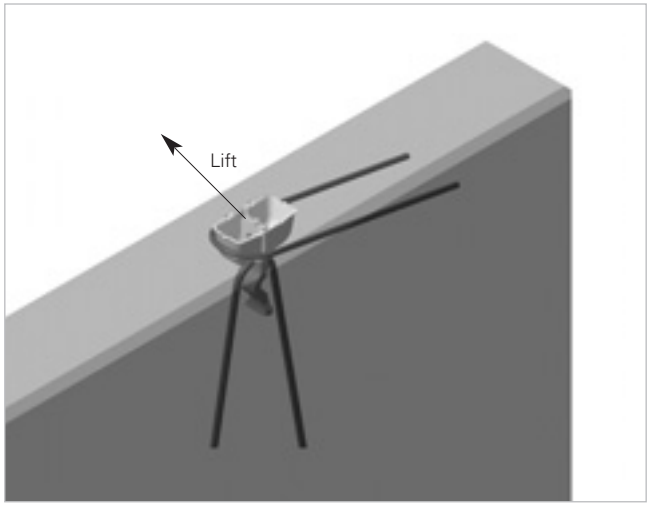
BRACKETING FOR THE TS AND LONG TS PLATES

Dimensions in mm



Extra bracketing for angled lift

If the panel is to be lifted at an angle, extra bracketing is required around the recess for the TS and Long TS plates, opposing the direction of lift.



TS plate

Bracket B Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	3	4	5	6	7,5	9	12
Ø	10	10	10	10	12	12	12
Development	700	700	1000	1000	1200	1200	1200

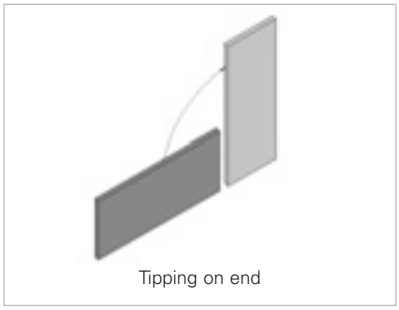
Long TS plate

Bracket B Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	2	3	4	5	6
Ø	10	10	10	10	10
Development	700	700	700	1000	1000

BRACKETING FOR THE TS AND LONG TS PLATES

Dimensions in mm

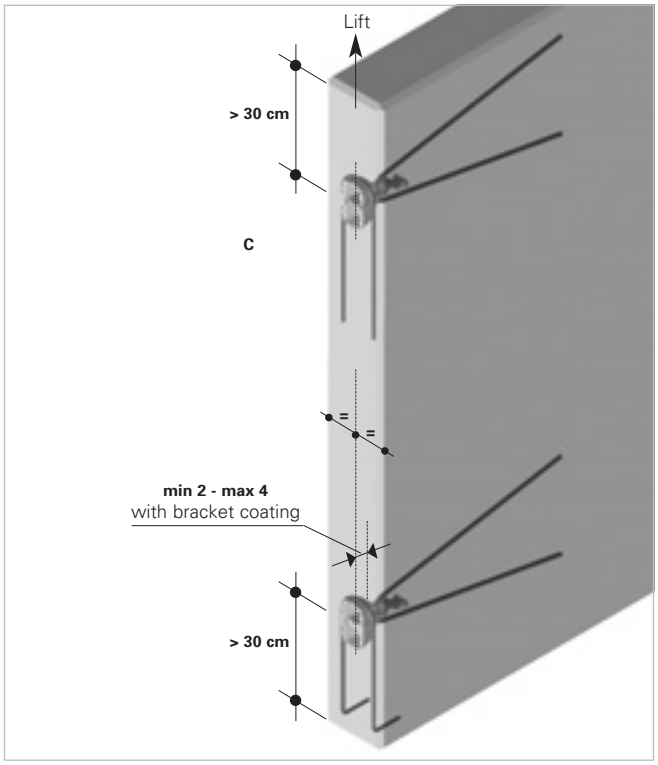


Tipping on end

Extra bracketing for tipping on end plates

If the panel is to be tipped on end, the TS plate must have extra bracketing **C**.

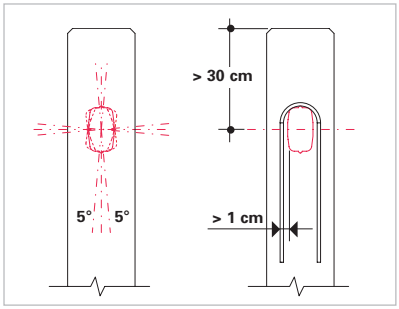
Minimum concrete strength for tipping on end > 350 kg/cm².



TS plate

Bracket C Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	3	4	5	6	7,5	9	12
Ø	10	10	10	10	12	12	14
Development	700	700	1000	1000	1200	1200	1400



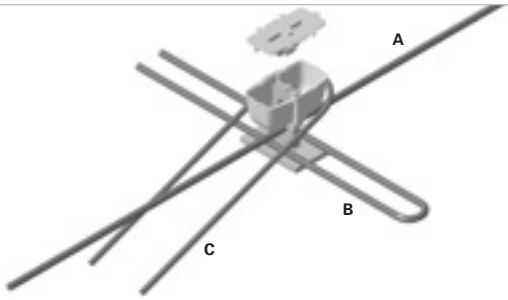
Bear in mind the tolerances shown here when positioning of the extra bracket **C** for a tipping on end plate.

BRACKETING FOR THE TB PLATE

Dimensions in mm

Flat lifting

Minimum concrete strength > 250 kg/cm^2.



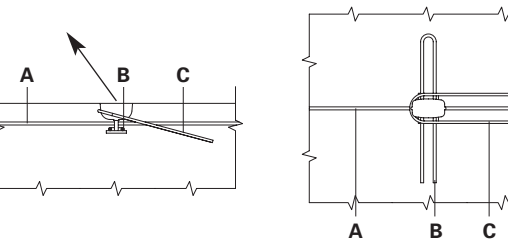
Brackets A and B Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	2	3	4	5	6	7,5	9	12
Ø	8	10	10	12	12	14	14	16
Development	800	800	800	1200	1200	1200	1400	1600

Bracket C Feb44k steel or higher (e.g. BSt500S)

Load capacity (tons)	2	3	4	5	6	7,5	9	12
Ø	10	10	10	10	10	12	12	12
Development	700	700	700	1000	1000	1200	1200	1200

Two type **C** brackets must be inserted if there are to be two opposing directions of lift.



MINIMUM THICKNESS

The TORRE plate must be inserted in concrete elements with the minimum thickness for the load capacity shown in the table below.

Load capacity	Minimum thickness
2 - 6 ton	16 cm
7,5 - 12 ton	20 cm

The resultant load R on each TORRE insert is calculated using the following formula:

$$R = \frac{P + (Q_a \times A_{SC})}{N} \times Q_b \times Q_c \times Q_d$$

Use the following design parameters to choose the right TORRE plate:

Parameters:

P **weight**
A_{sc} **element surface in contact with form**
N **number of inserts to use**
Q_a **adhesion effect**
Q_b **dynamic effect**
Q_c **cable inclination**
Q_d **lifting method**

Requirements:

1. Requirements for flat stripping Rc ≥ 250 kg/cm^2.

2. Requirements for edge stripping Rc ≥ 150Kg/cm^2.

3. Requirements for any lifting (excluding rotating in air) Rc ≥ 250kg/cm^2.

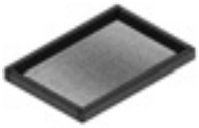
4. Requirements for rotating in air: Rc ≥ 350 kg/cm^2.

5. TORRE in confined smooth concrete, properly mixed and compacted (i.e., porosity and air entrainment < 6% volume, etc.) and crack-free concrete in any case, without separation or micro-cracking.

6. Design, reinforcement, elements, production methods, quality and concrete control in compliance with state of the art, current standards and laws, such as the Italian Ministerial Decrees and Eurocodes.

Q_a ADHESION EFFECT (see page 21)

Q_a min = 1,15



A_{SC} x 100 - 350 kg/m²
Mean

from 2 x P to 4 x P
Stiffened panels

Q_b DYNAMIC EFFECT (see page 22)

Q_b min = 1,15

Suggested coefficients

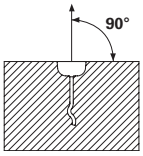
1,15 - 1,3
Moving means

1,2 - 1,6
Fixed means

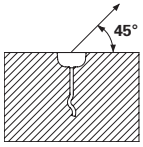
1,2 - 3,0

1,15 - 1,3
Slow lift

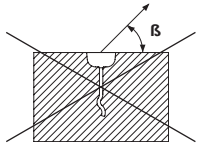
Q_c CABLE INCLINATION (see page 23)



Q_c = min 1
Vertical lift



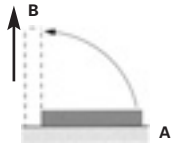
Q_c = max 1,41
Cable inclination = 45°



Cable inclination < 45° NOT allowed (angle ß).

Q_d LIFT METHOD (see page 24)

Q_d = min 1
Vertical lift



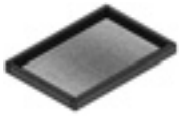
Q_d = 0,5 (stage A)
Q_d = 1 (stage B)
Edge lift

Q_d = 1,3
Rotating in air
(see page 24 - 26 - 27)

Q_d = 2
4 anchor points with just two points under tension (no pulley)

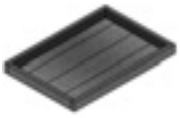
Q_a ADHESION EFFECT

Suggested values



> 100 Kg/m²

Oiled steel forms



> 200 Kg/m²

Oiled smooth wooden forms

> 300 Kg/m²

Oiled rough wooden forms

2 x P

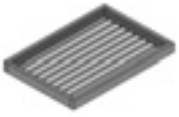
Form with 2 lines of stiffening

4 x P

Form with 2+2 lines of stiffening

> 350 Kg/m²

Form with shallow matrix < 1cm



> 500 Kg/m²

Form with deep matrix < 3cm

> 100 Kg/m²

Form with chemical retarding paper

> 200 Kg/m²

Form with chemical retarding paste

The contact between the cast concrete and the form generates adhesion forces that oppose stripping, thus amplifying the loads, and so need to be taken into consideration when choosing the size of the TORRE insert. This coefficient can be expressed as a simple factor multiplied directly by P, or as a specific weight to be multiplied by A_{sc} and then added to P.

Since stricter standards do not exist at present, the Norwegian technical rules are adopted. These require the following Q loads to be added to the weight/m² of the precast element.

- Steel form with stripping agent Q_a > 100 kg/m²
- Painted wooden form with stripping agent Q_a > 200 kg/m²
- Rough wooden form with stripping agent Q_a > 300 kg/m²
- Rubber form (matrix) Q_a > 350 kg/m²

The Q_a cannot, in any case, be less than 15% the weight of the precast element.

- In practice and theory, a **min value of double the weight of the element is** required in the case of TT elements and all cases where the element geometry includes two parallel strips of concrete stiffening, to take into account the risk of attrition.

- Again, a **min value of four times the weight of the element** is required in the case of box elements and all cases where the element geometry includes perpendicular sections of concrete (stiffening), even if just around the edges.

- The various form systems can change the values further (e.g. self-reacting forms, etc.).

Note that the amplifying load Q_a described above (100 kg/m², 300 kg/m², etc.) must be multiplied by the surface of the precast element coming into contact with the form (greater than the flat surface) to assess adhesion to the form.

Moreover, synchronising of the lift is essential when using two bridge cranes (otherwise the load isn't equally divided and the lift becomes uneven, creating bending moment and/or twist that is difficult to control).

Always use spreader beams during stripping to avoid inclined lift on elements made from fresh concrete.
Friction and other secondary effects, like prestressing, also need to be considered.

Suggested values
Fixed means

1,2 - 1,6

1,15 - 1,3

Suggested values
Moving means

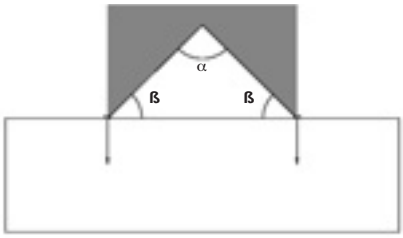
Fast lifting **1,2 - 1,6**
Slow lifting **1,15 - 1,3**

1,2 - 3,0

The presence of adhesion effect normally eliminates any dynamic force. However, some designers, to err on the safe side, always calculate the dynamic effect due to the immediate acceleration of the element after adhesion or to comply with **the min value prescribed by law (Italian Ministerial Decree 87, which fixes: $Q_b \geq 1.15$ as a standard value).**

The effects of dynamic loads (always present when the element is in motion) generate amplification factors which must be properly assessed and considered.
According to DIN 15018, the dynamic coefficient can vary between 1.15 and 3.0 due to the speed of the movement and type of crane.
For instance, a precast production crane that moves "slowly" on rails can have an amplification coefficient of between 1.15 and 1.30.
Obviously, a self-moving crane has to have the right level of structural rigidity and sit on stable ground (without this stability, the crane boom would oscillate and cause unwanted stress).
The values suggested for the fixed and mobile lifting systems are purely indicative. These could easily be higher if the means of transport are very fast and/or have other negative influences.

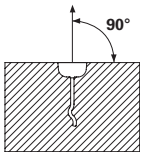
Q_c INCLINAZIONE FUNI



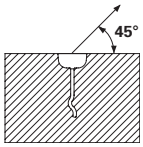
Any inclination of the cables automatically generates an increased load with a horizontal component that must be evaluated.
The SAFELIFT is marked with a vertical anchor load (without horizontal force components along the long axis of the tube).
For this reason, it is always necessary to consider the angle between the cable and the long axis of the SAFELIFT tube.

Q_c factor must be applied when the cable has an angle of inclination less than 90° (see table below).

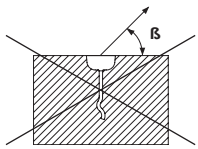
Initial angle		Q_c
α	β	**coefficient**
0°	90°	1,00
15°	82°	1,01
30°	75°	1,04
45°	67°	1,08
60°	60°	1,16
75°	52°	1,26
90°	45°	1,41
> 90°	< 45°	not allowed
α = angle between chain/chain β = angle between chain/insert		



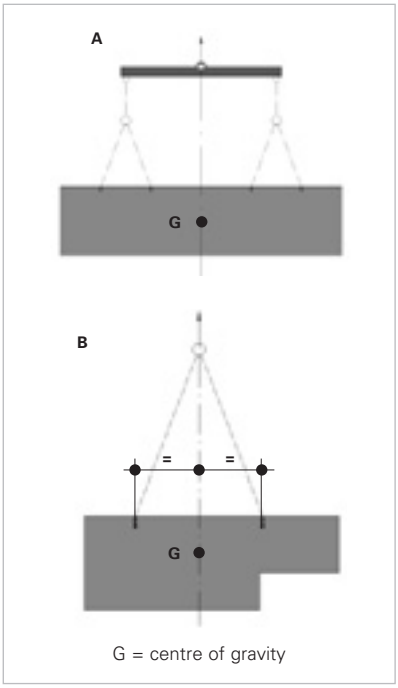
Q_c = min 1
Vertical lift



Q_c = max 1,41
Cable inclination = 45°



Cable inclination < 45° NOT allowed (angle ß).

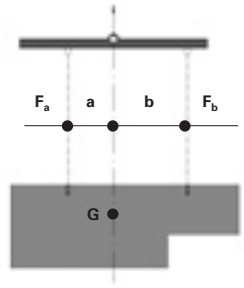


G = centre of gravity

Proper positioning of the TORRE is crucial to ensure correct handling of precast panels. There are two different methods:

Method A: using a spreader beam, the centre of gravity of the element must be centred on the vertical lifting axis of the crane.
Method B: without a spreader beam, the TORRE plates must be symmetrical on the vertical axis of the element.

If the TORRE is not symmetrical on the centre of gravity of the element, the weight component of each insert can be calculated as follows:



$$F_a = \frac{P \times b}{a + b}$$

$$F_b = P - F_a$$

N.B.: The overall stress on each plate must be calculated in view of all amplification coefficients (see page 25).

Machinery **Equipment**

Chains

Fixed balance beam with chains

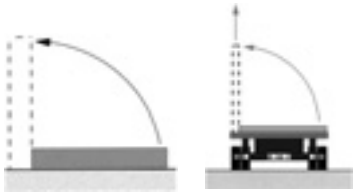
Balance beam with pulley and cables

Procedure:

Having found the centre of gravity, several questions need to be answered to find the best lifting method. These questions concern all stages of the process, from stripping to erection:

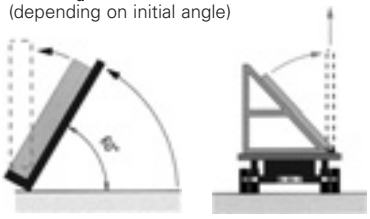
1. What type of movement does the precast element undergo: edge lifting, partial edge lifting, rotating in air, level lifting, etc.?
2. How many hooks are needed to lift the precast element (1, 2, 3, 4, 8 or more) and is the weight distributed evenly?
3. What type of equipment is used for lifting (chains, fixed balance beams or pulleys)?
4. Does the lifting involve one or two hooking points?

Q_d = 0,5



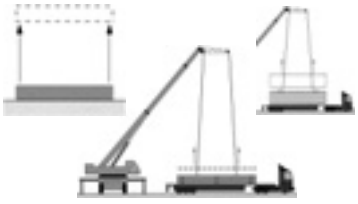
Edge lifting

0,5 < Q_d < 1
(depending on initial angle)



Semi-edge lifting

Q_d = 1

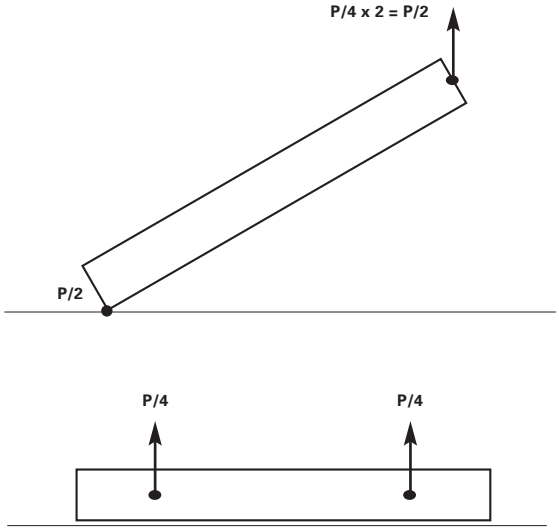


Vertical lift

Q_d = 1,3

Rotating in air

Edge lifting
The weight to be lifted is half the total weight.



Lifting a precast element from its horizontal position to the vertical position requires a different evaluation: in this case, the weight to be lifted is half the total weight.

The lifting method (direction, speed, reciprocal distance between hooks, height of crane boom, starting position of the precast element, etc.) establishes the correct way to move the precast element. The following points in particular need to be borne in mind:

- The centre of gravity of the element needs to be considered when positioning the lifting inserts (they must be symmetrical): diagrams A and B on page 24 are the basis for lifting with the TORRE system.
- If more than two lifting points are required, the TORRE inserts must be sized to cater for the worst possible load conditions for the system.

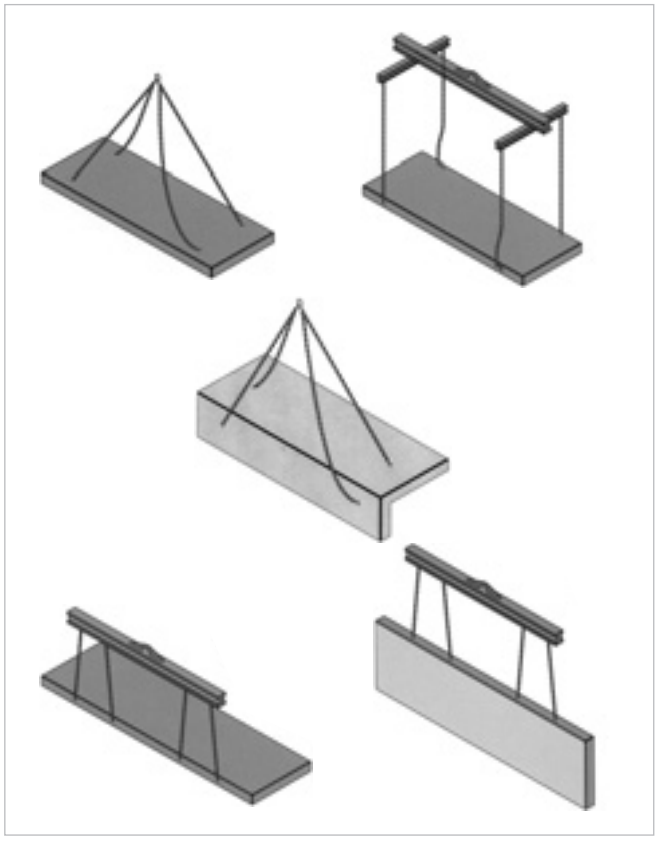
The use of spreader arms and independent lifting methods is recommended to guarantee equal distribution of the loads on a single TORRE (i.e., two winches on the same crane or two independent cranes). When the plate is sollicitated by alternate loads, that is a canvassing of opposite forces, the load factor increase must be considered of at least 10%

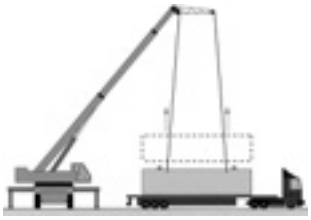
Q_d = 2

Multiple unbalanced lifting points
4 lifting points with only two points under tension. The weight is not divided into 4 equal parts, but is simply halved.

If pulleys are not being used, the forces acting on a single TORRE insert can't be calculated properly. This may be due to incorrect positioning or the use of different cable lengths. The calculation must, therefore, always adopt the worst scenario.

Moreover, if the multiple lifting points are not equalised with pulleys, you need to use the Q_d = 2 lifting method factor.



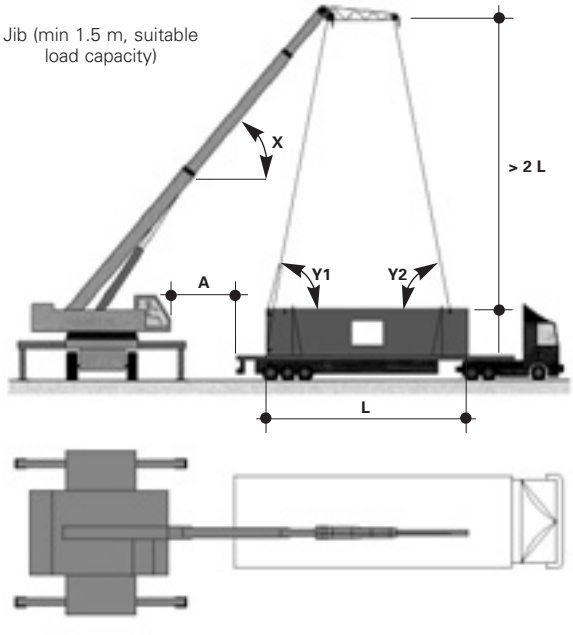


Erection of the precast element must guarantee total safety. The truck with the load must be directly under the crane boom or as close as possible to minimise the swinging of elements after lifting these from the trailer. The min distances and angles must be respected.

Standard lifting

Used mainly for beams, rooftiles, roof trusses and other horizontal structural elements.

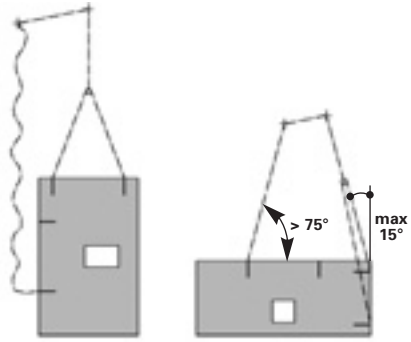
It is encountered when using two or four inserts, easily planned by the designer once evaluated all amplification effects (dinamic, inclination, etc.). the only recommendation is to use cables long enough to guarantee the right inclination angle with the horizontal in both directions.



Note: Y1 = Y2; X < Y1
A = appropriate safety distance

Rotation in air

Rotation in air is one of the most critical movements in any type of erection operation and is typical for vertical facade panels. The amplification of the loads is effected by various factors, such as the speed of lift, crane boom inclination, the position of the inserts, the jib length, the type of cable and the pulleys.

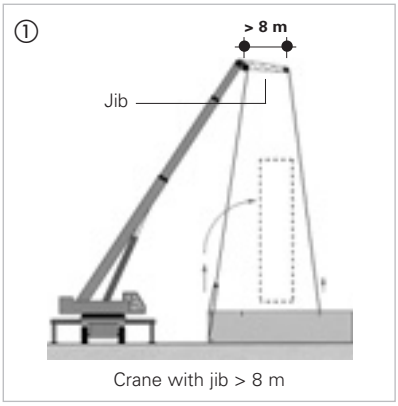


Prescribed angles during rotation in air

Q_d = 1,3 (see page 25)

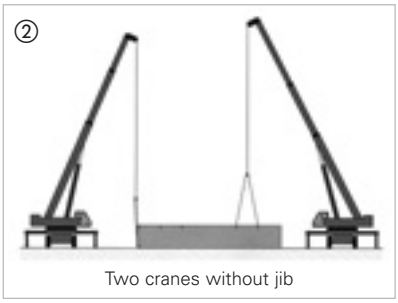
Erection of the precast element must guarantee total safety. The truck with the load must be directly under the crane boom or as close as possible to minimise the swinging of elements after lifting these from the trailer. The min distances and angles must be respected.

Rotating in air of a 10 m panel using a single crane

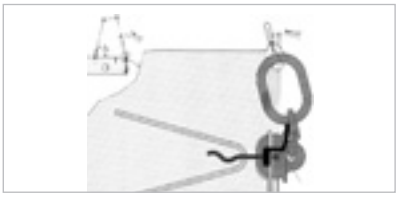


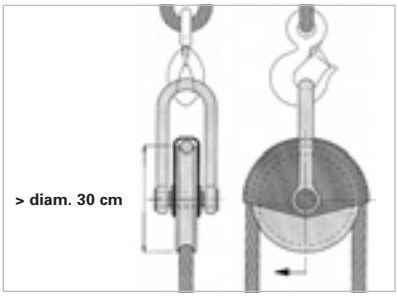
Crane with jib > 8 m

Rotating in air of 10 m panels using two cranes



Two cranes without jib





Recommendations

- Before starting the lifting, the crane should be aligned with the long side of the panel.
- Panels measuring 8 - 10 m: rotating in air must be done using a boom crane with a jib of min 1.5 m; use longer jibs to reduce the inclination angle of the cables.
- Panels longer than 10 m: a min 8.2 m jib must be used (①) or two cranes (②).
- The crane boom should be extended appropriately (2 L) and inclined (X < Y) to guarantee the safety distance between the panel and crane cabin A.
- The crane operator must control movement using two independent lines and hooks.
- The erection workers must use cables that are long enough for the purpose and a suitable jib length.

Rotating in air of the panel should only start after respecting the following points:

- Concrete strength > 350 kg/m^2.
- Suitable type of TORRE, with ties, confined and correctly positioned.
- Evaluation of all amplification effects when calculating stress.
- Use inspected shackles.
- Full respect for the information in this manual.
- Compliance with all design and safety rules and standards.

Pulley with cable guard

If only one double length cable is used instead of two cables, a suitable type of pulley must be used to guarantee:

- the cable does not slip off the guides in the pulley (a safety guard prevents this from happening);
- everything is fully efficient (smooth running, rotation and suitable load capacity).

Rings, loops, eyebolts and other equipment must not be used instead of a pulley.

The examples shown here refer to specific types of movement of the precast element. The stresses on the TORRE due to each type of movement from stripping to erection must all be calculated to find the worst scenario and so the most suitable TORRE can then be chosen.

Resultant load on the TORRE

$$R = \frac{P + (Q_a \times A_{sc})}{N} \times Q_b \times Q_c \times Q_d$$

Parameters:

P weight

$\mathbf{A_{sc}}$ element surface in contact with form

N number of inserts to use

$\mathbf{Q_a}$ adhesion effect

$\mathbf{Q_b}$ dynamic effect

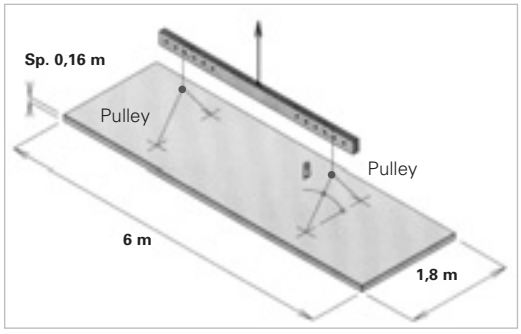
$\mathbf{Q_c}$ cable inclination

$\mathbf{Q_d}$ lifting method

1. Flat panel 600 x 180 x 16 cm

Assumptions: • flat stripping
• TORRE positioned symmetrically to centre of gravity.

Weight of panel (full concrete):
P = 0,16 x 6,00 x 1,80 x 2500 = 4320 kg
Rc ≥ 300 kg/cm²



- $\mathbf{Q_a}$ = 100 kg/m² $\mathbf{A_{sc}}$ = 6,00 x 1,80 = 10,80 m²
  $\mathbf{Q_a \times A_{sc}}$ = 10,80 x 100 = 1080 kg
- $\mathbf{Q_b}$ = 1,15
- $\mathbf{Q_c}$ cable inclination: ß = 45°
  cable inclination coefficient: $\mathbf{Q_c}$ = 1,41
- $\mathbf{Q_d}$ = 1

Stress on each TORRE during stripping $\mathbf{R} = \frac{4320 + 1080}{4} \times 1{,}15 \times 1{,}41 = 2189$ kg = **2,19 ton**

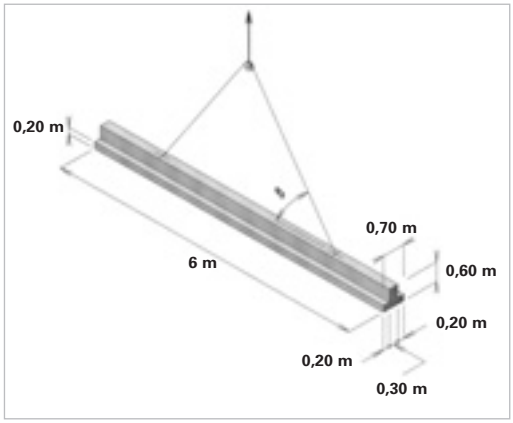
Choice: **TORRE 3 ton - with base**

N.B.: the lifting method coefficient without the use of pulleys is $\mathbf{Q_d = 2}$
This would double the stress on each insert and so an TORRE 5 ton with base would be needed.

2. Inverted "T" beam 600 x 70 x 60 cm

Assumptions: • flat stripping;
• TORRE positioned symmetrically to centre of gravity;
• Since the element is precast with self-acting forms and the full surface is in contact with the form, the adhesion effect (Q_a) is eliminated.

Weight of panel (full concrete):
P = [(0,20 x 0,70) + (0,40 x 0,30)] x 6,00 x 2500 = 3900 kg
Rc ≥ 150 kg/cm²



- Q_a = 0 kg/m²
- Q_b = 1,15
- Q_c cable inclination: ß = 45°
  cable inclination coefficient: Q_c = 1,41
- Q_d = 1

Stress on each TORRE during stripping:

$$R = \frac{3900}{2} \times 1,15 \times 1,41 = 3162 \text{ kg} = \mathbf{3,2 \text{ ton}}$$

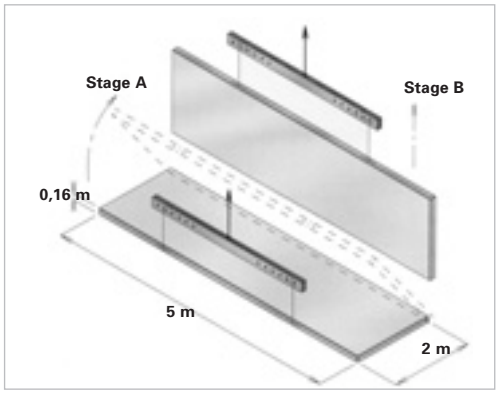
Choice: TORRE "S" 4 ton

---

3. Wall panel 500 x 200 x 16 cm

Assumptions: • stripping via edge lifting;
• TORRE positioned symmetrically to centre of gravity.

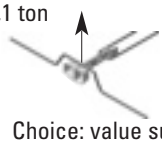
Mean weight of panel = 280 kg/m²
(mean weight calculated by assuming the volumes of polystyrene inside the panel):
P = 5 x 2 x 280 = 2800 kg
Rc ≥ 150 kg/cm²



- Q_a = 100 kg/m² A_{sc} = 5,00 x 2,00 = 10 m²
  Q_a x A_{SC} = 10 x 100 = 1000 kg
- Q_b = 1,15
- Q_c cable inclination: ß = 0°
  cable inclination coefficient: Q_c = 1
- Q_d = 0,5 stage A Q_d = 1 stage B

Stress on each TORRE stage A - edge lifting:

$$R = \frac{2800 + 1000}{2} \times 1,15 \times 1 \times 0,5 = 1093 \text{ kg} = 1,1 \text{ ton}$$



Stage B vertical lift:

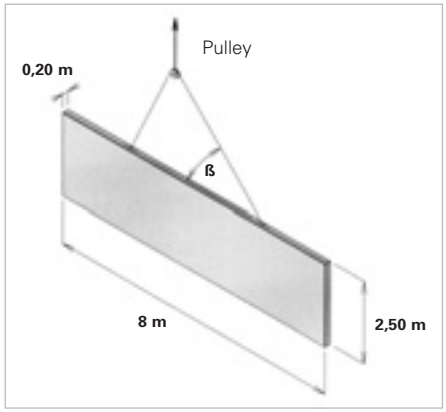
$$R = \frac{2800}{2} \times 1,15 \times 1 \times 1 = 1610 \text{ kg} = 1,61 \text{ ton}$$

Choice: value superior of 2 x A and B: **TORRE 2 ton**

4. Wall panel 800 x 250 x 20 cm

Assumptions : • laying;
• TORRE positioned symmetrically to centre of gravity.

Mean weight of panel = 320 kg/m²
(mean weight calculated by assuming the volumes of polystyrene inside the panel):
P = 8 x 2,5 x 320 = 6400 kg
Rc ≥ 150 kg/cm²



- Q_a none
- Q_b = 1,15
- Q_c cable inclination: ß = 45°
  cable inclination coefficient: Q_c = 1,41
- Q_d = 1

Stress on each TORRE during laying:

$R = \frac{6400}{2}$ x 1,15 x 1,41 x 1 = 5188 kg = **5,2 ton**

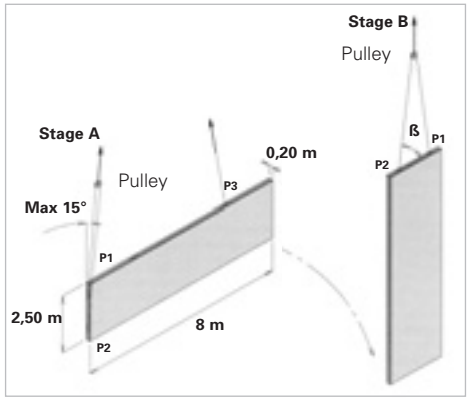
Choice: **TORRE 6 ton**

---

5. Wall panel 800 x 250 x 20 cm - Rotating in air

This example shows how to chose the correct TORRE in vertical panels: calculate the load on the P1 and P2 TORRE during stage B and apply the max cable inclination factor and then enter the actual dynamic effect coefficient.
Assumptions: • TORRE positioned symmetrically to centre of gravity.
• two cranes and correct cable inclination (see page 28)

Mean weight of lightened = 320 kg/m²
(mean weight calculated by assuming the volumes of polystyrene inside the panel):
P = 8,00 x 2,50 x 320 = 6400 kg
Rc > 350 kg/cm²



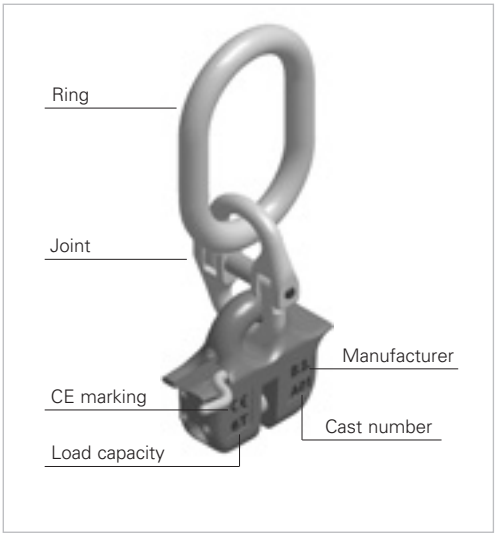
- Q_a none
- Q_b = 1,15
- Q_c cable inclination: ß = 60°
  cable inclination coefficient: Q_c = 1,16
- Q_d = 1,30

Stress on each TORRE during rotation in air:

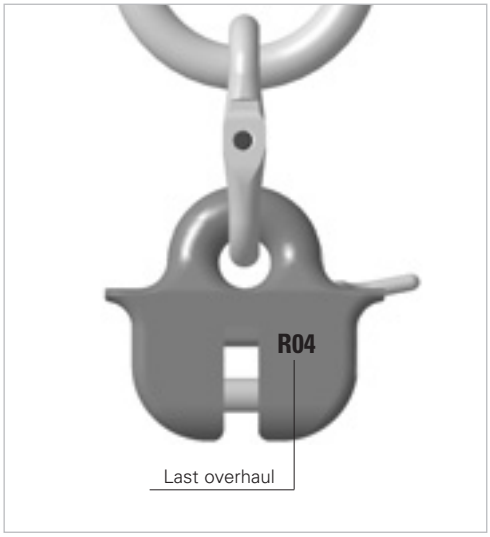
$R = \frac{6400}{2}$ x 1,15 x 1,16 x 1,30 = 5550 kg = **5,6 ton**

Choice for P1 and P2: **TORRE 6 ton**
To size P3, enter the actual value for the weight of the panel being supported.

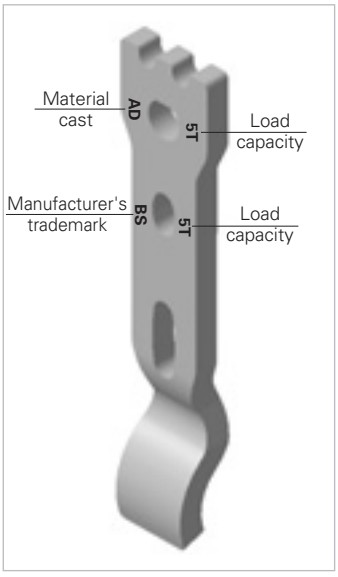
TORRE shackle



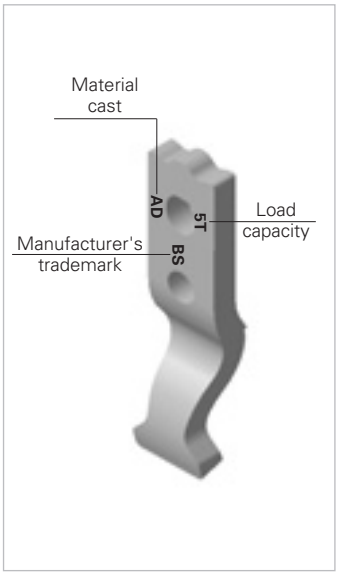
Back of TORRE shackle



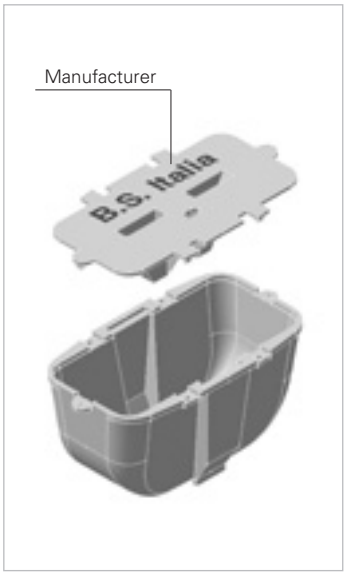
Big TORRE plate



TORRE "S" plate



Box



WORN OR DAMAGED PARTS

Correctly used and maintained lifting equipment must, in any case, be checked and replaced if found to be damaged or worn,
The frequency of these checks will depend on the amount of use made of the equipment and the conditions in which the system elements are used or stored. The user is responsible for scheduling the checks and replacing any damaged/worn parts.

WELDING OR MODIFYING

The welding or modifying of any components in the TORRE system is not permitted where this may cause a reduction in load capacity, changes to the technical characteristics of the materials or lead to unsafe working conditions.
B.S.Italia cannot be held liable for any damage or injury as the result of modifications to its products or individual components.

REPLACING OR EXCHANGING COMPONENTS

The products that B.S.Italia manufactures and supplies are designed as part of an inseparable system for lifting precast/prestressed concrete elements. Non original spare-parts are therefore not allowed.

CHANGES IN DESIGN

B.S.Italia reserves the right to alter the design of the components and/or accessories and/or to the load capacities at any time, without prior notice.

CALCULATIONS

Follow the instructions in this manual carefully when designing the inserts and reinforcement. The designer of the concrete elements is, in any case, legally responsible for the correct choice of components in the TORRE system.

In accordance with local regulations, an individual must be appointed for each product to be responsible for the safety of the workplace. A detailed assembly plan must be issued and followed. This manual must always be present and available on site and handed to the relevant managers: production, storage and site.

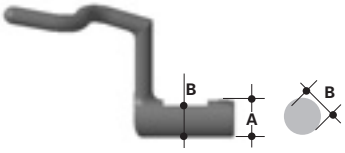
Shackle

Routine maintenance: visual inspection and efficiency test

To be done before every hook-up: visual inspection consists in checking that the safety chain on the closing bolt is working properly. The efficiency test consists in checking that the closing bolt moves properly (translation and rotation) and that the joints turn properly.

The joints must turn and move freely, meaning that there should be no built-up dirt, traces of concrete or anything else. There should be no deformation preventing the joints from moving properly.

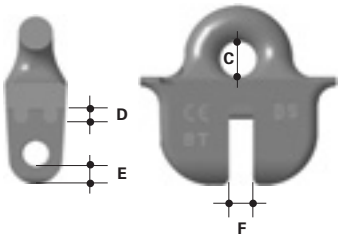
Closing bolt straightness



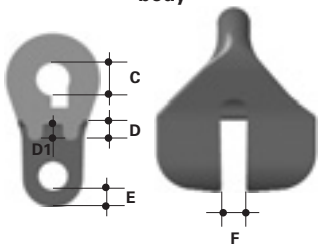
Dimensional test

The dimensional test should be carried out every 6 months and consists in checking for any deformation in the body of the shackle, in the plate-retaining teeth, in the closing bolt, in the ring or in the joints.

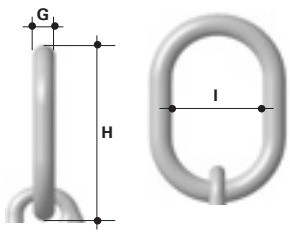
Dimensions of 6 ton shackle body



Dimensions of 12 ton shackle body



Dimensions shackle ring



	A	B	C	D	D1	E	F	G	H	I
6 ton	Ø 19	17,5	Ø 27	11	-	14,5	18	Ø 24	200	94
12 ton	Ø 29	26,5	Ø 38	22	19	20	26	Ø 36	341	134

Last overhaul

Extraordinary maintenance

Extraordinary overhauls (to be c/o B.S.Italia) must be done at least once a year. The user is responsible for requesting the annual extraordinary overhaul. An overhaul consists in checking the suitability of the steel, the movements, the sections in the ring, closing bolt, shackle body, mechanisms and sliding surfaces that take the weight. The marking on the shackle certifies that it has been revised by B.S.Italia. Overhaul guarantees that the shackle meets safe working criteria.

Marking

A new marking on the shackle certifies that it has been revised and therefore the annual warranty has been renewed.

Warranty

A shackle must be replaced if it shackle fails to conform to the safety standards. The product warranty becomes null and void if extraordinary maintenance by B.S.Italia has not been requested and the user therefore accepts full liability inherent with and/or consequent to its use. It is strictly prohibited to weld or change the components in the TORRE system.
B.S.Italia cannot be held liable for any damage or injury whatsoever arising from changes being made to its products or single components of the same (see page 35).

Always replace the damaged these revenues shackle in the event of an overload, incorrect use, wear or other factors.

COMPONENT CODES

Load capacity (tons)	Description	Code
2-6	Shackle for TORRE plate	MANIGL97
2-6	Plastic box	SCA-TOR1
2	Big TORRE plate TG	9500-2.0
2	Small TORRE plate TP	9501-2.0
2	Long TORRE plate S	9702-2.0
3	Big TORRE plate TG	9500-3.0
3	Small TORRE plate TP	9501-3.0
3	TORRE plate S	9700-3.0
3	Long TORRE plate S	9702-3.0
3	TORRE plate with base TB	9800-3.0
4	Big TORRE plate TG	9500-4.0
4	Small TORRE plate TP	9501-4.0
4	TORRE plate S	9700-4.0
4	Long TORRE plate S	9702-4.0
4	TORRE plate with base TB	9800-4.0
5	Big TORRE plate TG	9500-5.0
5	Small TORRE plate TP	9501-5.0
5	TORRE plate S	9700-5.0
5	Long TORRE plate S	9702-5.0
5	TORRE plate with base TB	9800-5.0
6	Big TORRE plate TG	9500-6.0
6	Small TORRE plate TP	9501-6.0
6	TORRE plate S	9700-6.0
6	Long TORRE plate S	9702-6.0
6	TORRE plate with base TB	9800-6.0

6 ton shackle

6 ton box

TG TP TS long TS TB

N.B.: The long TORRE "S" plate is only made to order

COMPONENT CODES

Load capacity (tons)	Description	Code
7,5-12	Shackle for TORRE plate	MANIGL12/98
7,5-12	Plastic box	SCA-TORG1
7,5	TORRE plate S	9700-7.5
7,5	TORRE plate with base TB	9800-7.5
9	TORRE plate S	9700-9.0
9	TORRE plate with base TB	9800-9.0
12	TORRE plate S	9700-12.
12	TORRE plate with base TB	9800-12.

12 ton shackle

12 ton box

TS

TB

TORRE plate can be supplied with different finishes: black (N), cold galvanized (F)

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