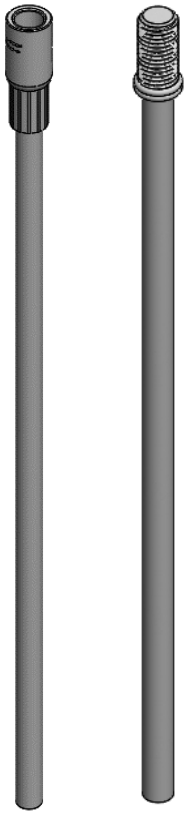
STARCON



STARCON

Rebar coupler system M16 to M42

Fixing insert systems for concrete elements

User and design manual

1 Nomenclature

Symbol	Description	Unit
$°C$	Temperature Celsius	$°C$
COG	Center of gravity	[-]
d_b	Diameter of bending roller	mm
d_s	Diameter of bar	mm
D_{thread}	Thread diameter of Rebar coupler	mm
L	Length of Rebar coupler	mm
L_{th}	Thread length of Rebar coupler	mm
L_{bmin}	Minimum bending length	mm
L_{bx}	Bending length	mm
S	Load group symbol (STARCON)	–
WLL	Working Load limit	$tons$

Table 1 Nomenclature

Starcon Precast Concrete Design & Lifting Manual

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	29-10-2024	New documentation

Table 2 Revision table

3 Introduction Rebar coupler system M16 to M42

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

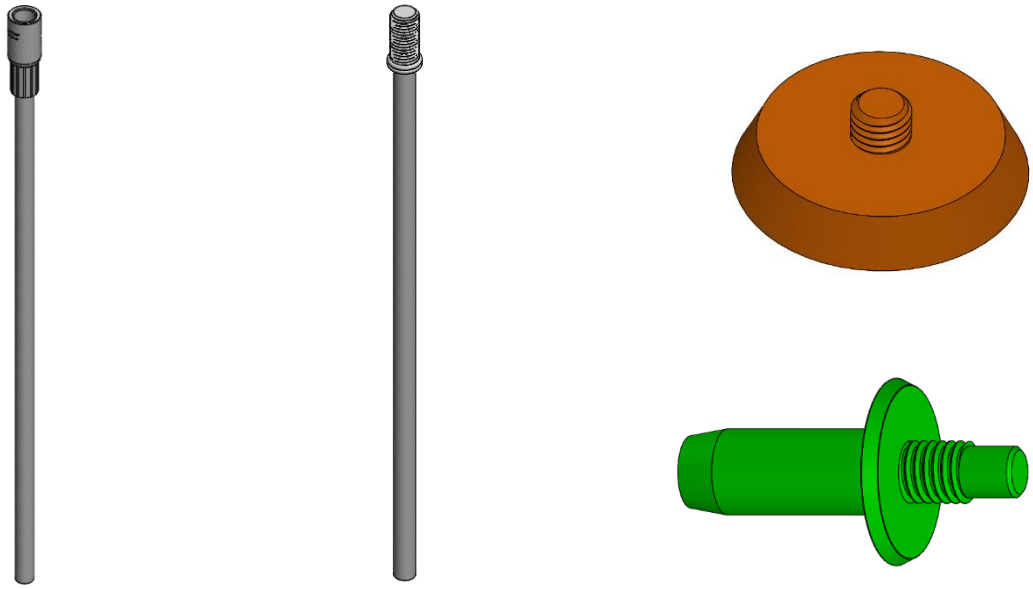
Safety is paramount when using lifting devices and equipment. Only trained individuals should operate them as per national law. Familiarize yourself with the instruction manual before use to ensure safe operation. Adhering to these guidelines reduces the risk of accidents. Consult relevant national regulations as they may supersede these instructions. All individuals involved with the equipment must read and understand this manual. Contact Certex for assistance or clarification. Always keep the manual with the product. Contact information is provided on the last page.

General concept of the use Rebar coupler:

The Rebar coupler consists of two key components: Female rebar coupler, Male rebar coupler and accessories such as Starcon nailing plate, connection holding plate, bolt shown on Figure 1.

To ensure proper placement of the Rebar coupler in the finished concrete product, Rebar couplers are always installed in concrete elements before casting. They can be positioned within the wall walls, columns, beams, future extensions, beam columns and secured to the formwork using nailing plates, magnetic plates, positioning nipples, breaking and seal caps. Once the concrete has reached a minimum strength of 15 MPa, the formwork and protective elements can be removed. The connection is considered load bearing only after the grout has attained a minimum strength of 25 MPa. Contact CERTEX DK for lower strength values.

Material: Steel.
Surface treatment: White zinc plated (WZP)



Female rebar coupler | Male rebar coupler | Accessories

Figure 1 Starcon fixing system.

4 Safety instructions before use 

- The Rebar coupler that are exposed to corrosion, or damaged must not be used.
- The Starcon Female rebar coupler can be used to connect reinforcing bars and also as a lifting socket.
- The Starcon fixing and handling system must not be used to fix more than the specified load.
- The Starcon fixing system must only be used by skilled, trained employees.
- 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 Rebar couplers. These Rebar couplers are used for the mechanical connection of reinforcing steel bars in concrete structures. The system is suitable for predominantly static loaded structures as well as for constructions that are subject to fatigue loading.

The Starcon system is available in groups M16 to M42. Typically embedded in concrete elements during the prefabrication stage, it is used to transfer forces safely between adjacent concrete elements. These systems are used in various applications such as shear walls, columns, beams, future extensions, and beam columns, offering low-cost, easy, and safe joint formation.

The system's efficiency has been proven through many years of successful use and numerous laboratory tests. Components are regularly tested during production and are clearly marked with the maximum load. The Rebar couplers are individually tested and come 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 fixing 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 includes a wide range of Rebar couplers grouped from M16 to M42, each Rebar coupler offers various lengths. The principle for using the system is the same for the entire range.

6.1 Rebar couplers

Rebar couplers are devices embedded in concrete elements during the prefabrication stage and used to transfer forces safely between adjacent concrete elements. Typically made of reinforcing steel bars, they come in various sizes to suit different applications. Rebar couplers undergo rigorous testing to ensure safety. Each Rebar couplers is marked with its article number, identification number, maximum working load, and a clear indication of a 3:1 safety factor. Additionally, a certificate is issued with every delivery for complete documentation.

7 Safety factors for Rebar coupler systems

For the calculations of the Rebar coupler system, the following safety factors shown Table 3 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 Rebar coupler	$SF_{Steel} = 3$
Concrete pull out failure	$SF_{concrete} = 2{,}5$

Table 3 Failure safety factors

8 General information

This section provides essential details on the Rebar coupler systems, offering clarity and guidance for safe and efficient usage.

8.1 Marking on the female rebar coupler

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

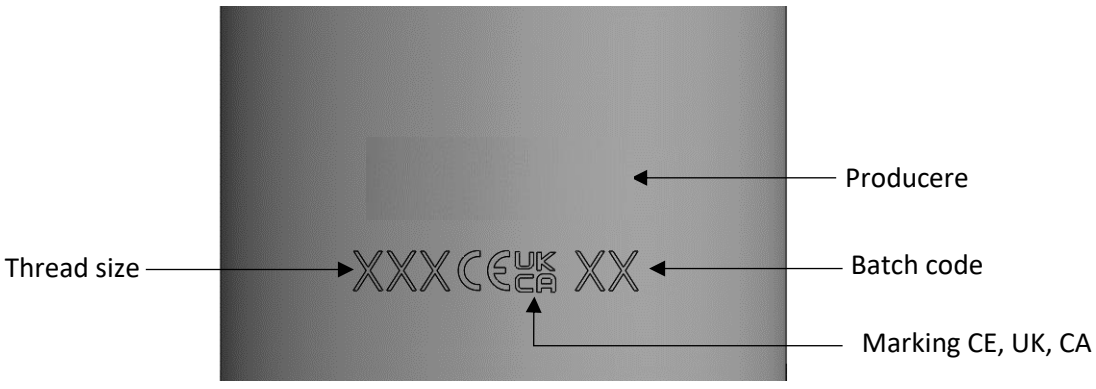


Figure 2 Marking on the cylinder of Female rebar coupler.

8.2 Guidelines for Rebar coupler selection

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

- Wall thickness of the precast element.
- The number of Rebar coupler.
- How the Rebar couplers are arranged.
- The load-bearing capacity of the Rebar coupler.
- Geometry of the joint
- Space in the casting recess.
- Environmental impact on the use.

8.3 Guidelines for installation

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

- Adherence to load-bearing capacity specifications of the Rebar coupler.
- 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 a Rebar coupler 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 Rebar coupler.
- The spacing between the Rebar coupler 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 provides essential information for the correct and safe selection and use of the Rebar coupler. To ensure the construction's durability and safety, it is crucial to carefully follow the manufacturer's technical specifications and guidelines during design and construction. Additionally, the casting process is discussed, including the transfer of load to the concrete, and the importance of correctly placing formwork and Rebar coupler 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 Correct placement Rebar coupler during casting.

The Rebar coupler system is designed to transfer forces safely between adjacent concrete elements embedding male or female Rebar couplers in concrete at separate times. Before concreting, the female rebar is securely fastened to the formwork with a nailing plate, connection holding plate, magnetic plate or bolt, depending on the type of formwork. Figure 3 illustrates assembly steps the Rebar coupler. Proper installation necessitates precise alignment of the rebar coupler with the subsequent reinforcing bars. Any misalignment can lead to inadequate concrete cover or improper bar spacing in the adjacent concrete element.

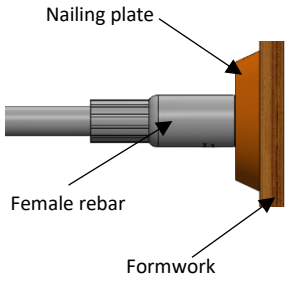
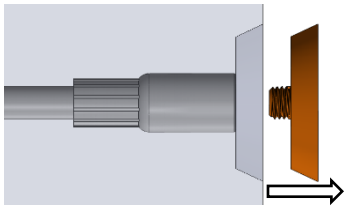
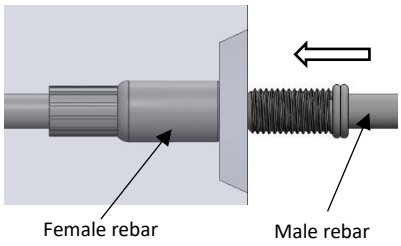
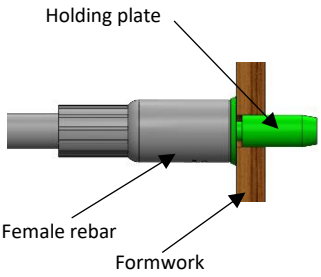
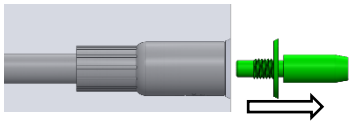
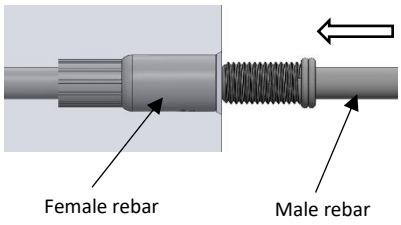
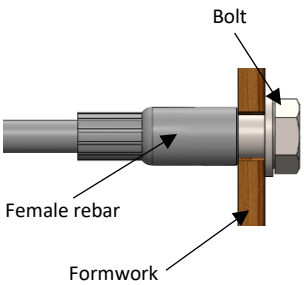
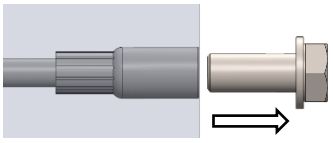
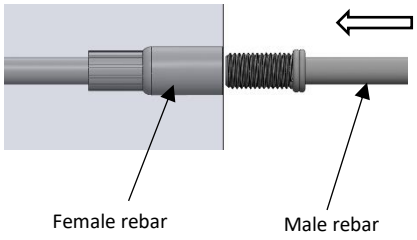
Accessories	Fixing Female rebar coupler to the formwork	To remove accessories	Connection male rebar coupler using a torque wrench
Plastic nailing plate			
Plastic holding plate			
Hexagonal bolt			

Figure 3 Assembly steps of Rebar coupler.

9.2 Quality of connection for Rebar coupler

The Female rebar coupler and Male rebar coupler must be stored so that they remain free of dirt to ensure both can be easily connected. For further protection against ingress of dirt and concrete sludge, we also advise greasing the inside of the sleeve.

Clean all threads properly. Visually check that the thread is not damaged. Hand-tighten the Male rebar coupler so it sits tightly in Female rebar coupler.

Male rebar coupler should be tightened using a torque wrench set to the correct torque value. Table 4 shows Torque values of the Rebar coupler

Bar diameter d_s mm	Ø 12	Ø 16	Ø 20	Ø 25	Ø 32
Torque Nm	100	100	160	250	400
Tigthening torque tolerances ± 5%					

Table 4 Torque values of the Rebar coupler.

9.3 Bending the Rebar coupler

The minimum bending radius for reinforcing bars shall comply with the relevant national standard for reinforced concrete. To avoid damage, the bending roller diameter shall not be less than 5 times the bar diameter d_{br} = 5 x d_s as shown in Figure 4.

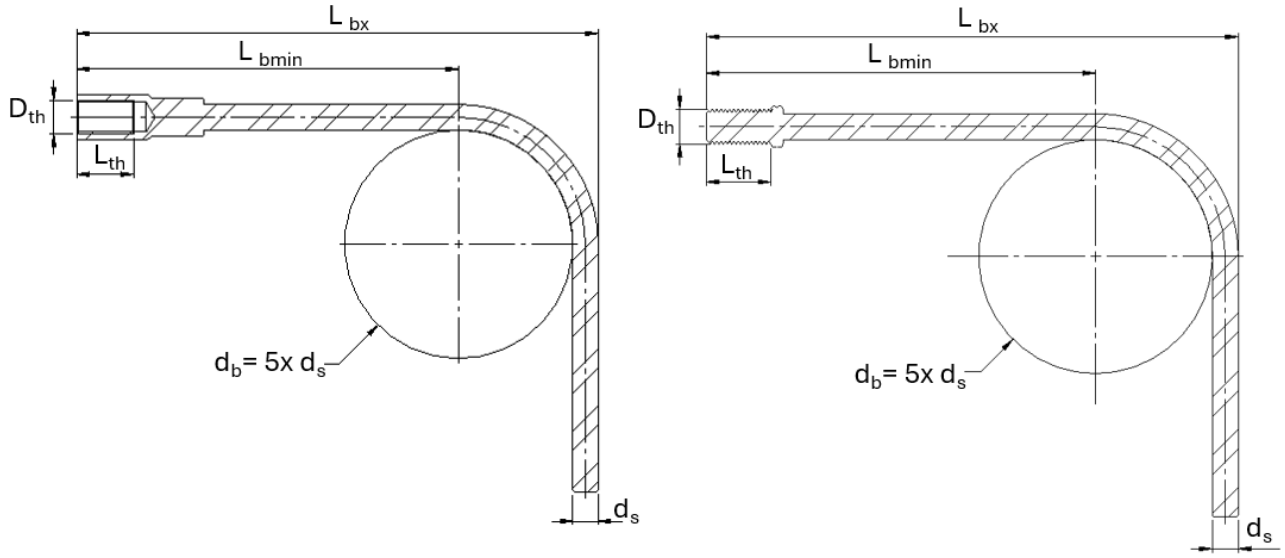


Figure 4 Bending role of Rebar coupler.

The dimensions of female and male rebar couplers are shown in Table 5 and Table 6.

Bar diameter d_s mm	**Thread D_{th} mm**	**Thread length L_{th} mm**	**Bending roller d_b mm**	**Bend length L_{bmin}/L_{bx} mm**
Ø 12	M16	27	60	100/140
Ø 16	M20	33	80	125/180
Ø 20	M24	38.5	100	140/210
Ø 25	M30	43	125	190/275
Ø 32	M42	65	160	210/325

Table 5 Dimension of the Female Rebar coupler.

Bar diameter d_S mm	Thread D_{th} mm	Thread length L_{th} mm	Bending roller d_b mm	Bend length L_{bmin}/L_{bx} mm
Ø 12	M16	30	60	85/130
Ø 16	M20	40	80	112/170
Ø 20	M24	46	100	137/210
Ø 25	M30	50	125	160/250
Ø 32	M42	70	160	210/325

Table 6 Dimension of the Male Rebar coupler.

10 Rebar coupler design load and ductility

Rebar coupler design loads are determined based on the tensile strength of the reinforcing bars. Furthermore, the minimum anchorage length for bars embedded in concrete shall be verified as per EN 1992-1-1, clause 8.4 "Anchorage of longitudinal reinforcement".

Table 7 Design loads and ductility – Rebar Couplers B500B according to EN 10080.

Diameter d_S (mm)	Area A_S (mm^2)	Design loads N_{Rd} [Ton]	Ductility	
			R_m/R_e	A_{gt} (%)
Ø 12	113	3,86	≥1.08	≥5%
Ø 16	201	6,87		
Ø 20	314	10,72		
Ø 25	491	16,75		
Ø 32	804	27,44		
Design loads $N_{Rd} = A_s \times f_{yd}$ ($f_{yd} = f_{yk}/1,15$) according to EN 1992-1-1.				

Table 7 Design loads and ductility.

11 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 accepts 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.

11.1 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.



11.2 Preparation of the product before use

11.2.1 Transport and Storage

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

11.2.2 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.

11.2.3 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.

11.2.4 Preparatory Work Before Installation

After unpacking, visually inspect the anchors for any damage.

11.2.5 Installation and Assembly

The anchors are delivered ready for use.

11.2.6 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.

11.2.7 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 lifting bar and all its functions and positioned to have a clear view of the entire lifting operation.

11.2.8 Placement of Instruction

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

12 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.

12.1 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 ready and clearly labeled.	X			X
Inspection should be carried out by a qualified individual with a report prepared.				X

Table 8 Maintenance schedule

13 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.

14 Product data of Female Rebar coupler

Figure 5 shows a measurement sketch for the Female Rebar coupler with labels for the respective dimensions.

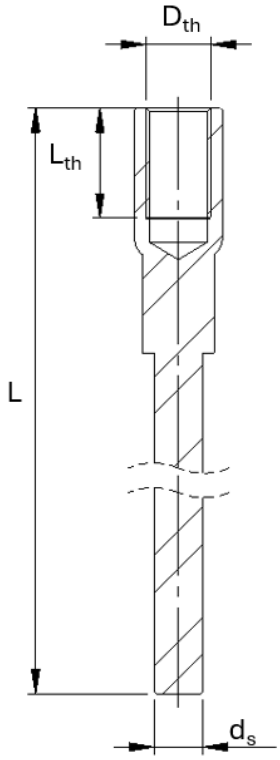


Figure 5 Female Rebar coupler.

14.1 Technical data

Table 9 shows the dimensions of the various types of Female Rebar coupler.

Length L mm	Bar diameter d_s mm	Thread D_{th} mm	Thread length L_{th} mm
450	Ø 12	M16	27
600	Ø 12	M16	27
550	Ø 16	M20	33
700	Ø 16	M20	33
850	Ø 16	M20	33
700	Ø 20	M24	38.5
1060	Ø 25	M30	43
1400	Ø 32	M42	65

Table 9 Female Rebar coupler dimension.

15 Product data of Male Rebar coupler

Figure 5 shows a measurement sketch for the Male Rebar coupler with labels for the respective dimensions.

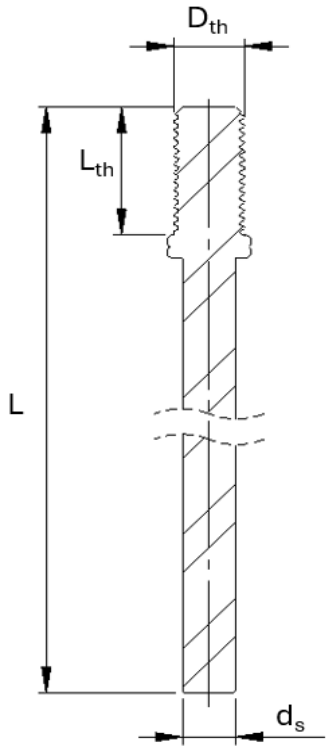


Figure 6 Male Rebar coupler.

15.1 Technical data

Table 10 shows the dimensions of the various types of Male Rebar coupler.

Length L mm	Bar diameter d_s mm	Thread D_{th} mm	Thread length L_{th} mm
575	Ø 12	M16	30
775	Ø 16	M20	40
975	Ø 20	M24	46
1000	Ø 25	M30	50
1400	Ø 32	M42	70

Table 10 Male Rebar coupler dimension.

16 Product data of connection holding plate for transport anchors

Figure 7 shows a measurement sketch for the Connection holding plate.

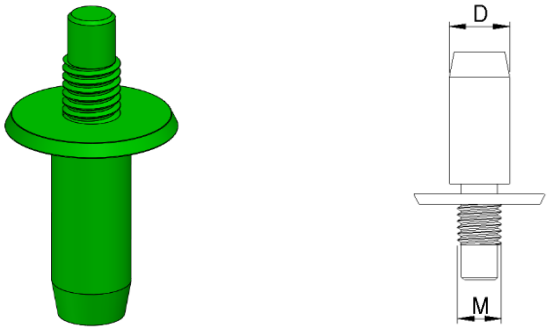


Figure 7 Connection holding plate for transport anchors.

16.1 Technical data

Table 11 shows the dimensions of the various types of the Connection holding plate used for casting of the transport anchors.

Connection holding plate Starcon Group	D mm
M8	11
M10	11
M12	11
M16	17

Table 11 Dimension of Connection holding plate for transport anchor.

17 Product data of nailing plates for transport anchors

Figure 8 shows a measurement sketch for the nailing plates.

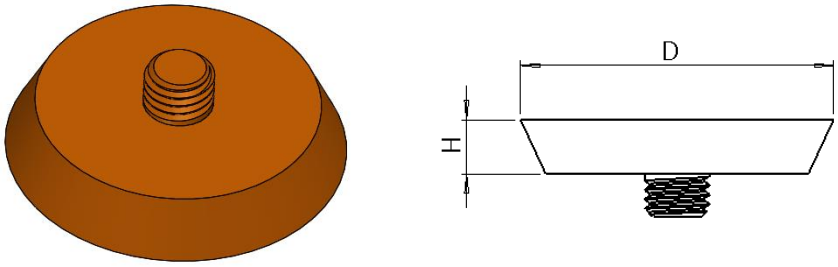


Figure 8 Nailing plates for transport anchors.

17.1 Technical data

Table 12 shows the dimensions of the various types of the nailing plate used for casting of the transport anchors.

Nailing plates Starcon Load group	D mm	H mm	Color
0.4S	58	10	Yellow
0.5S	58	10	Orange
1.2S	58	10	Red
2.0S	58	10	Light Green
2.5S	58	10	Black
4.0S	58	10	Dark Green

Table 12 Dimension of nailing plate for transport anchor.

18 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**
Address: **Trekanten 6-8**
6500 Vojens
Denmark
Tel. No.: **+45 74 54 14 37**
E-mail: **info@certex.dk**

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:	**Rebar coupler**
Drawing No.:	**XXXXXXXXXXXXX**
Serial No.:	**XXXXXX**
Lifting Capacity:	**WLL pr unit**
Own Weight:	**Kg pr unit**

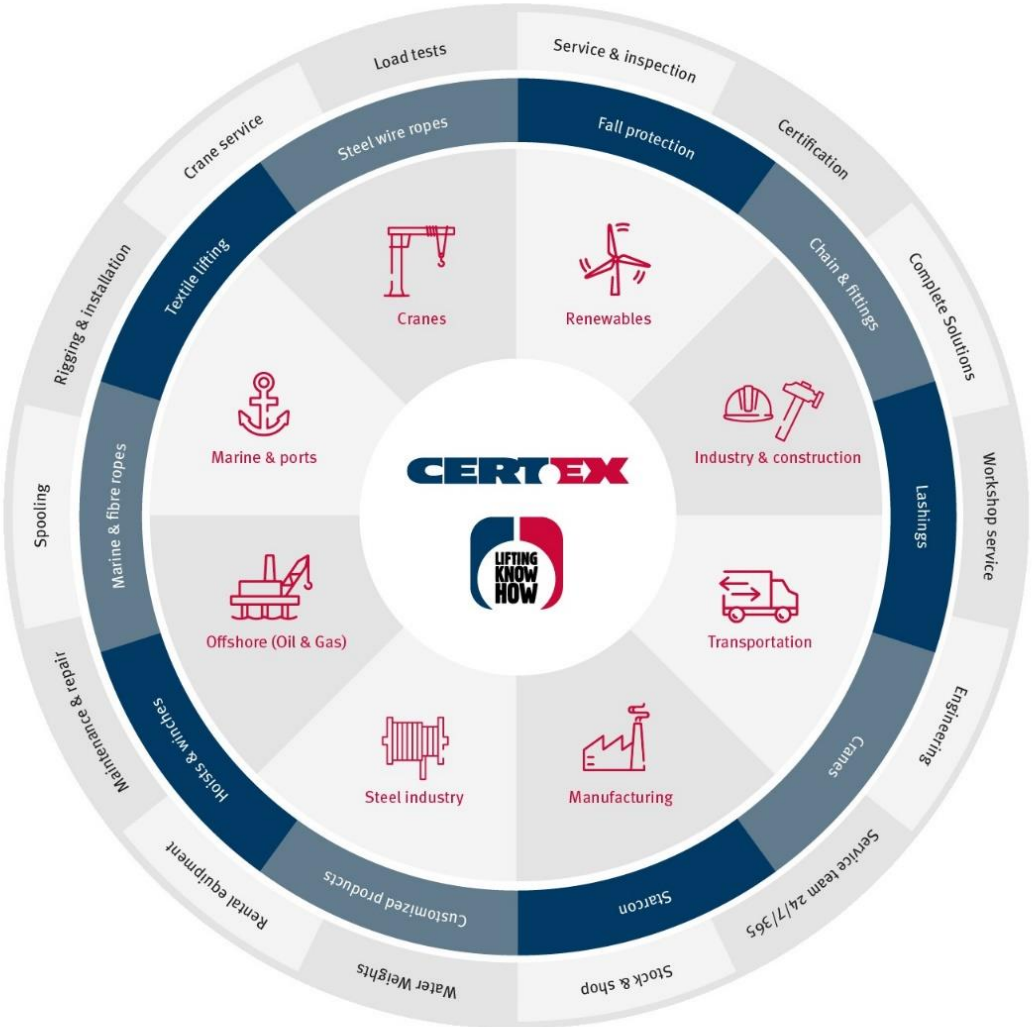
Is made in accordance with the following EC-directive;
2006/42/EC

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."



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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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Axel Johnson International

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