

STARCON



STA S spread anchor 1.4S to 22S

Lifting and handling systems for concrete elements.

User and design manual

1 Nomenclature

Symbol	Description	Unit
α	Diagonal pull angle between sling and axial direction	°
β	Tilting angle between element and axial direction	°
γ	Turning angle between element and horizontal direction	°
°C	Temperature Celsius	°C
σ_{ele}	Concrete strength of the element at the time of lifting	MPa
COG	Center of gravity	[-]
d_s	Diameter of the U-bar	mm
d_{s1}	Diameter diagonal pull bar	mm
d_{s2}	Diameter edge bar	mm
d_{s3}	Diameter edge bar around STA anchor	mm
d_{bar}	Bending diameter of the diagonal pull bar	mm
F_S	Load in diagonal direction	N
F_Z	Load in axial direction	N
K	Former embedding depth in the concrete element	mm
l	Length / height of the anchor	mm
l_1	Length u bar	mm
l_{bar}	Total link length of the diagonal pull bar	mm
l_s	Additional reinforcement bar length	mm
o	Distance between U-bars	mm
S	Load group symbol (STARCON)	-
S_R	Minimum thickness of precast element	mm
S_Z	Distance between anchors	mm
WLL	Working Load limit	tonne

Table 1 Nomenclature

Starcon Precast Concrete Design & Lifting Manual

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2 Identification

Table 2 provides insight into the revision number of this document. It facilitates tracking changes and ensuring version control for accurate referencing and updates.

Version	Responsible	Creator	Date	Comment
A	CERTEX Denmark	JLJ	10-02-2025	New documentation

Table 2 Revision table

3 Introduction Starcon STA anchor system 1.4S to 22S.

Read this instruction manual before using the spherical anchor. Incorrect use can cause injury or danger!

Safety is paramount when using lifting devices and equipment.

Only trained individuals should operate them as per national law.

Familiarize yourself with the instruction manual before using the Starcon lifting system to ensure safe operation.

Adhering to these guidelines reduces the risk of accidents.

Consult relevant national regulations as they may supersede these instructions.

All individuals involved with the equipment must read and understand this manual.

Always keep the manual with the product. Contact information is provided on the last page.

Contact Certex for assistance or clarification.



General concept of the use STA anchor:

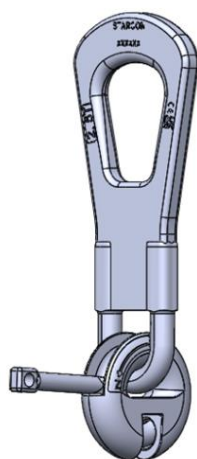
The Starcon Lifting and Handling System consists of three key components: Starcon STA S anchor, Starcon STA ring clutch, and Starcon former shown on Figure 1.

To ensure proper placement of the lifting unit in the finished concrete product, the head of the Starcon Lifting Anchor is assembled into a corresponding Starcon former before pouring. Once the concrete reaches a strength of at least 15 MPa, the former can be removed, and lifting can commence at the factory. At the installation site, lifting can only begin once the concrete has reached a strength of at least 25 MPa. Contact CERTEX DK for lower strength values. Lifting can be initiated by attaching the respectably rated STA ring clutch to the hole of the Starcon STA Anchor.

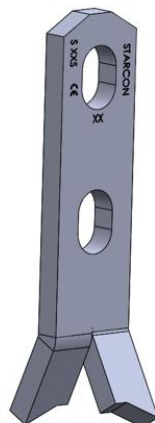
The Starcon lifting anchors and systems use the guidelines described in the German guidelines VDI/BV-BS 6205 and Technical Report CEN/TR 15728, combined with EN 13155-2009. This ensures the highest level of safety when using our products.

Material: Steel.

Surface treatment: Untreated or hot dip galvanized (Corrosion class: C3, ISO 12944).



STA ring clutch



STA S spread anchor



STA Former

Figure 1 Starcon lifting system.

4 Safety instructions before use



- The Starcon lifting anchor must only be installed in a Starcon former of the same rating.
- Starcon lifting anchors that are exposed of corrosion, or damaged must not be used.
- The Starcon lifting anchor must only be hoisted by a lifting unit of the same size.
- The Starcon lifting and handling system must not be used to lift more than the specified load.
- The Starcon lifting and handling system must not be used for personnel lifting.
- The Starcon products are designed for one-time lifting only.
- The Starcon lifting system must only be used by skilled, trained employees.
- A lifting accessory used with the lifting eye must be correctly marked and approved for lifting.
- Before use, check the weather conditions. Never operate the system outdoors if there is a likelihood of lightning in the area and avoid use in extreme weather conditions such as storms, heavy rain, or snowing.
- The concrete safety factor assumes a factory production control complying with EN13369. If these requirements are not fulfilled, a safety factor of $\gamma = 2,5$ shall be used.
- All relevant concrete failure modes shall be verified by the pre casting manufacturer of the concrete elements; the different failure modes and verification methods are specified in EN13155 (Annex H).

5 Advantages of the Starcon system.

The Starcon system offers immediate assembly and release options for the lifting STA ring clutch, enabling precast concrete units to be handled quickly, safely, and economically, as shown in Table 3. A self-locking lifting STA ring clutch prevents accidental release. With the Starcon systems, time-consuming screw connections and wires prone to wear are avoided. Due to the lifting STA ring clutch high robustness, they can be used reliably for many years.

The Starcon system is available in load group 1.4S to 26S. The lifting STA ring clutch rotates freely around the anchor's axis, and the unique geometry of the system means the anchors can bear their full load even if they pull perpendicular to the anchor's axis.

The system's efficiency has been proven through many years of successful use and numerous laboratory tests. Components are regularly tested during production and clearly marked with the maximum load. The lifting STA ring clutch is individually tested and comes with a traceability batch code.

5.1 Note

The information in this manual is for guidance only, and the use of the manual does not in any way exempt the manufacturer from ensuring that the chosen lifting system is suitable for the intended purpose. The information and data listed in this manual only refer to original Starcon products supplied by *CERTEX DANMARK A/S*.

6 Using the Starcon system

The Starcon system comprises a wide range of anchors in a load group from 1.4 to 26S per anchor with various lengths. The principle for using the system is the same for the entire range. The Starcon system consists of the following three main components:

6.1 Starcon Anchor

The Starcon anchor is a steel component designed for embedding, featuring a specially engineered foot for secure anchoring in hardened concrete. The Starcon anchor, which is plate-shaped, connects to a Starcon lifting STA ring clutch for lifting purposes. Each Starcon anchor is clearly labeled with its size (e.g., 2.5S) and is available in various lengths. They undergo sample testing for defects, dimensional deviations, and tensile strength, ensuring a minimum safety factor of 3:1 for metallic failure.

6.2 Starcon Former

The former are soft PVC components used for embedding an anchor in wet concrete. The anchor head is placed in the former, which can then be bolted to the formwork. After the unit is cast and hardened, the former is removed, revealing the anchor head seated in a semi-spherical depression in the concrete. Each former can be used for multiple castings if cleaned and lubricated after each use.

The Former are also available with a holding plate for the STA former.

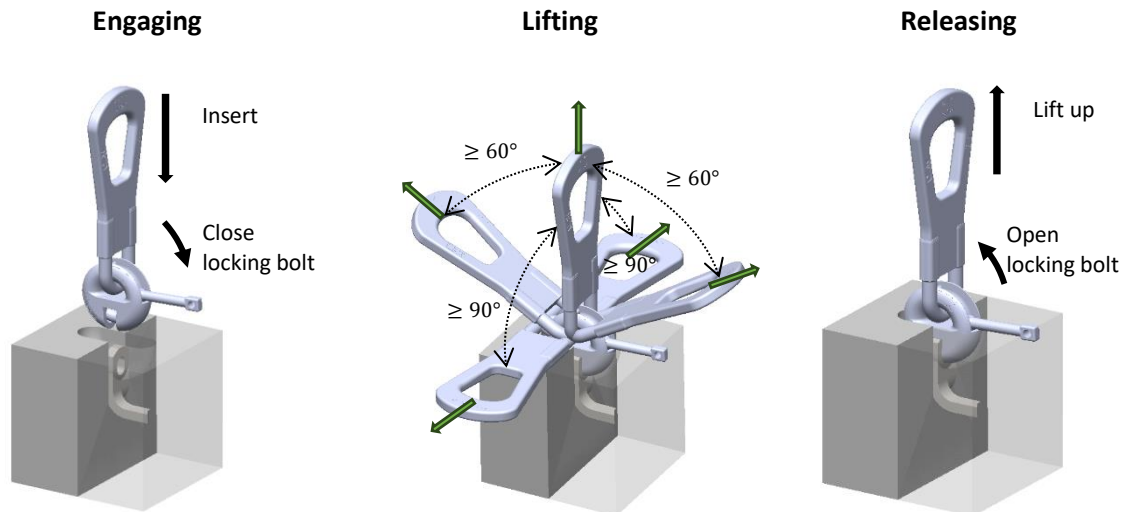
6.3 Starcon Lifting STA ring clutch.

The Starcon STA ring clutch is a specially designed component with a pin-shaped claw that grips the top hole of the Starcon STA anchor. Starcon STA ring clutches are tested to twice the allowable load, and all test results are recorded. Each Starcon STA ring clutch is marked with an article number, identification number, and maximum working load with a safety factor of 4:1. A certificate is issued for each delivery.

An additional safety measure is that the Starcon system is available in several non-compatible load groups. It is not possible to incorrectly assemble components from different load groups, thus avoiding failure of the lifting arrangement.

6.4 Starcon STA ring clutch assembly instructions.

The Starcon STA ring clutch system enables efficient handling of flat cast concrete elements. To secure the STA ring clutch, insert it into the concrete recess and tighten the locking bolt manually. The system allows safe lifting in any direction, up to 60° vertically and 90° sideways, see Table 3. To remove the clutch, open the locking bolt manually.



Insert the STA ring clutch into the concrete recess and manually close the locking bolt by sliding it to its limit position. Once secured, you can begin the lifting process.

The STA ring clutch is designed to handle loads from any direction, provided the load limits of the anchors are not exceeded. When using a spreader beam, it is permissible to apply an angled pull of up to 60°. And up to 90° to the sides.

Manually retract the pin to enable the removal of the STA ring clutch.

Table 3 The connection between the Starcon STA ring clutch and Starcon STA anchor is fast and easy.

7 Safety factors for lifting systems

For the calculations of the lifting system, the following safety factors shown in Table 4 have been applied to ensure its reliability and safety. These factors, in accordance with the recommendation of EN13155, have been carefully selected as guidelines to ensure optimal safety during the system's operation.

Failure safety factors	
Steel failure of anchors	$SF_{Steel} = 3$
Concrete pull out failure	$SF_{concrete} = 2,5$
Failure in the STA ring clutch	$SF_{Link} = 4$

Table 4 Failure safety factors

8 General information

This section provides essential details on the Starcon lifting anchor systems, offering clarity and guidance for safe and efficient usage.

8.1 Marking on the anchor

Each anchor is clearly labeled with its load capacity, length, and manufacturer's identification, ensuring easy and secure identification of the systems, even post-installation show on Figure 2.

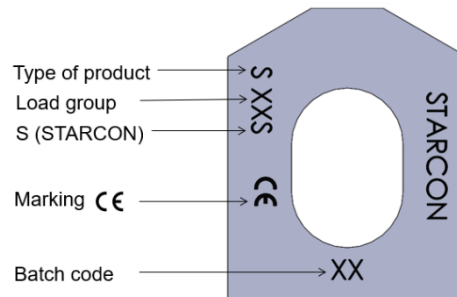


Figure 2 Marking on top of the STA S

8.2 Guidelines for Anchor Selection

When selecting anchors, it's essential to consider various factors to ensure safety and effectiveness. Tables provided contain crucial information such as maximum load capacities, edge distances, and installation values for different anchor types. Key points to consider:

- Weight of the precast element.
- The number of anchors.
- How the anchors are arranged.
- The load-bearing capacity of the anchors
- Sling handling angle.
- Dynamic factor.
- The diagonal pull properties of the anchors.
- Environmental impact at the use.

8.3 Guidelines for installation

For the Starcon lifting anchor systems to be appropriately installed, it is imperative to ensure compliance with specific technical criteria and prerequisites:

- Adherence to load capacity specifications of the anchor.
- Maintaining appropriate edge spacing.
- Ensuring the concrete grade is suitable.
- Verifying alignment with the load direction.
- Additional reinforcement requirements.

8.4 Guideline for load capacity

Load capacity of an anchor relies on several factors:

- The strength of the concrete at the moment of lifting, as determined by a cube-test with dimensions of 15 × 15 × 15 cm.
- The length of the anchor.
- The spacing between the anchor and the edges, both axially and along the edge.
- The direction of the applied load.
- The arrangement of reinforcement within the concrete structure.

9 Design method

This section covers the design method for lifting operations as well as illustrations of various lifting techniques. It describes when the different types of lifts occur, including axial lifting, diagonal lifting, tilting, and rotation of elements. Additionally, the casting process is discussed, including the transfer of load to the concrete using the anchor base, and the importance of correctly placing formwork and anchors during casting to avoid errors and risks. Warnings are given regarding the correct size of formwork and the risk of errors with incorrect sizes, which can lead to potentially dangerous situations.

9.1 Illustration of lifting methods

Figure 3 shows a description of when the different types of lifts occur:

- **Axial pull:** occurs in the same direction as the pulling force and happens within the range of $0^\circ \leq \alpha \leq 10^\circ$.
- **Diagonal pull:** occurs when slings/chains are angled between $10^\circ \leq \alpha \leq 60^\circ$ relative to the lift.
- **Tilting:** occurs when the object needs to rotate around its COG on the short side of the element.
- **Turning:** occurs when the object needs to rotate around its COG on the long side of the element.

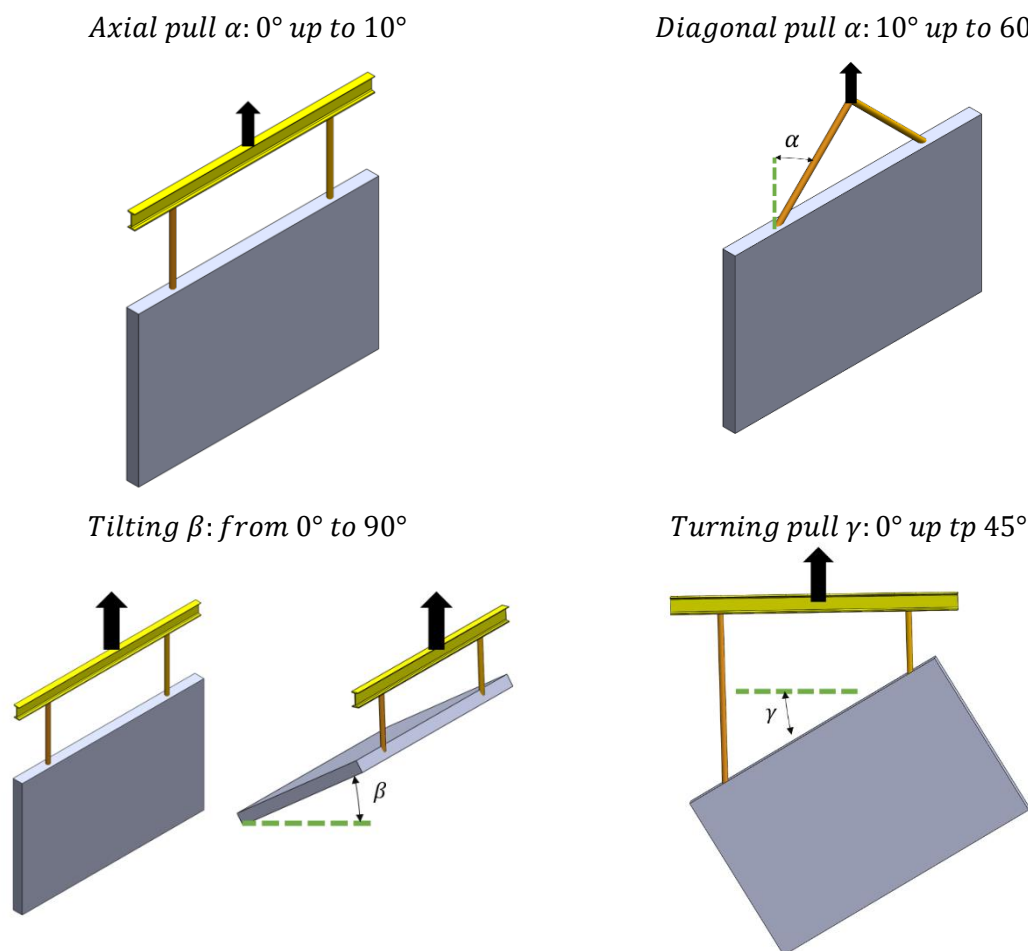


Figure 3 Lifting methods.

9.2 Correct placement of former and anchors during casting.

Caution: If the form is too small, it won't be compatible with the lifting equipment later. Conversely, if the recess block is too large, attaching the lifting equipment correctly will be impossible, increasing the risk of the lifting STA ring clutch slipping out. This could lead to premature anchor failure and the subsequent collapse of the construction element. Always ensure the form size matches the identified appropriate size. Figure 4 illustrates the correct placement of the former in wet concrete to ensure optimal anchorage strength for the anchor.

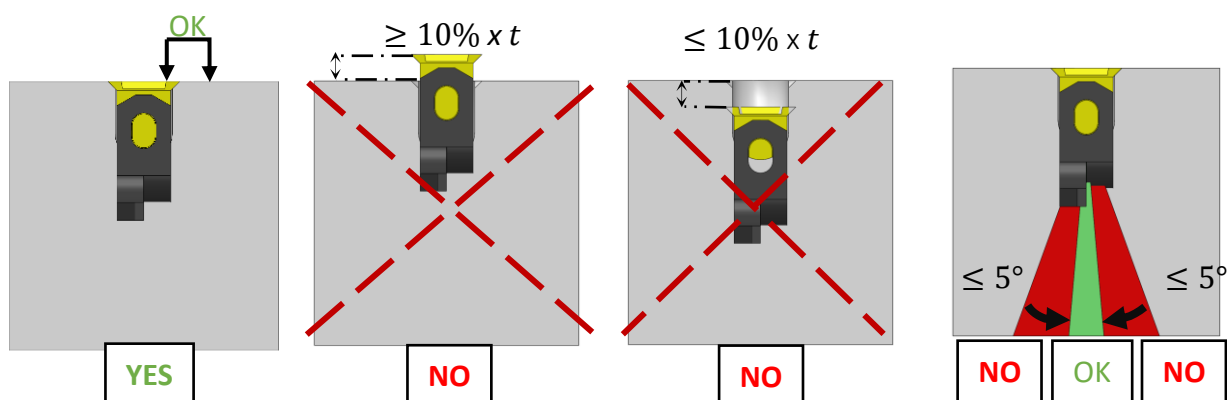


Figure 4 Correct placement of former.

Spread anchors and two-hole anchors should only be installed in thin-walled materials. The flat piece of steel must be positioned at a right angle to the slab to ensure proper installation and stability.

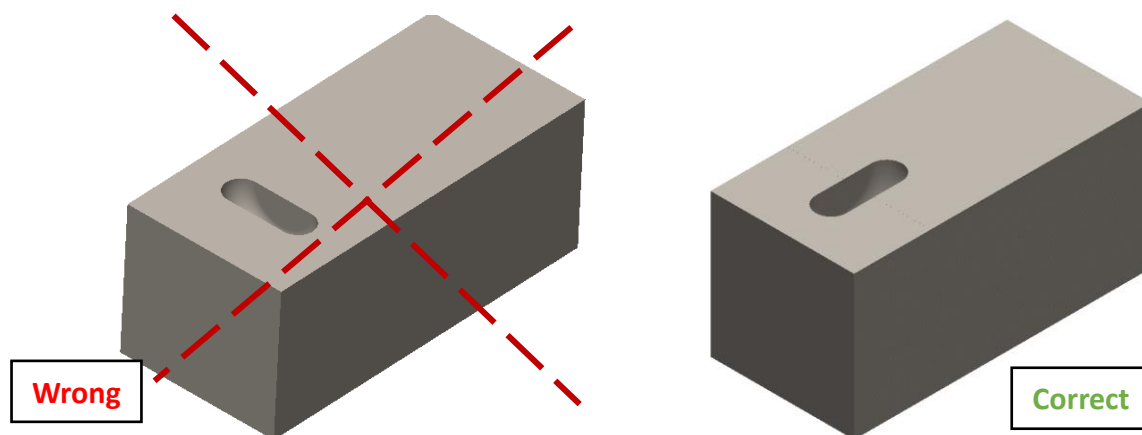


Figure 5 Correct placement of former direction in the wall.

9.3 Calculate load cases of removing from formwork and transport.

To ensure proper anchoring, each anchor must consider several factors: weight of the element, adhesion to the mold, shock load, sling angle, and the number and position of the anchors.

When lifting a concrete unit from a form, consider the adhesion factor between the concrete and the mold. For complex shapes, adhesion can increase anchor load, especially when concrete strength is at its lowest. Calculate the total weight of the elements in tons, including all equipment and accessories attached to the device.

9.3.1 Load case removing the formwork and transport of the element.

The tension force F_A in each the anchor:

1. Load case when removing the element from the formwork:
$$F_A = \frac{(F_Z + S * P_a) * F_s}{n}$$

2. Load Case during transport lifting of the element.
$$F_A = \frac{F_Z * F_s * \varphi_{dyn}}{n}$$

Where,

- F_Z : Weight of the concrete element in tonne
- S : Surface area of the mould in contact with the fresh concrete (m^2)
- P_a : Adhesion factor between the pouring box and concrete (See Table 6)
- F_s : Sling angle factor (See Table 5)
- n : Number of load-bearing anchors in the element.
- φ_{dyn} : Dynamic factor of the element under transport

9.3.2 Sling angle factor (F_s)

The illustration in Figure 6 provides a visual explanation of how to measure the sling angle. Referencing Table 5, you can find the sling factor corresponding to the measured angle.

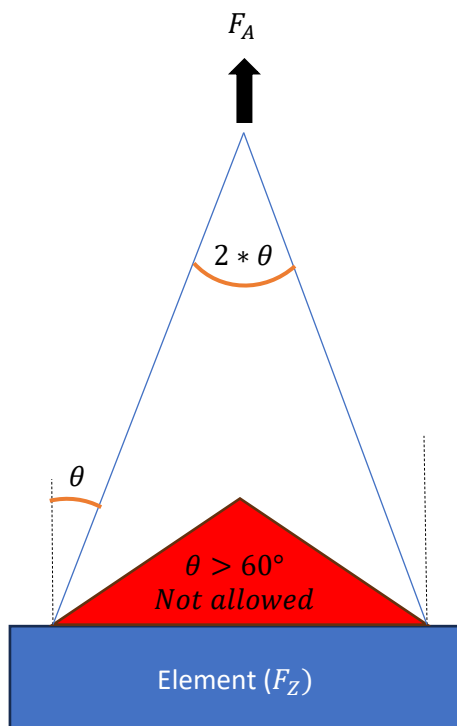


Figure 6 Sling angle factor illustration.

Sling angle degree (θ)	Sling factor (F_s)
0°	1
10°	1,02
20°	1,07
30°	1,16
45°	1,41
60°	2

Table 5 Sling angle factor

9.3.3 Adhesion to formwork factors (Pa)

Adhesion factor between the pouring box and concrete is shown in Table 6.

Mould type	Adhesion($\frac{tonne}{m^2}$)
Lubricated steel form work	$Pa = 0,1$
Varnished timber formwork	$Pa = 0,2$
Rough formwork	$Pa = 0,3$

Table 6 Adhesion factor to formwork

9.3.4 Dynamic factors (φ_{dyn})

If the concrete unit is handled or transported by mechanical equipment, it is exposed to shock/impact from gripping and transport over uneven ground. This factor can increase the anchor load several times its own weight. The correct load can be determined by adding the dynamic factor φ_{dyn} shown in Table 7

Lifting condition	Dynamic load factor
Static crane, rope speed <90 m/min	1
Static crane, rope speed >90 m/min	1,3
Lift and transport with mobile crane on smooth ground	1,75
Lift and transport with mobile crane on uneven ground	2,5
Transport with forklift or excavator over uneven ground	4

Table 7 Dynamic factor

9.3.5 The number and position of lifting points

The effective load carried by each anchor is typically calculated by dividing the total weight by the number of load-bearing anchors. However, this calculation assumes equal load distribution among all anchors. If the load distribution is unequal, the load to be carried by each anchor should be determined using static calculations as shown in Figure 7.

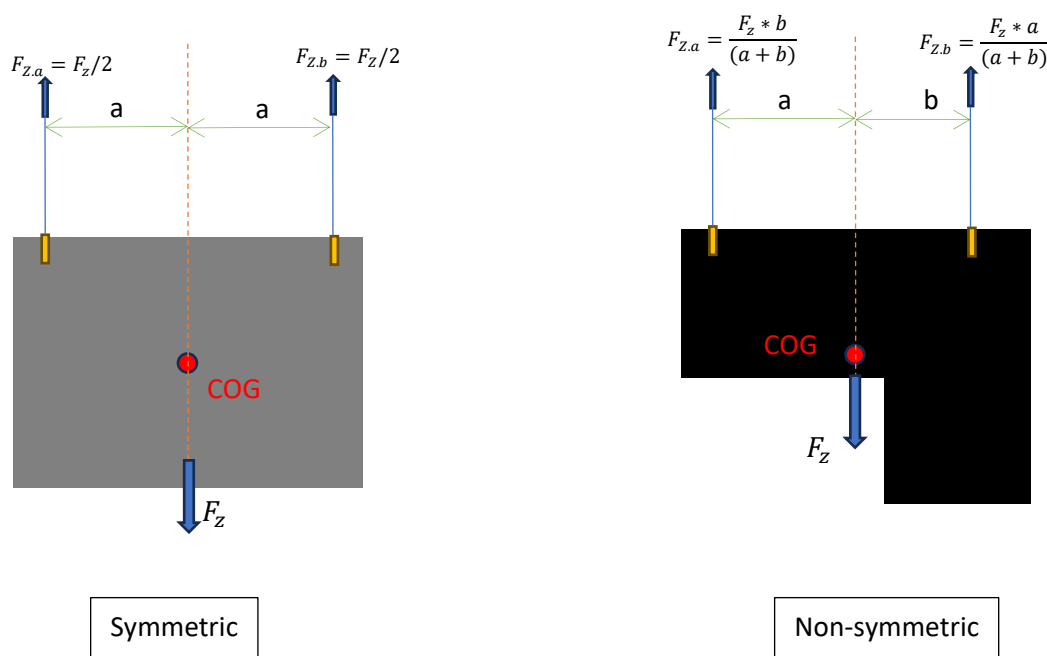


Figure 7 Calculation symmetric and non-symmetric loading element.

10 Recommend support for STA near the wall in concrete elements.

Figure 8 explains how to correctly position the reinforcement mesh inside the element. It also demonstrates the proper placement of diagonal pull bars to effectively support the anchor and the opposite face during lifting or pulling operations. All reinforcement must be classified as B500B according to DIN 488 or equivalent standards. The reinforcement pull bar should be bent at a $30^\circ \pm 2^\circ$ angle, as shown in the illustration, to give the optimal strength and embedment.

- The diagonal pull reinforcement should be positioned as near as possible beneath the former and must be installed in full contact with the anchor.

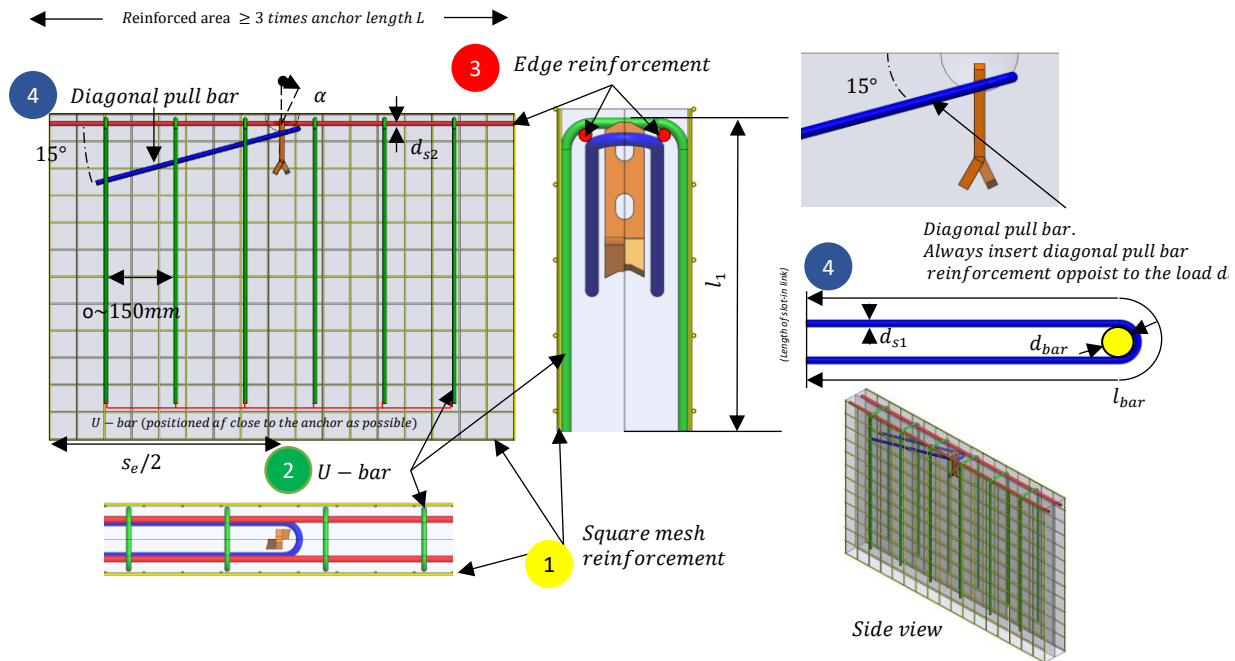


Figure 8 Reinforcement in the concrete wall.

Table 8 provides a detailed description of the correct placement of mesh and reinforcement within the concrete for each anchor type.

Load group	<div>①</div> Square mesh reinforcement			<div>②</div> U-Bar			<div>③</div> Edge reinforcement both sides d_{s2} mm	<div>④</div> Diagonal pull bar ①		
	For pull > 30° [α]							d_{s1} mm	d_{bar} mm	l_{bar} mm
	Antal Net	Net dia. mm	Afstand i net mm	pcs.	d_s mm	l_1 mm				
1.4S	2	Ø6	60	4	Ø6	400	Ø8	Ø6	47	900
2.5S	2	Ø8	100	4	Ø8	600	Ø10	Ø8	47	1200
5.0S	2	Ø10	140	4	Ø10	800	Ø12	Ø12	53	1550
7.5S	2	Ø10	160	4	Ø10	800	Ø12	Ø14	71	2000
10.0S	2	Ø10	180	6	Ø10	1000	Ø14	Ø16	71	2300
14.0S	2	Ø12	240	6	Ø10	1000	Ø14	Ø20	116	2600
22.0S	2	Ø12	350	8	Ø10	1200	Ø16	Ø28	116	3450
① There is no requirement for diagonal tension reinforcement in concrete with the following strength: Concrete compressive strength (σ_{ele}) is ≥ 15 N/mm² and 3 times the minimum wall thickness, Concrete compressive strength (σ_{ele}) is ≥ 25 N/mm² and 2.5 times the minimum wall thickness, Concrete compressive strength (σ_{ele}) is ≥ 35 N/mm² and 2 times the minimum wall thickness. (!) The reinforcement for diagonal loads needs to be positioned near the recess former, ensuring complete contact with the anchor during installation										
σ_{ele} Stands for concrete element strength at time of lifting.										
Disclaimer: The table serves solely as a guideline. For accurate guidance and calculations, please contact www.Certex.dk .										

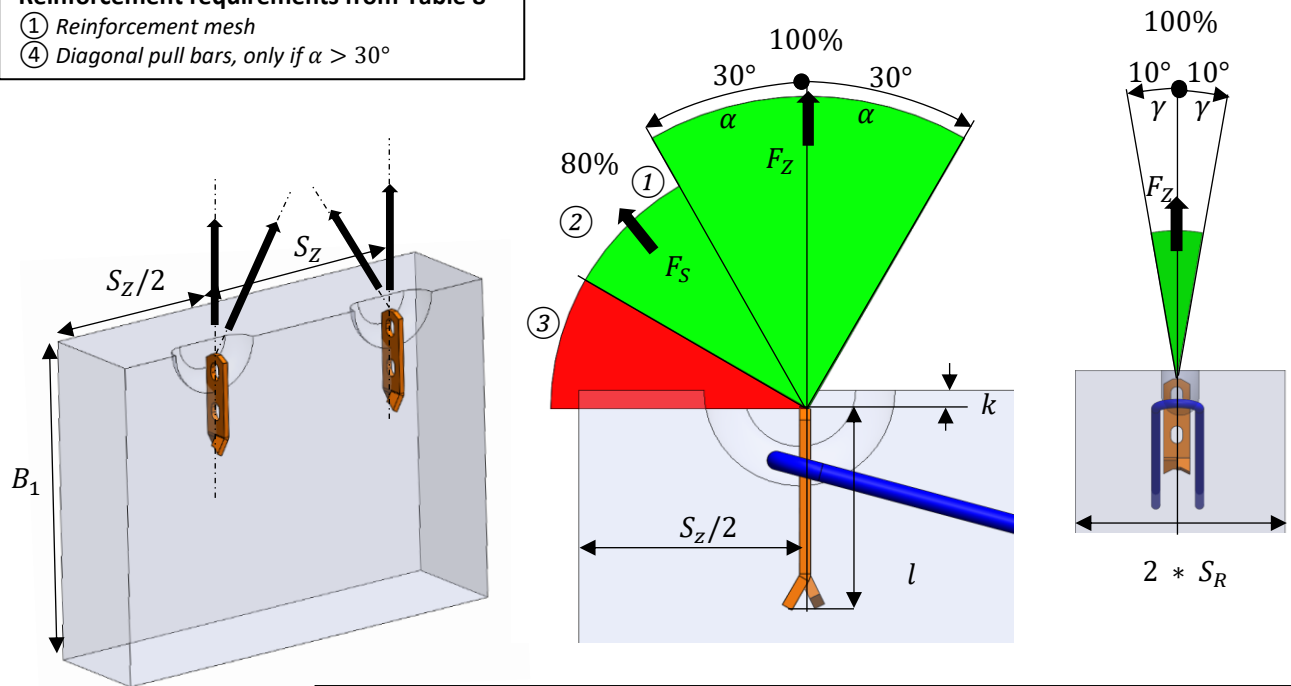
Table 8 Reinforcement data for elements

11 STA S anchors with only standard reinforcement.

This description aims to provide an understanding of the capacity of these anchors within structures with standard reinforcements shown on Figure 9, including the following components, Reinforcement mesh and diagonal pull bars only if, $\alpha > 30^\circ$. The table below provides insights that can contribute to an accurate evaluation of the suitability of lifting concrete elements in various scenarios. When loads are directed towards the edge of the element, insert diagonal pull reinforcement as used for spreading or two-hole anchors. (see Figure 8 and Table 8).

Reinforcement requirements from Table 8

- ① Reinforcement mesh
- ④ Diagonal pull bars, only if $\alpha > 30^\circ$



- (1) Diagonal tension at $30^\circ \leq \alpha \leq 60^\circ$ without reinforcement is only allowed if:
 - Concrete compressive strength (σ_{ele}) is $\geq 15 \text{ N/mm}^2$ and 3 times the minimum wall thickness,
 - Concrete compressive strength (σ_{ele}) is $\geq 25 \text{ N/mm}^2$ and 2.5 times the minimum wall thickness,
 - Concrete compressive strength (σ_{ele}) is $\geq 35 \text{ N/mm}^2$ and 2 times the minimum wall thickness.
- (2) With concrete strength $\sigma_{ele} \geq 23 \text{ N/mm}^2$, F_s can be taken as 100%
- (3) Diagonal tension with cable/chain spreading $\alpha > 60^\circ$ is not permitted.

Figure 9 Reinforcement requirements.

Lifting a Wall Element with standard reinforcement

Table 9 provides information to assist in determining the appropriate anchors for lifting concrete elements under various loading conditions.

The following boundary conditions are utilized for the calculation:

- **1 anchor** symmetrically positioned to the center of gravity.
- **Dynamic factor** (site handling) $\Gamma_{dyn} = 1.3$
- **Formwork adhesion** is not considered.

Load class lifting STA ring clutch	Load group	Anchor length. L	Min. thickness B_1	Load capacity [Ton] at concrete strength σ_{ele}				Min. distance between anchors. S_z	Min. edge distance. $2 * S_R$
				Diagonal Pull $\alpha < 45^\circ$ $\gamma < 10^\circ$	Axial Pull $\alpha < 10^\circ$ $\gamma < 10^\circ$	Diagonal Pull $\alpha < 45^\circ$ $\gamma < 10^\circ$	Diagonal Pull $\alpha < 45^\circ$ $\gamma < 10^\circ$		
		mm	mm	15 N/mm ²	25 N/mm ²	25 N/mm ²	35 N/mm ²	mm	mm
2.5S	1.4S	110	240	0,8	1,2	0,9	1,0	380	100
	2S	120	320	1,0	1,6	1,2	1,3	530	110
		210	320	1,0	1,6	1,2	1,3	530	110
	2.5S	150	320	1,2	2,0	1,4	1,5	530	520
		200	420	1,2	2,0	1,4	1,5	720	720
5.0S	3	160	380	1,4	2,7	1,7	1,8	600	240
		280	380	1,4	2,7	1,7	1,8	600	300
	5	180	380	1,7	4,0	2,1	2,4	600	400
		240	500	1,7	4,0	2,1	2,4	840	300
		260	550	2,3	5,2	2,4	2,8	900	400
10.0S	7.5	300	550	2,3	5,2	2,4	2,8	1060	400
		300	630	2,9	6,4	2,9	2,9	1030	500
	10	370	770	2,9	6,4	2,9	2,9	1310	400
		520	1070	2,9	6,4	2,9	2,9	1910	400
		300	1070	2,9	6,4	2,9	2,9	1910	400
26.0S	14	370	770	3,5	7,7	3,5	3,5	1230	600
	22	500	1030	4,6	10,3	4,6	4,6	1700	800

σ_{ele} Stands for concrete element strength at time of lifting.

Disclaimer: The table serves solely as a guideline. For accurate guidance and calculations, please contact www.Certex.dk.

Table 9 Standard reinforcement requirements only.

12 STA S which requires standard reinforcement including, U-bar, and edge reinforcement.

This description aims to provide an understanding of the capacity of these anchors within structures with standard reinforcements including U-bar and edge reinforcement as shown on Figure 10, including the following components, Reinforcement mesh and diagonal pull bars only if, $\alpha > 30^\circ$. The table below provides insights that can contribute to an accurate evaluation of the suitability of lifting concrete elements in various scenarios. When loads are directed towards the edge of the element, insert diagonal pull reinforcement as used for spreading or two-hole anchors. (see Figure 8 and Table 8).

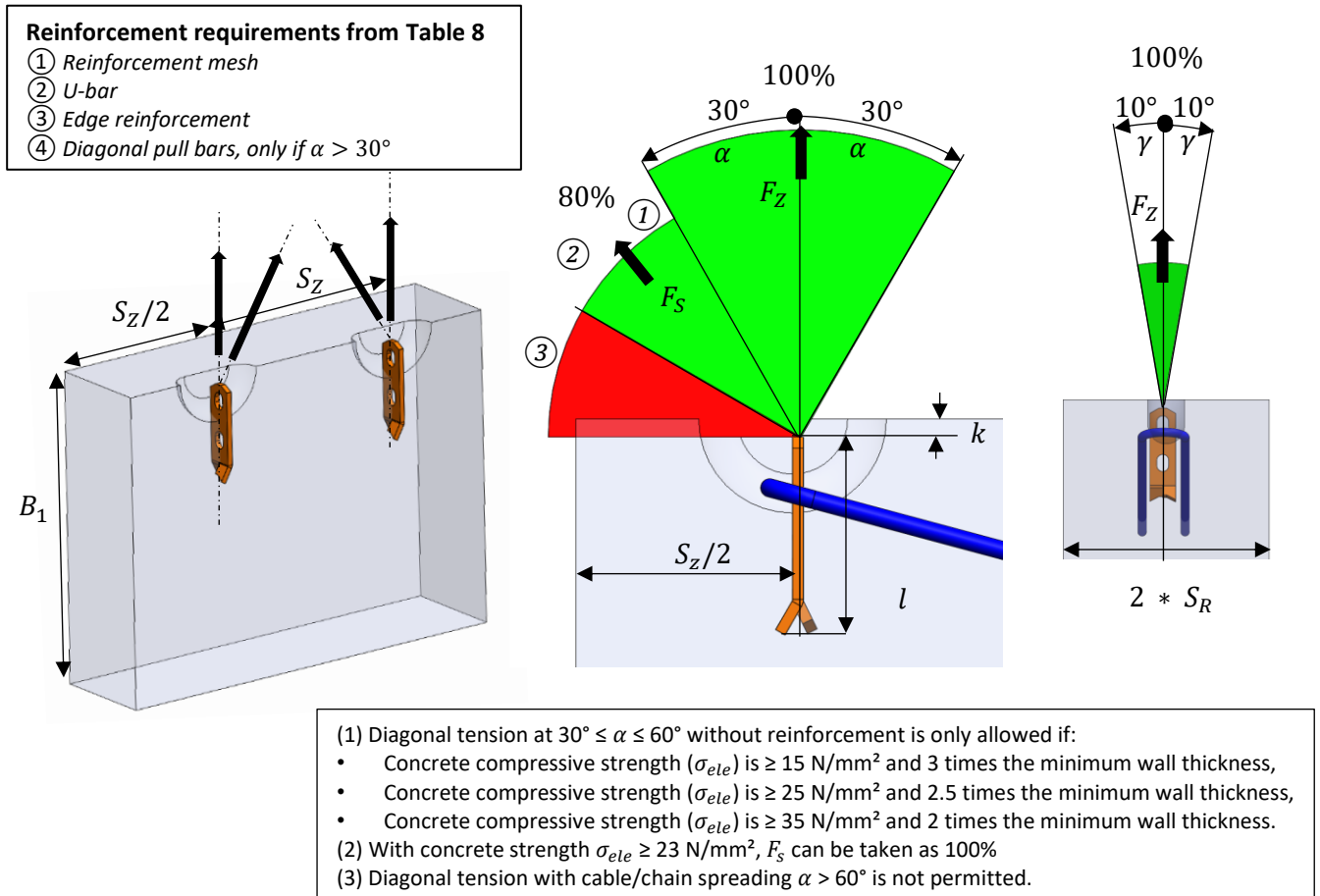


Figure 10 Reinforcement requirements.

Lifting a Wall Element with standard reinforcement including U-bar and edge reinforcement

Table 10 provides information to assist in determining the appropriate anchors for lifting concrete elements under various loading conditions.

The following boundary conditions are utilized for the calculation:

- **1 anchor** symmetrically positioned to the center of gravity.
- **Dynamic factor** (site handling) $\Gamma_{dyn} = 1.3$
- **Formwork adhesion** is not considered.

Load class lifting STA ring clutch	Load group	Anchor length. L	Min. thickness B_1	Load capacity [Ton] at concrete strength σ_{ele}				Min. distance between anchors. S_Z	Min. edge distance. $2 * S_R$
				Diagonal Pull $\alpha < 45^\circ$ $\gamma < 10^\circ$	Axial Pull $\alpha < 10^\circ$ $\gamma < 10^\circ$	Diagonal Pull $\alpha < 45^\circ$ $\gamma < 10^\circ$	Diagonal Pull $\alpha < 45^\circ$ $\gamma < 10^\circ$		
				25 N/mm2	25 N/mm2	25 N/mm2	35 N/mm2		
		mm	mm	15 N/mm2	N/mm2	25 N/mm2	35 N/mm2	mm	mm
2.5S	1.4S	110	240	0,9	1,2	0,9	1,0	380	100
	2S	120	320	1,1	1,6	1,1	1,2	530	110
		210	320	1,1	1,6	1,1	1,2	530	110
	2.5S	150	320	1,2	2,0	1,3	1,5	530	520
		200	420	1,2	2,0	1,3	1,5	720	720
5.0S	3	160	380	1,6	2,7	1,6	1,8	600	240
		280	380	1,6	2,7	1,6	1,8	600	300
	5	180	380	2,4	4,1	2,4	2,4	600	400
		240	500	2,4	4,1	2,4	2,4	840	300
10.0S	7.5	260	550	3,3	5,8	3,3	3,3	900	400
		300	550	3,3	5,8	3,3	3,3	1060	400
	10	300	630	4,1	7,2	4,1	4,1	1030	500
		370	770	4,1	7,2	4,1	4,1	1310	400
		520	1070	4,1	7,2	4,1	4,1	1910	400
26.0S	14	370	770	5,3	8,7	5,3	5,3	1230	600
	22	500	1030	7,8	11,6	7,8	7,8	1700	800
σ_{ele} Stands for concrete element strength at time of lifting.									
Disclaimer: The table serves solely as a guideline. For accurate guidance and calculations, please contact www.Certex.dk .									

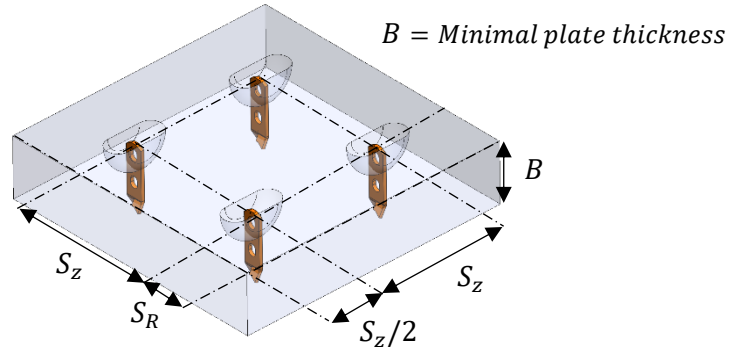
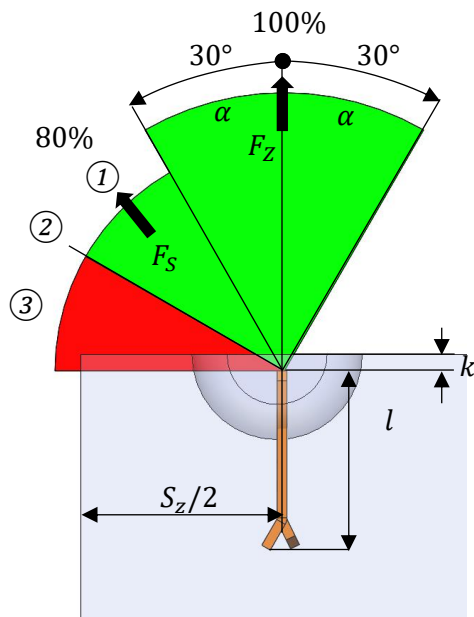
Table 10 Full reinforcement requirements, with u-bar and edge reinforcement.

13 STA S anchors in slabs with standard reinforcement.

This description aims to provide an understanding of the capacity of anchors within slabs shown on Table 11, including the following components, Reinforcement mesh and diagonal pull bars only if, $\alpha > 30^\circ$. The table below provides insights that can contribute to an accurate evaluation of the suitability of lifting concrete slab in various scenarios. When loads are directed towards the edge of the element, insert diagonal pull reinforcement as used for spreading or two-hole anchors. (see Figure 8 and Table 8).

Reinforcement requirements from Table 8

- ① Reinforcement mesh
- ④ Diagonal pull bars, only if $\alpha > 30^\circ$



- (1) Diagonal tension at $30^\circ \leq \alpha \leq 60^\circ$ without reinforcement is only allowed if:
- Concrete compressive strength (σ_{ele}) is $\geq 15 \text{ N/mm}^2$ and 3 times the minimum wall thickness,
 - Concrete compressive strength (σ_{ele}) is $\geq 25 \text{ N/mm}^2$ and 2.5 times the minimum wall thickness,
 - Concrete compressive strength (σ_{ele}) is $\geq 35 \text{ N/mm}^2$ and 2 times the minimum wall thickness.
- (2) With concrete strength $\sigma_{ele} \geq 23 \text{ N/mm}^2$, F_S can be taken as 100%
- (3) Diagonal tension with cable/chain spreading $\alpha > 60^\circ$ is not permitted.

Figure 11 Reinforcement requirements for a slab.

Lifting of slab element

Table 11 provides information to assist in determining the appropriate anchors for lifting concrete slab element under various loading conditions.

The following boundary conditions are utilized for the calculation:

- **1 anchor** symmetrically positioned to the center of gravity.
- **Dynamic factor** (site handling) $\Gamma_{dyn} = 1.3$
- **Formwork adhesion** is not considered.

Load class lifting STA ring clutch	Load group	Anchor length. L mm	Min. thickness B mm	Load capacity [Ton] for Axial pull ($\alpha < 30^\circ$) at concrete strength σ_{ele}		Load capacity [Ton] for Diagonal Pull ($\alpha < 45^\circ$) at concrete strength σ_{ele}		Min. distance between anchors. S_Z mm	Min. edge distance. S_R mm
				15 N /mm ²	25 N /mm ²	15 N /mm ²	25 N /mm ²		
2.5S	1.4S	110	150	1,0	1,0	0,9	0,9	380	70
		120	160	1,3	1,3	1,1	1,2	520	120
	2S	210	250	1,3	1,3	1,1	1,2	700	100
		150	190	1,5	1,5	1,2	1,4	520	120
		200	240	1,5	1,5	1,2	1,4	720	90
5.0S	3	160	200	1,8	1,8	1,6	1,7	520	260
		280	320	1,8	1,8	1,6	1,7	720	195
	5	180	240	2,4	2,4	2,4	2,4	600	260
		240	280	2,4	2,4	2,4	2,4	840	195
		260	300	3,2	3,2	3,3	3,3	900	300
10.0S	7.5	300	340	3,2	3,2	3,3	3,3	1060	265
		300	350	4,0	4,0	4,1	4,1	1030	390
	10	370	412	4,0	4,0	4,1	4,1	1310	315
		520	570	4,0	4,0	4,1	4,1	1910	225
		14	370	4,8	4,8	5,3	5,3	1230	500
26.0S	22	500	550	6,4	6,4	7,8	7,8	1700	675

σ_{ele} Stands for concrete element strength at time of lifting.

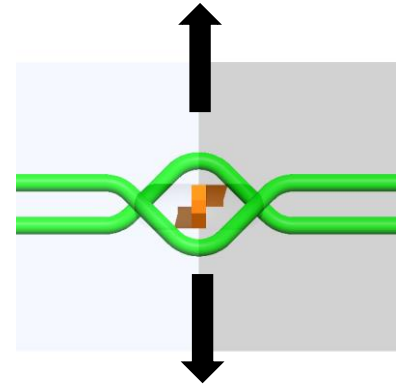
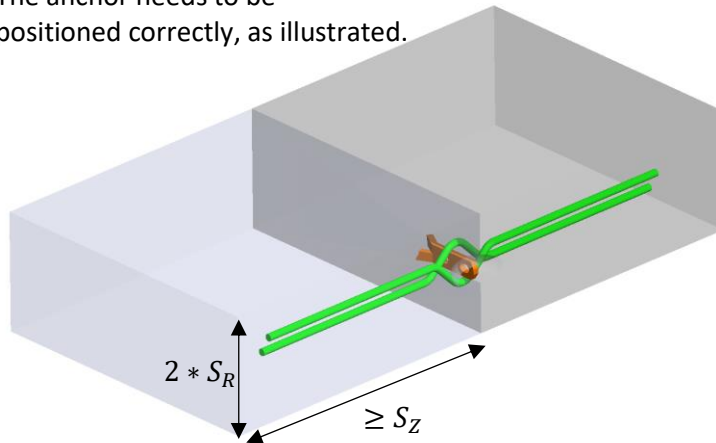
Disclaimer: The table serves solely as a guideline. For accurate guidance and calculations, please contact www.Certex.dk.

Table 11 Reinforcement requirements, in slabs / deck with standard reinforcement.

14 STA S anchor with reinforcement requirements for tilt up and turning.

This description aims to provide an understanding of the load capacity of the anchors when the element is lifted with either tilting or turning, as well as the dimensions and location of the reinforcement as shown on Figure 12. The table below provides insights that can contribute to an accurate evaluation of the suitability of lifting concrete elements in various scenarios.

The anchor needs to be positioned correctly, as illustrated.



The horizontal sections of the tilt-up and rotational reinforcement are situated precisely at the outermost edge of the reinforced zone.

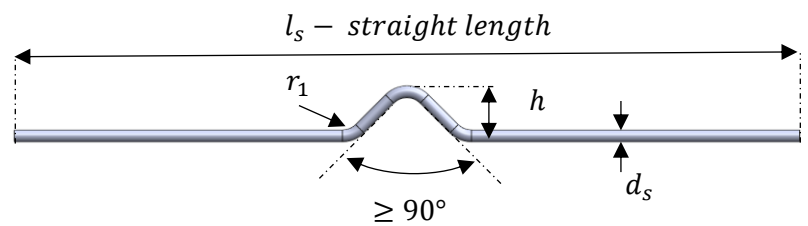


Figure 12 Reinforcement requirements for tilting and turning of the element.

Lifting a Wall Element for tilting and turning

Figure 11 provides information to assist in determining the appropriate anchors for lifting concrete elements under various loading conditions.

The following boundary conditions are utilized for the calculation:

- **1 anchor** symmetrically positioned to the center of gravity.
- **Dynamic factor** (site handling) $\Gamma_{dyn} = 1.3$
- **Formwork adhesion** is not considered.

Load class lifting STA ring clutch	Load group	Tilting and turning reinforcement			Load capacity [Ton] at $\sigma_{ele} \geq 15 \text{ N/mm}^2$	Min. distance between anchors. S_z mm	Min. wall thickness. $2 * S_R$ mm
		d_s mm	r_1 mm	l_s mm			
2.5S	1.4S	Ø10	25	700	0,5	700	100
	2S	Ø12	25	800	0,7	875	100
	2.5S	Ø12	25	800	1,0	875	100
5.0S	3	Ø14	32	1000	1,2	1435	150
	5	Ø16	32	1000	2	1435	150
10.0S	7.5	Ø20	40	1200	2,9	1470	250
	10	Ø20	40	1500	3,8	1820	300
26.0S	14	Ø25	50	1800	5,4	1800	525
	22	Ø28	50	1800	8,5	2200	710

σ_{ele} Stands for concrete element strength at time of lifting.

Disclaimer: The table serves solely as a guideline. For accurate guidance and calculations, please contact www.Certex.dk.

Table 12 Reinforcement requirements, for tilting and turning.

15 General safety information when using the Starcon system.

General safety information when using the Starcon system.



- Ensure that the marking on the Starcon lifting unit always points in the direction of pull during lifting.
- The lifting machine must be approved to lift at least the maximum applied load + the weight of the Starcon lifting and handling system + any hoisting accessories.
- Lifting movements must be smooth; no sudden or abrupt changes in direction with the lifting machine should be made during a lifting operation, as this can lead to pendulum movements of the load, causing crushing hazards or dropping of the load.
- Where there is a risk of crushing between the load and objects, building parts, machinery, etc., the operator must not be in the danger zone.
- The operator's work area must be flat and free of obstacles that could pose a tripping hazard.
- When depositing the load, the operator must ensure this occurs on a flat and stable surface.
- Only when the load has been deposited and secured the Starcon lifting unit is completely unloaded may it be released and lifted free.
- Before each lift, ensure that both the Starcon lifting unit and the Starcon lifting anchor embedded in the concrete product are free from dirt that could reduce grip.
- Never insert arms or feet under a concrete product.
- Concrete products must never be dragged, only lifted.
- No modifications to the Starcon lifting and handling system may be made without written permission from the manufacturer.
- The operator must always ensure that the connection between the lifting machine and/or any hoisting accessories and the Starcon lifting unit is correct and secured against unintentional detachment.
- The operator must always ensure that the connection between the Starcon lifting unit and the Starcon lifting anchor is correct and secured against unintentional detachment.
- Keep a safe distance and never walk under a suspended load.
- Use gloves, safety shoes and other PPE when handling.
- Never use a Starcon lifting and handling system that has visible defects such as wear, deformations, rust damage, etc.
- Most anchors are designed to be easily handled during installation without the need for lifting equipment. However, some anchors may weigh more and should be handled using lifting equipment. Please refer to the order list for the accurate weight of each product.

15.1 Personal Protection

Always use gloves, a safety helmet, and safety shoes as a minimum requirement when operating the equipment. Keep hands and other body parts away from the lifting stand, lifting accessories, and the load during use.



15.2 Preparation of the product before use

15.2.1 Transport and Storage

Anchors should be transported and stored safely to prevent risks to personnel and nearby objects.

15.2.2 Unpacking

Remove the pallet and packaging protecting the anchors.

Cut the safety straps. The person unpacking should wear gloves, safety shoes, and safety glasses when cutting the straps.

15.2.3 Safe Disposal of Packaging Materials

All packaging used by Certex Denmark can be reused. Pallets and all wooden packaging can be reused or recycled.

All plastic, cardboard, and paper materials should be sent to the local recycling center.

If there are no local recycling facilities, the packaging should be returned to Certex Denmark for disposal at the customer's expense.

15.2.4 Preparatory Work Before Installation

After unpacking, visually inspect the anchors for any damage.

15.2.5 Installation and Assembly

The anchors are delivered ready for use.

15.2.6 Storage and Protection Between Periods of Normal Use

Inspect the anchors before each use and lift. Never use anchors or lifting accessories with visible defects such as wear, deformations, corrosion damage, etc.

Always store the lifting bar indoors, in a dry and ventilated area.

15.2.7 Provision of Information (Users, Operators, Service Experts)

All operators or individuals within the danger zone must receive information on operating the anchors and must be trained by the supervisor, familiarizing themselves with the product and its use before lifting operations commence.

Operators must be trained in the use of the Starcon lifting equipment and all its functions and positioned to have a clear view of the entire lifting operation.

15.2.8 Placement of Instruction

All user manuals should always be stored together with the Starcon lifting equipment.

16 Maintenance and inspection

- All maintenance must be performed when the Starcon lifting unit is unloaded.
- The Starcon lifting unit should be inspected and maintained to ensure it remains in proper condition during use.
- After each use, the Starcon lifting unit should be cleaned and inspected for any faults or deficiencies.
- If any faults are found, they must be rectified, or the Starcon lifting unit should be discarded.
- The Starcon lifting unit should always be stored in a dry and well-ventilated area.
- Any damaged, corroded, or worn-out Starcon lifting unit must be immediately taken out of service and marked not be used again.
- Equipment from Starcon should undergo at least one annual inspection by a qualified skilled person to inspect lifting equipment and cranes.

16.1 Maintenance Schedule



- Only original spare parts may be used, and they must be replaced by a trained individual.
- The annual inspection must be carried out by a qualified individual who has received the necessary training and certification for lifting equipment.
- All services must be documented, and the data must be stored.
- If there are any visual defects or if the labeling is not present on the lifting stand, the lifting stand must be marked as "out of service".

B Before use

A After use

M Monthly, or a maximum of 200 hours of usage.

Y Annually, or after a maximum of 2400 hours of use.

Inspection	B	A	M	Y
Perform a visual inspection to check for signs of overload, deformation, damage, wear, and corrosion.	X	X	X	X
The equipment must undergo inspection.			X	
Ensure that the equipment is clear and legibly labeled.	X			X
Inspection should be carried out by a qualified individual with a report prepared.				X

Table 13 Maintenance schedule

17 Disposal / Recycling

This section describes the end of use for the product.

- End of use / Disposal The lifting points shall be sorted / scrapped as general steel scrap.
- The Starcon lifting and handling system should be sorted and disposed of according to appropriate material categories, including metal, plastic, etc.
- Certex can assist you with disposal if required.

18 Product data of STA S

Figure 13 shows a measurement sketch for the STA S with labels for the respective dimensions.

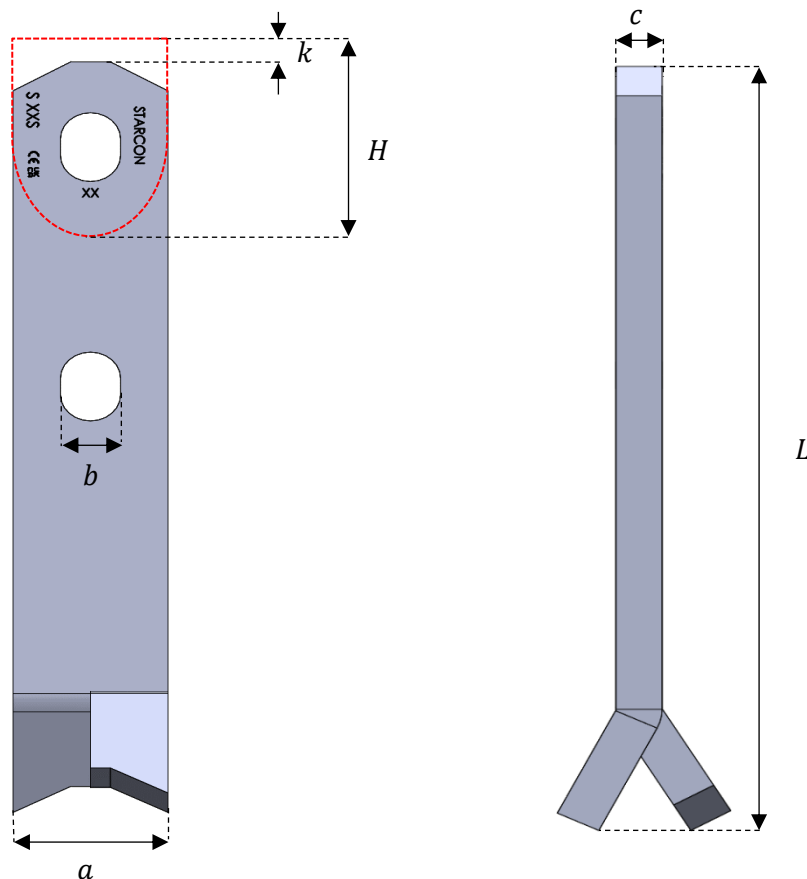


Figure 13 STA S sketch.

18.1 Technical data

Table 14 shows the dimensions of the various types of STA S.

Load class lifting clutch	Load group	a mm	b mm	c mm	k mm	H – former height mm	L - Anchor length mm
2.5S	1.4S	30	14	6	10	45	110
	2.0S	30	14	8	10	45	120, 210
	2.5S	30	14	10	10	45	150, 200
5S	3S	40	18	10	10	59	160, 280
	5.0S	40	18	15	10	59	180, 240
10S	7.5S	60	26	16	15	85	260, 300, 420
	10S	60	30	20	15	85	300, 370, 520
26S	14S	80	35	20	15	118	370
	22S	90	35	28	15	118	500

Table 14 STA S dimension.

19 Product data of STA ring clutch

Figure 14 shows a measurement sketch for the STA ring clutch.

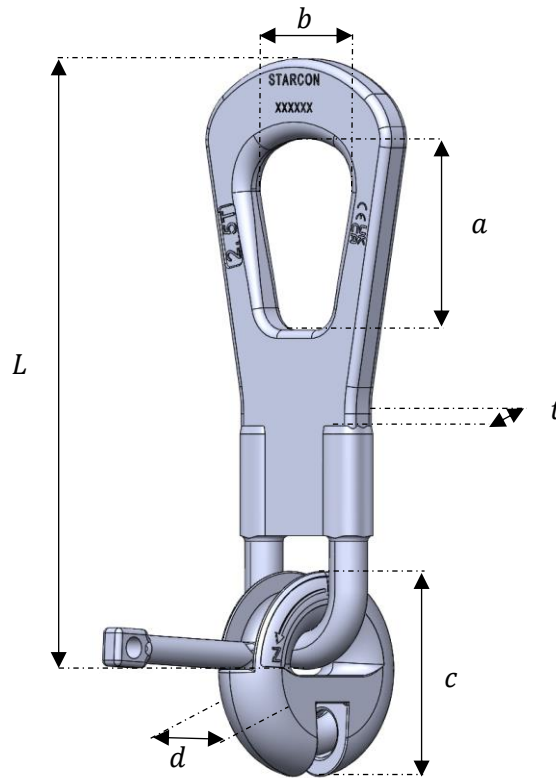


Figure 14 STA ring clutch sketch.

19.1 Technical data

Table 15 shows the dimensions of the various types of STA ring clutch.

Load group	Length plate. L mm	Length hole a mm	Width hole b mm	Clutch head diameter c mm	Head thickness. d mm	Thickness of the plate t mm
2.5S	265	70	58	80	27	12
5.0S	330	86	65	105	36	16
10S	425	112	90	150	50	25
26S	605	160	120	206	72	30

Table 15 STA ring clutch dimension.

20 Product data of STA ring clutch with wire

Figure 15 shows a measurement sketch for the STA ring clutch with wire.

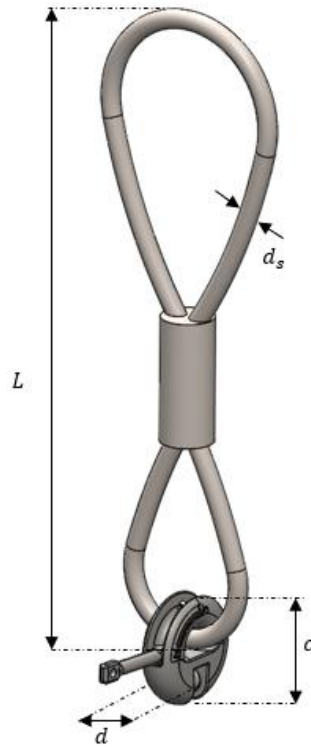


Figure 15 STA ring clutch sketch.

20.1 Technical data

Table 16 shows the dimensions of the various types of STA ring clutch with wire.

Load group	Wire length. L mm	Clutch head diameter c mm	Clutch head thickness. d mm	Thickness of the plate d_s mm
1.3S	330	50	18	8
2.5S	540	80	27	14
5.0S	615	105	36	16
10S	715	150	50	24

Table 16 STA ring clutch with wire dimension.

21 Product data of former for STA.

Figure 16 shows a measurement sketch for the former.

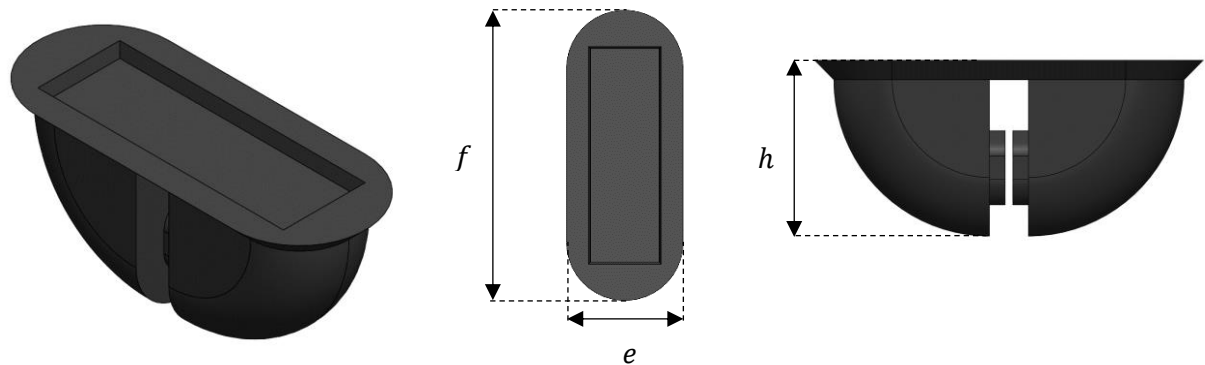


Figure 16 Former for STA.

21.1 Technical data

Table 17 shows the dimensions of the various types of the former used for casting of the Two-hole.

Former STA Load class	e mm	f mm	h mm	Thread M
2.5S	43	104	45	8
5.0S	49	126	59	8
10S	67	188	85	12
26S	112	234	118	16

Table 17 Dimension of former for STA former.

22 EC – Declaration of Conformity of the Machinery

This certificate meets the requirements of the Directive 2006/42/EC Annex II.

Manufacturer and responsible for compiling the technical documentation:

Company:	CERTEX Danmark A/S	Tel. No.:	+45 74 54 14 37
Address:	Trekanten 6-8	E-mail:	info@certex.dk
	6500 Vojens		
	Denmark		

The undersigned hereby declares that the below specified tool comply with the current safety and health rules and legislation within the European Union. If any changes are made on the tool without approval from the manufacturer, this Declaration no longer applies.

Description:	STA S spread anchor
Drawing No.:	XXXXXXXXXXXXXXXX
Serial No.:	XXXXXX
Lifting Capacity:	WLL pr unit
Own Weight:	Kg pr unit

Is made in accordance with the following EC-directive;
2006/42/EC

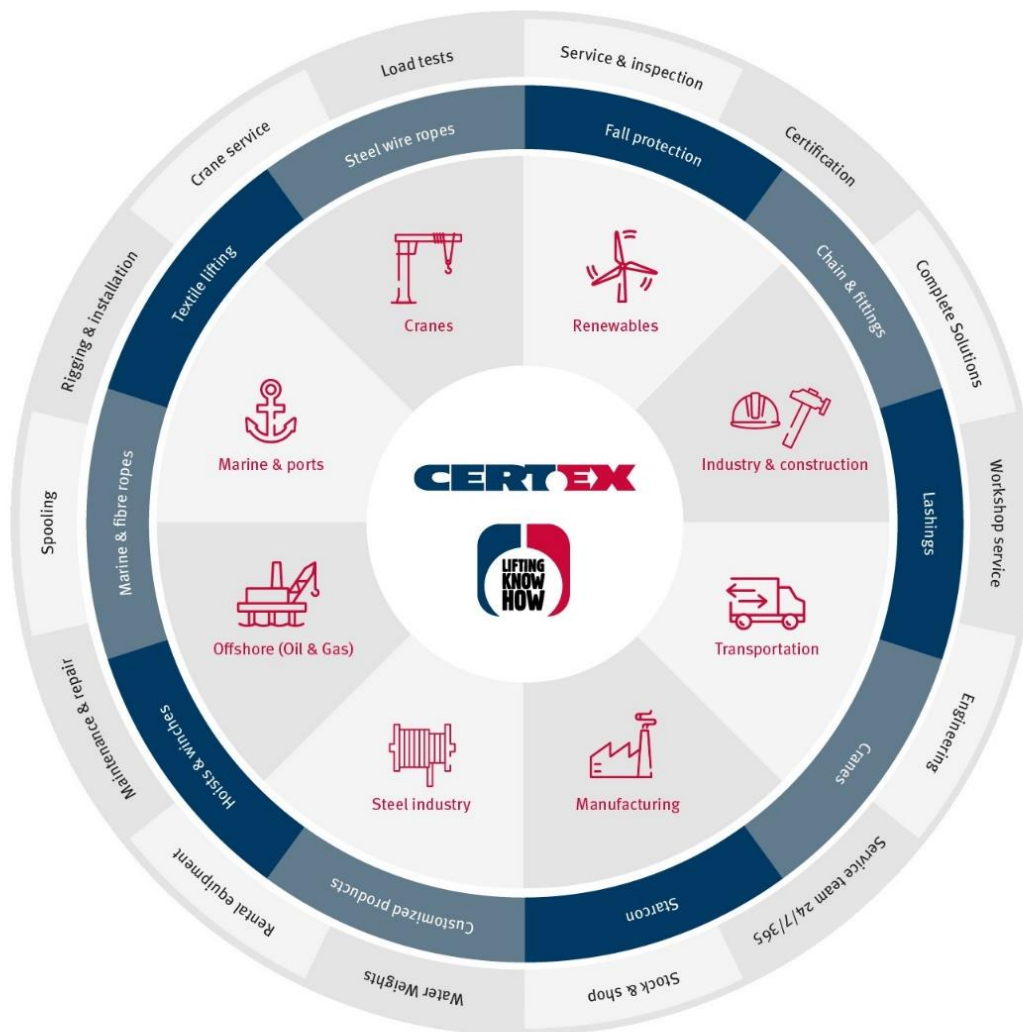
The following standards have been used:
EN 13155+A2 : 2009

Date:

For CERTEX Danmark A/S

Our industries, products & services

At CERTEX Denmark, we are a secure and reliable total supplier and partner within lifting equipment. Below is an overview of the industries we service, our product range, and the services we offer."



"

**Based on many years of experience
& know-how within lifting, load
tests & engineering, CERTEX
Denmark is your reliable partner &
supplier of steel wire, lifting
applications & related services."**



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