

ENERGY

TENSOREX C+ INSTALLATION INSTRUCTIONS 000 300 336



KEEP
Ready to hand

I	Introduction	4
II	General Information	5
III	Safety	7
IV	Delivery / Storage	10
V	Installation Accessories	11
VI	Technical Data	12
VII	Checking	13
VIII	Installation	17
IX	Commissioning	33
X	Maintenance and Control Procedure	36
XI	Uninstalling	39
XII	Further Information	44
XIII	Note	46

1 Introduction

TENSOREX C+ is an innovative spring automatic tensioning device that gives a constant pull force to the overhead contact lines of railways and tramways in order to compensate for the expansion and contraction caused by temperature changes during day and night through all seasons.

In comparison to the counterweight tensioning devices, it is very compact (overall dimensions) due to the use of spiral springs instead of weights.

TENSOREX C+ is mounted just in the overhead side, so it does not obstruct the pedestrian area.

TENSOREX C+, in railways applications, is a solution for train stations, tunnels, installation on portals, bridges and narrow places, or where there are safety needs.

In tramway applications, it is the complete solution and fully replaces the traditional counterweights. It gives advantages in handling and installing, shipping and storing, reducing overall costs.

TENSOREX C+ can be considered as a spring giving a constant force to the overhead contact line during all the variation of its length.

A spiral spring (or springs) and two pulleys with variable radii are assembled and acting on the same shaft.

The moment applied by spiral spring is equilibrated from the moment applied to the pulley by the contact line. Therefore, the pull force remains constant throughout the complete working travel.

2 General Information

2.1 Information regarding the installation instructions

These installation instructions describe the safe and proper use of the product described. The specified warnings and instructions, and the applicable local accident prevention regulations must be observed together with general safety regulations.

Before starting work on the product, read the installation instructions all the way through, particularly the chapter on safety and specific safety precautions. It is vital that what is read is understood. The installation instructions are a part of the product. It must be kept available and accessible in the immediate vicinity of the product (e.g. control room, switch room) at all times.

2.2 Contents of the installation instructions

Any person who is tasked to perform work on or with the product must have read and understood the installation instructions before commencing the work. This is the case even if the person has already worked with this or a similar product or has been trained by the manufacturer. Knowing the contents of the installation instructions is one of the requirements for the protection of personnel from hazards and the avoidance of mistakes, and to operate the product safely and in a trouble-free manner. The operator is recommended to ensure that staff can demonstrate that they have taken note of the contents of these installation instructions.

2.3 Additional installation instructions

Depending on the scope of delivery (e.g. special versions or additional options that may have been ordered), these instructions may be supplemented by additional installation instructions, which must be observed and applied in the same way.

2.4 Copyright protection

These installation instructions are to be treated confidentially. It is exclusively intended for persons employed to use the product. All contents, text, drawings, images and other representations are protected under the Copyright Act and are subject to other intellectual property rights. Any misuse is punishable under copyright law.

Any disclosure to third parties, including making copies of any type or in any form - even extracts - as well as the use and / or communication of the contents without written permission from the manufacturer is not allowed. Any infringements will lead to a claim for compensation. We reserve the right to assert further claims. We reserve the right to exercise our intellectual property rights.

2.5 Liability and warranty

All information and data contained in these installation instructions were compiled taking into account the applicable standards and regulations, along with state-of-the-art technology and long standing expertise and experience.

These installation instructions are to be kept in the immediate vicinity of the product (e.g. work train) and be accessible at all times to all persons who work on or with the product. These installation instructions are to be read carefully before starting work on and with the product! The manufacturer accepts no liability for any damage or malfunction resulting from non-compliance with these installation instructions.

The text and illustrations do not necessarily represent the scope of delivery. The illustrations are not to scale. Due to fact that special versions or additional options may have been ordered, or innovative technical modifications may have been made, the actual scope of delivery can differ in some circumstances from the information and instructions described here. Pictorial representations may also differ. If you have any questions, please contact the manufacturer. We reserve the right to make technical modifications within the framework of improving performance characteristics and further development.

2.6 Guarantee

The warranty provisions are contained in the purchase agreement and the manufacturer's general terms and conditions.

The manufacturer shall make the final decision with a warranty claim as to whether the product or defective parts should be returned or a site visit is made.

2.7 Spare parts

Use only original spare parts from the manufacturer.

Where unapproved replacement parts are used, all warranty, service, compensation and liability claims against the manufacturer or its agents, distributors and representatives are no longer valid.

Please contact MOSDORFER if you require any spare parts (e.g. upper fitting, rope with or without thread).

3 Safety

At the time of its development and manufacture, the product was built according to currently applicable, accepted rules of engineering and is safe to operate. However, the product can pose dangers if it is not used by professionally trained staff or is used in an improper or unintended manner.

3.1 Intended use



Any use beyond the intended use and/or any other use of the product is prohibited. Any claims against the manufacturer and/or his authorised representative for damage resulting from improper use of the product are excluded. The operator is solely liable for all damages resulting from improper use.

Operational reliability can only be maintained if the product is used as intended. It may only be installed when the ambient temperature complies with the local rules.

3.2 Changes and modifications to the product

To avoid hazards and to ensure optimum performance, neither changes, nor additions nor modifications may be made to the product that have not been expressly approved by the manufacturer.

3.3 Responsibility of the operator

TENSOREX C+ may only be used as an automatic tensioning device for railways overhead contact lines in reliable environmental conditions. The information given in these installation instructions must be followed in its entirety!

In addition to the safety precautions and instructions given in these installation instructions which are applicable to the area of use of the product, local accident prevention regulations and general safety must be observed and followed along with regulations for the protection of the environment.

The operator and personnel authorised by them are responsible for the trouble-free operation of the product and for clear definitions of the responsibilities for installation and repair of the product.

3.4 Risks that may arise from the use of the product

The product has been subjected to a risk analysis. The state-of-the-art design and configuration of the product based on this analysis correspond to the latest technological developments.

The product is operationally reliable in the industry when used for its intended purpose, however, a residual risk remains! Always remember, the product works alongside high voltage electrical currents.



Danger - electrical current!
Electrical energy can cause serious injuries. Damage to the insulation or individual components may result in the danger of death by electrical current.

Observe the following points before starting work on electrical systems:

- 1 Disconnect completely.
- 2 Secure against re-connection.
- 3 Verify absence of operating voltage.
- 4 Carry out earthing and short-circuiting.
- 5 Provide protection against adjacent live parts.

3.5 Safety in the workplace

Following the warnings and instructions given in these installation instructions can prevent personal injury and damage to property while working with and on the product. Failure to follow these instructions may result in danger to persons and damage to or destruction of the product.

Failure to follow the warnings and instructions given in these installation instructions, along with the applicable accident prevention and general safety regulations, shall void any liability or claims for damages against the manufacturer or their authorised representative.

3.6 Personnel requirements



Only personnel that are authorised and trained may operate the product. Staff will receive training and a certificate of training and certificate of attendance from the manufacturer if desired (please contact MOSDORFER).

Skilled personnel means those who, due to their technical training, knowledge, experience and understanding of the regulations that apply to the work assigned to them, can identify possible hazards. The responsibilities working on and with the product (installation, maintenance) must be clearly defined and adhered to, so that there is no lack of clarity as regards safety when it comes to the division of responsibilities.

Only persons may work on and with the product who can be expected to do their job reliably. Do not perform any activity that may affect the safety of persons, the environment or the product.

Persons who are under the influence of drugs, alcohol or medication that affects their reactions are not allowed to work on and with the product under any circumstances.

When selecting personnel, the age and profession-specific regulations in force at the location where the product is used must be observed.

The personnel are obliged to immediately report any changes that occur in the product that may affect the safety of the operator.

3.7 Personal protective equipment (PPE)

During work on and with the product, the following must always be worn:



Protective clothing, tight-fitting work clothing (low tear resistance, no long sleeves, no rings or other jewellery, etc.).



Safety shoes for protection against heavy falling objects and slipping on a non-slip-resistant surface.

For work in particularly hazardous areas (depending on local conditions):



Helmet for protection from falling and flying parts and materials.

When carrying out cleaning and lubricating work, the following are to be worn:



Gloves to protect the skin against contact with hazardous substances.



Safety glasses to protect the eyes.

3.8 Warnings



In these installation instructions, warnings are indicated by warning symbols.

4 Delivery / Storage

4.1 Scope of delivery

Check the package contents against the packing list (see chapter 7.2 on page 14) to ensure they are complete. If anything is missing, contact the manufacturer immediately. Reference is made to the terms and conditions of purchase and delivery.

After the product has been delivered, immediately report any damage due to faulty packaging or transport to the carrier, the insurer and the supplying factory. Steps must be taken to minimize the incurred damage and to prevent further damage.

4.2 Packaging

The predominant packaging materials are wood and materials derived from wood and plastic (PE). If no agreement to the contrary has been made regarding the return of the packaging material, the packaging material remains with the customer.

Disposal must be environmentally sound and in accordance with the relevant waste disposal regulations. If necessary, hire a waste management company to dispose of the packaging material.

4.3 Storage



**After delivery, the packages must be stored until installation. During transport and storage, the product must not be unpacked!
Do not stack more than 3 crates on top of each other!
Observe symbols on the crate.**

The storage time is generally limited to 2 years under the following conditions:

- Store covered in dry place (preferable indoor). Maximum relative humidity not higher than 85 %. In addition, ensure that the floor of the storage area is dry.
- Storage temperature -10 °C to +40 °C. Store in dust-free conditions. Avoid mechanical shock and damage.
- Storage time could be extended. After 2 years remove the protective bag, then pack again the device in the crate.

4.4 Disposal

If no return or disposal agreement has been made, disassembled components should be disposed of as below:

- Scrap the metallic materials.
- Send plastic elements to plastic recycling.
- Sort and dispose of remaining components according to material type.



Lubricants and other additives are subject to special waste treatment and may only be disposed of by authorised companies!

5 Installation Accessories

5.1 Required tools

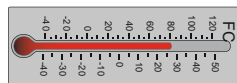


It is not possible to install TENSOREX C+ without the following tools. The tools are not included in the scope of delivery.

- Water level (min. 500 mm long)



- Thermometer or access to local weather forecast



- Ratchet lever hoist in correct size (2 units)



- Come along clamp in correct size (2-4 units, available from MOSDORFER)



- Lifting strap (2 units)



- Pliers



- Screwdriver



- Open end wrench
 - 2 pieces in size 21 mm
 - 2 pieces in size 27 mm
 - 1 piece of sizes 13, 24, 30 mm



5.2 Optional tools

- Dynamometer



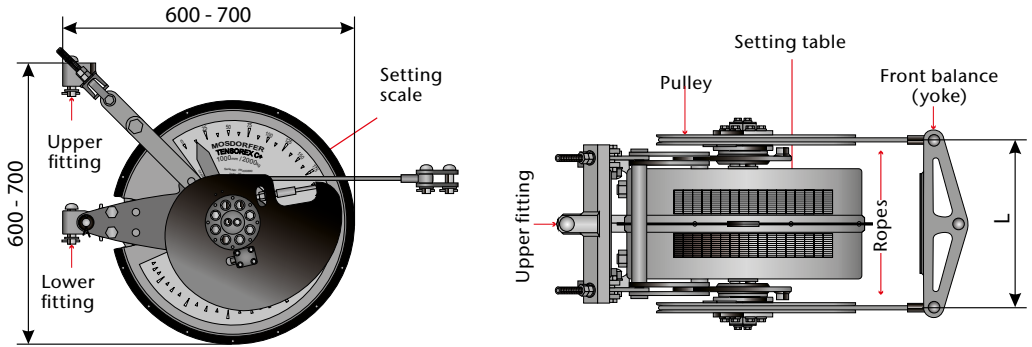
- Eyebolt, stronger, with red ring for lifting during horizontal installation of TENSOREX C+ only
 - market 0.8 t, M8 for 1 or 2 or 3 or 4 springs model
 - market 6 t, M20 for 5 springs model



- Shackle, min. WLL 0,5 t



6 Technical Data



TENSOREX C+ consists of eight product groups having different number and types of springs.

Size	Springs	Drawing	Range of compensation capacity [mm]	Range of pull value [kg]	Weight [kg]	L [mm]
TRC+ 1	11.4 x 120	000700711	450 to 250	750 to 1350	80	270
TRC+ 1	9.5 x 60	000700696	800 to 450	450 to 800	90	270
TRC+ 2	9.5 x 60	000700697	1000 to 400	500 to 1800	120	270
TRC+ 3	9.5 x 60	000700698	1100 to 450	850 to 2400	150	340
TRC+ 4	9.5 x 60	000700699	1100 to 450	1350 to 3000	180	410
TRC+ 4S	11 x 60	000700695	1100 to 675	1500 to 2800	235	410
TRC+ 5S	11 x 60	000700694	1100 to 550	2000 to 4000	290	482
TRC+ 5SL	11 x 60 XL	000700693	1100 to 650	2400 to 4000	350	482

*) Please note, that not all combinations of pull value and compensation capacity are possible due to technical limitations.

For more details, please contact your local MOSDORFER office or search in our online-catalogue for available variants: <https://www.mosdorfer.com/en/produkte/railway/>



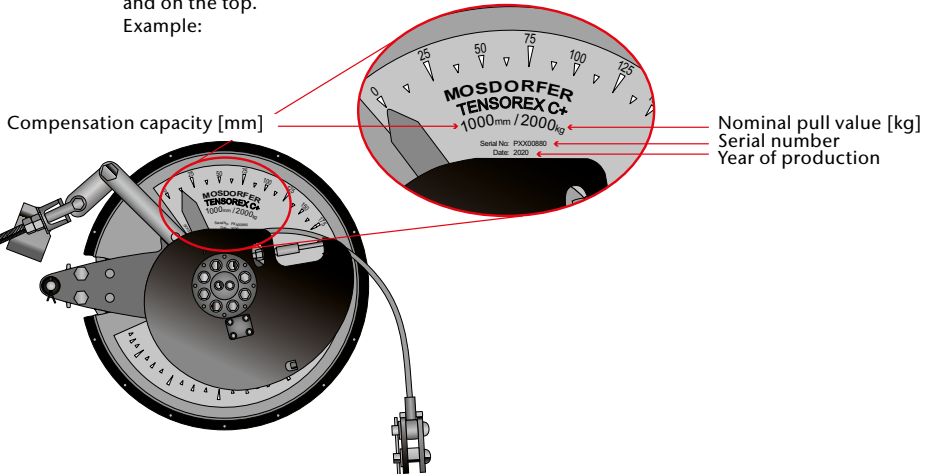
Each TENSOREX C+ has a fixed combination of compensation capacity and pull value. Each of them is identified by article number and variant code.

Minimum breaking load:	≤ 65 kN with rope Ø 8 mm or ≤ 80 kN with rope Ø 8,75 mm
Standard corrosion protection:	H.D.G.EN 1461 (2009)
IP protection:	IP20 EN ISO/IEC 17025:2005 and CEI EN 60529:1997 + A1:2000
Corrosion protection test:	1000 hours salt spray EN ISO 9227 (2006)
Standard pull tolerance:	+6% to -4%
Service temperature:	-40°C to +70°C (-40°F to +158°F).
Standard cover colour:	RAL 7040
Storage:	2 years -10°C to +40°C in dry place and dust-free conditions (preferable indoor) Relative humidity 85%. Max 3 crates on top of each other – observe symbols on the crate.

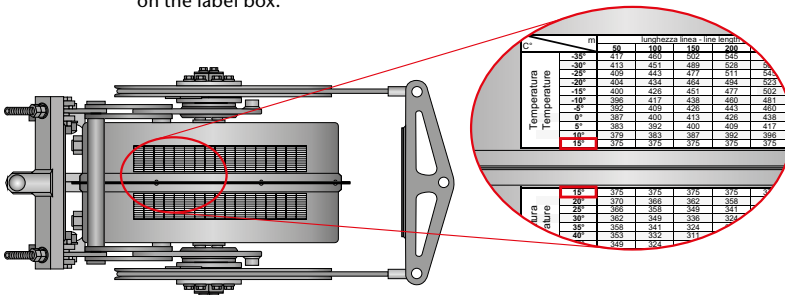
7 Checking

7.1 Relevant parameters and backside

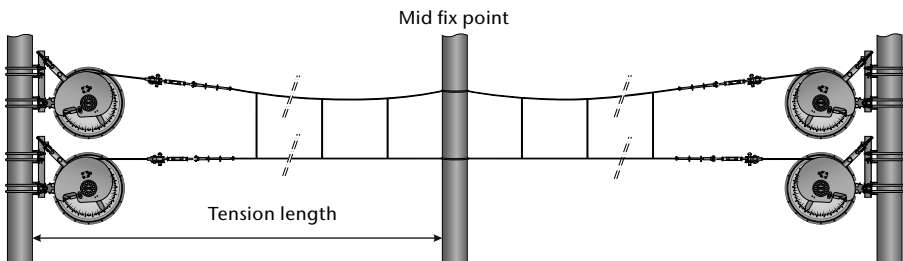
- 1 Check the correctness of the TENSOREX C+ model, whether compensation capacity, pull value, and medium temperature are correct. You find the relevant parameters marked at the side and on the top. Example:



- 2 Medium temperature is marked two times on the setting table (in this example, it is 15°C). It must match the product description on the label box.



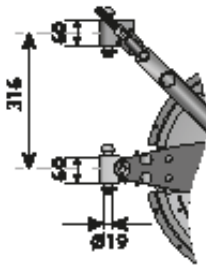
- 3 Make sure you know the tension length (the distance between TENSOREX C+ and mid fix point).



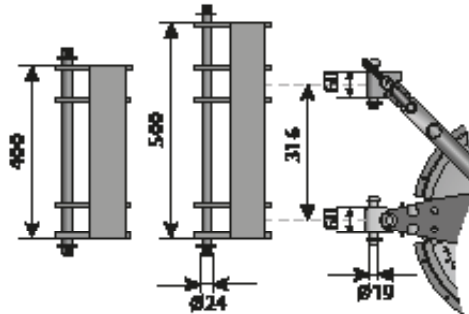
- 4 Check whether fixing brackets are compatible with the pole.

There are two different families of fixing brackets (Type A and Type B) for a wide range of poles and structures. According to that, an adapter needs to be mounted. See drawings below.

Backside TENSOREX C+ Type A
Standard configuration

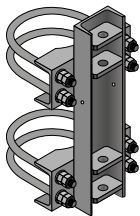


Backside TENSOREX C+ with adapter Type B
The adapter has to be ordered separately.
(The result is like former Type B.)

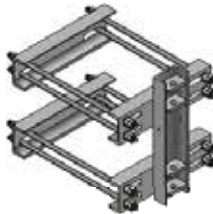


Fixing Brackets Type A

For round poles

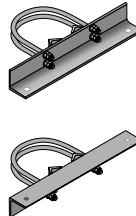


For square poles or to H

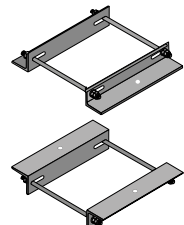


Fixing Brackets Type B

For round poles



For square poles or to H



7.2 Packing list

The package must contain the following:

- This installation instruction
- TENSOREX C+
- Plastic bag that contains:
 - Installation instructions
 - 2 steel pins
 - 2 washers
 - 2 split pins
 - 1 steel pin, 1 washer, 1 split pin for center balance



Optional:

- Fixing bracket if it was ordered from MOSDORFER.
- Type B adapter if it was ordered from MOSDORFER.

7.3 Check sheet

Warranty claims can only be granted if this check sheet is returned within 4 weeks after installation.

Address for reconsignment:

MOSDORFER RAIL s.r.l.
Product Management TENSOREX C+

Customer/Contractor: _____

End user: _____

inforail.IT@mosdorfer.com

Country: _____

Project name: _____

Installation area: _____

System type:	Railways	<input type="checkbox"/> Lines
		<input type="checkbox"/> High speed lines (HSL)
	Urban mass transportation	<input type="checkbox"/> Light train
		<input type="checkbox"/> Tramways
		<input type="checkbox"/> Underground

TENSOREX C+ model:
(see chapter 7.1 on page 13: ex. TRC+ 1000 mm/2000 Kg)

Serial number: _____

Year of production: _____

Notes:

_____	_____	_____	_____
Name	Company	Date	Signature



8 Installation

For standard installation go on with chapter 8.1.

For horizontal installation go to chapter 8.2, page 23.

For installation of the obsolete back interface Type B see chapter 12.1, page 44.

8.1 Standard installation

8.1.1 Fixing brackets onto the pole

Type A

- 1 Mount the fixing brackets to the pole, orientated in the direction of the overhead contact line, at the height prescribed by the design team. Use the approximate center of the fixing brackets as positional reference point.



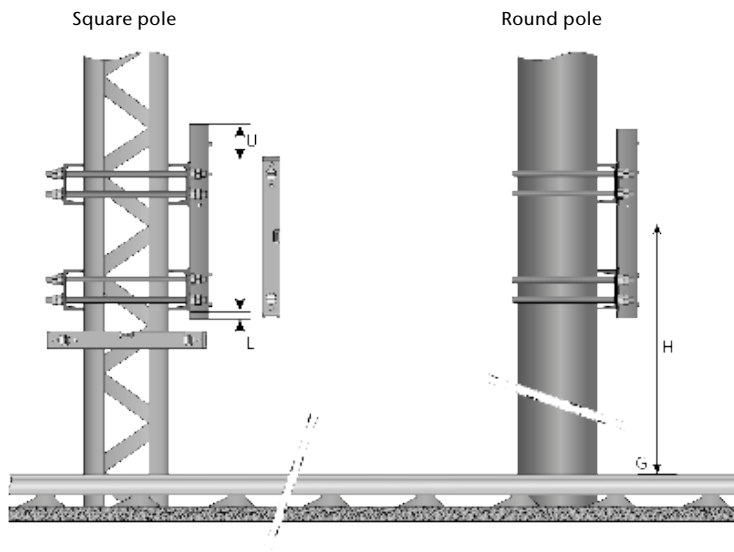
Fixing brackets Type A have an upper part (U) and a lower part (L). Make sure that fixing bracket is mounted accordingly, with the **upper part** (long side) **to the top**.

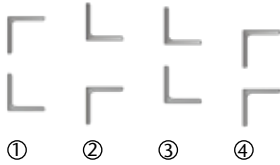


Use a water level to align the fixing bracket vertically and horizontally.

G = Top of the rail

H = Height of pull force applied from TENSOREX C+



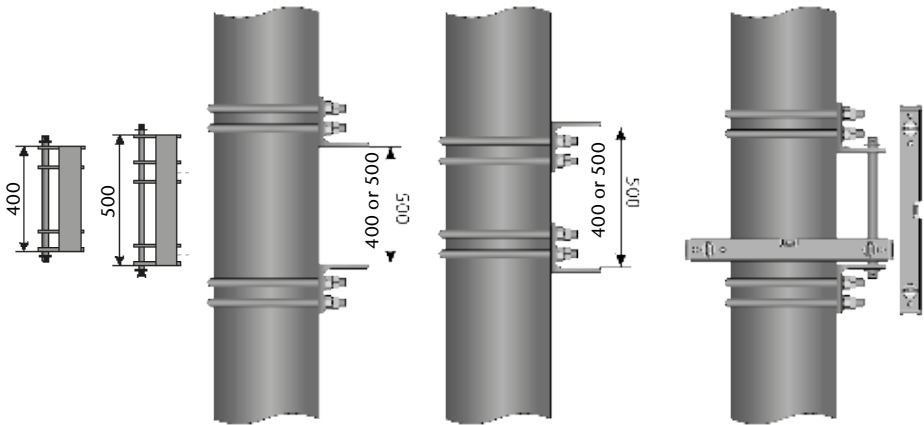


Sequence of preferable solutions in according of pole configuration

Type B

- Mount both L profile brackets with a distance of 400 or 500 mm between the upper and lower L profiles, according to the adapter's height (tolerance: $-0/+5$ mm). The two holes $\varnothing 26$ must be vertically aligned.

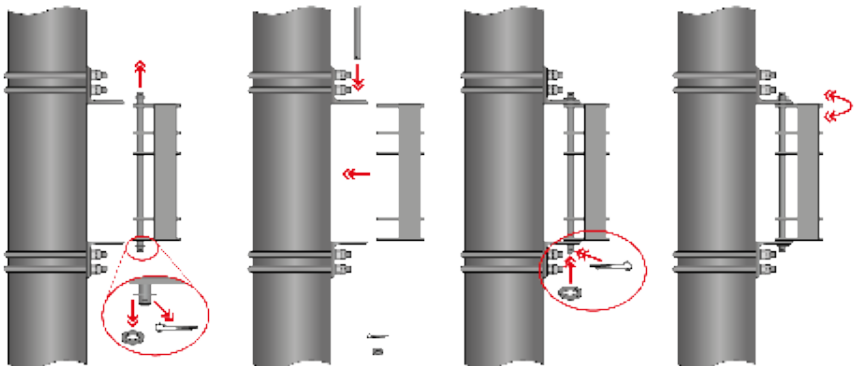
It can be helpful to insert the $\varnothing 24$ rod, taken from the adapter kit, and control the vertical and horizontal orientation with water level.



- Mount the adapter, and lock it using the rod with washer and split pin.



Control that the adapter is free to rotate.

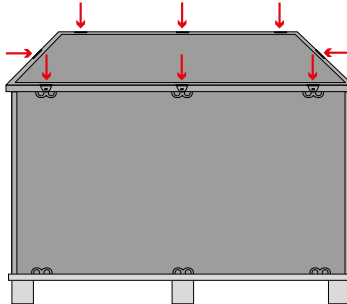


8.1.2 Lifting TENSOREX C+ out of the crate



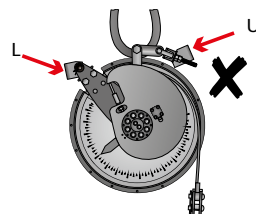
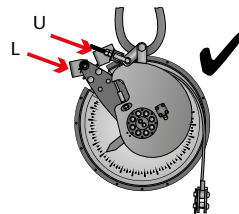
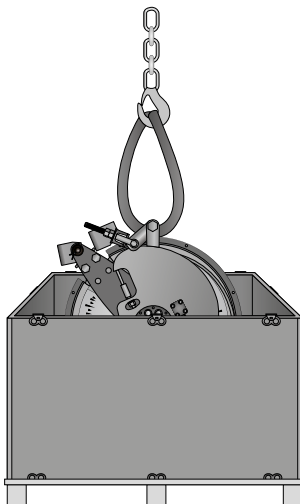
Transport TENSOREX C+ on site in the crate.

- 1 Position the crate at the bottom of the structure where TENSOREX C+ has to be installed.
- 2 Open the crate by bending up the 8 tabs using a screwdriver.



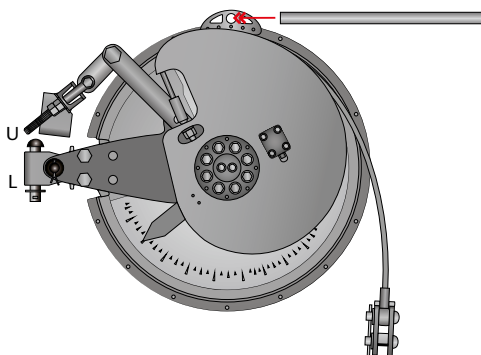
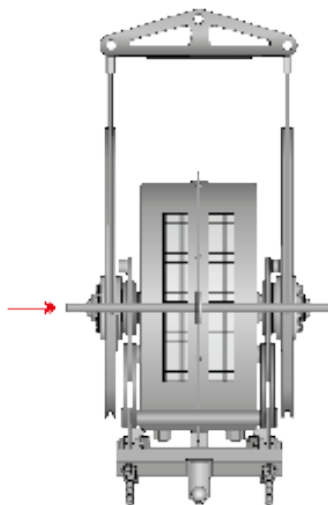
There are two ways to lift a TENSOREX C+, shown in the following sections.

- 3 Hang TENSOREX C+ as shown in the drawing below and lift by crane or hoist out of the crate. Upper and lower fittings must be on the same side with respect to the lifting strap.



Some models have a lifting eye

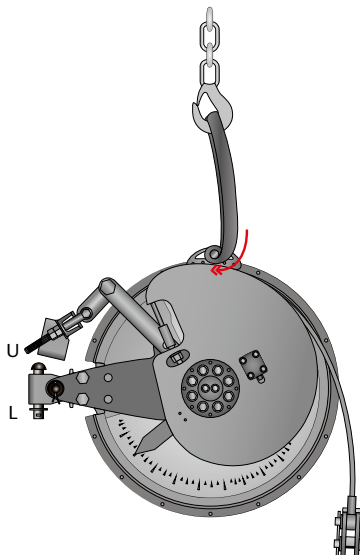
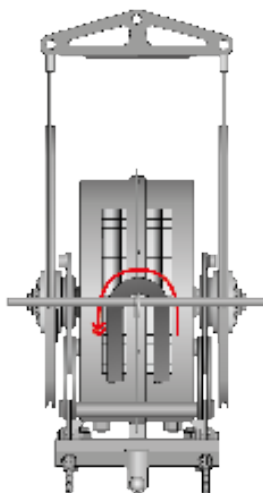
- Put a steel rod with a diameter of min. 12 mm, max. 18 mm through the lifting eye.



- Wrap a lifting strap around the steel rod and lift up TENSOREX C+ by crane or hoist out of the crate.

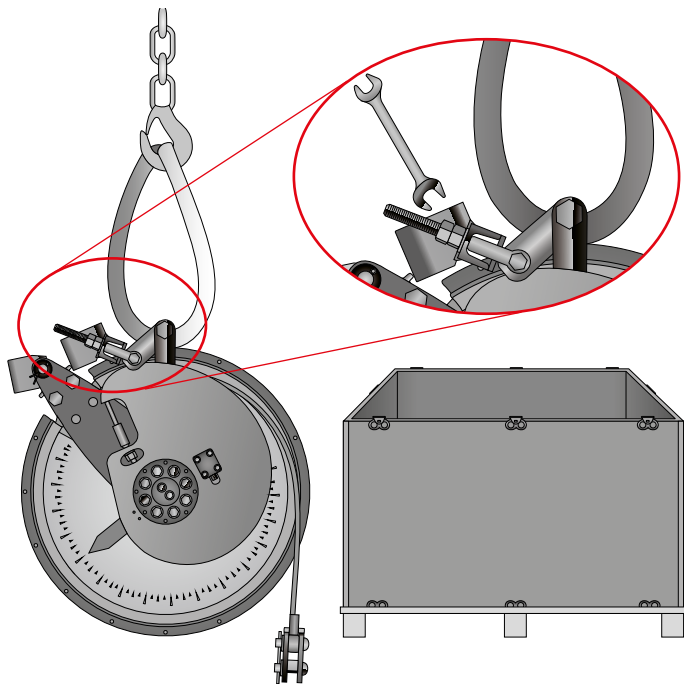


Only use the lifting eye during installation of TENSOREX C+.

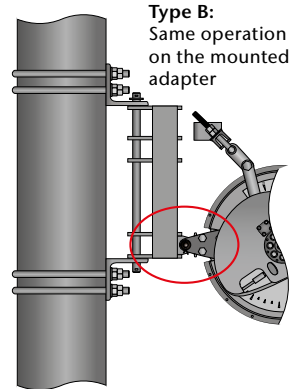
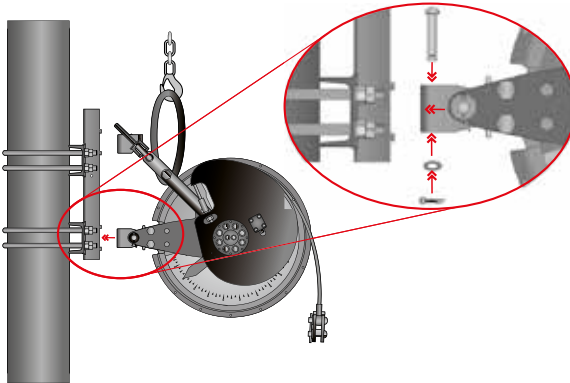


8.1.3 Installation of TENSOREX C+ on the fixing bracket

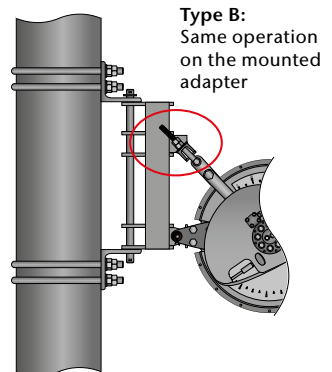
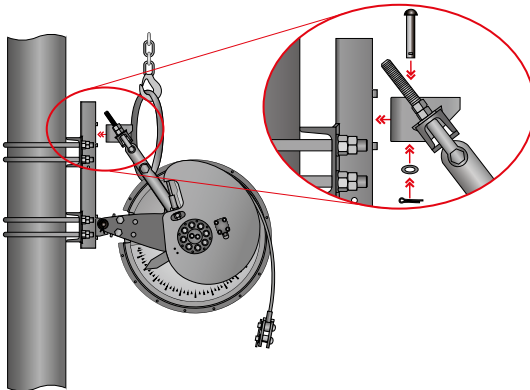
- 1 Tighten the double nuts **on both sides** up to the end of the threaded rod, when TENSOREX C+ is still at ground level.



- 2 Fit the **lower fitting (L)** of TENSOREX C+ in the fixing bracket and secure using the $\varnothing 19$ pin and corresponding washer and split pin supplied in the installation kits.



- 3 Fit the **upper fitting (U)** of TENSOREX C+ in the fixing bracket and secure using the $\varnothing 19$ pin and corresponding washer and split pin supplied in the installation kits.



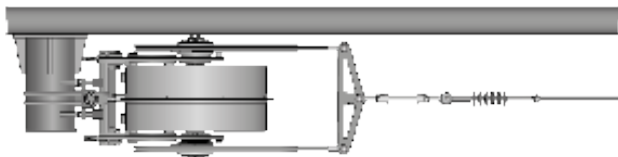
TENSOREX C+ must be easily rotatable laterally.

- 4 Remove the crane or the hoist tackle from TENSOREX C+.
- 5 Go to chapter 8.3, page 27, for further steps which are the same for standard and horizontal installation of TENSOREX C+.

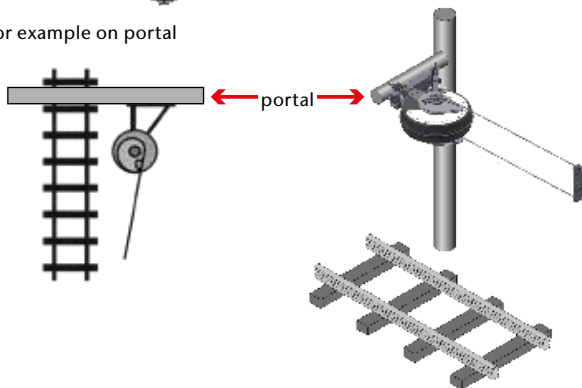
8.2 Horizontal installation

It is possible to install TENSOREX C+ horizontally (turned by 90°).

For example in tunnel



For example on portal



8.2.1 Fixing onto a sample type of horizontal bracket

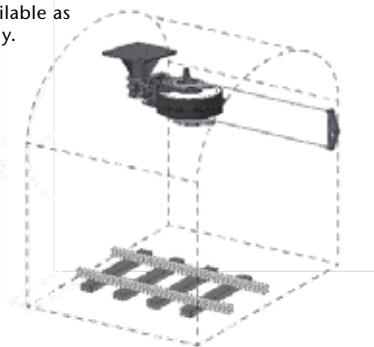
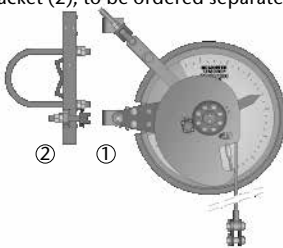
For a horizontal installation on a pole, TENSOREX C+ is available as Type A (1) plus a special bracket (2), to be ordered separately.

Examples:

000700646-01

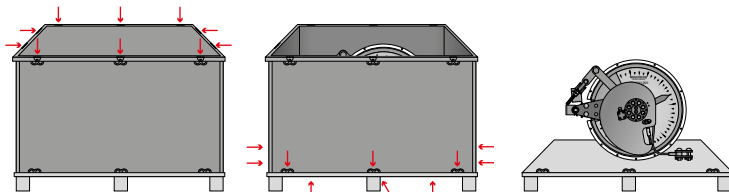
000700646-19 3-spring

000700646-22 5-spring



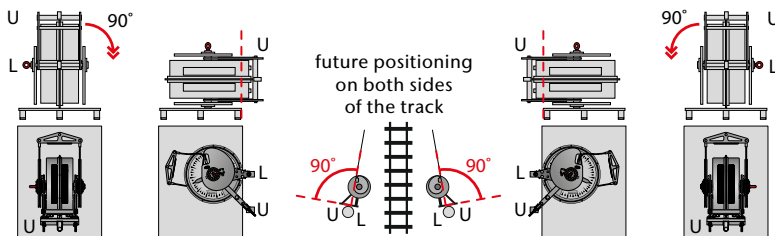
8.2.2 Preparation of TENSOREX C+ out of the crate

- 1 Open the case and remove the cushions higher packing. Unhook the lower 10 tabs and remove the strip of wood from the packaging.



- 2 TENSOREX C+ stands vertical in the box. Lay it on its side carefully using lifting straps. Determine the correct side to be turned with respect to the way it has to be installed, referring to the sketch below.

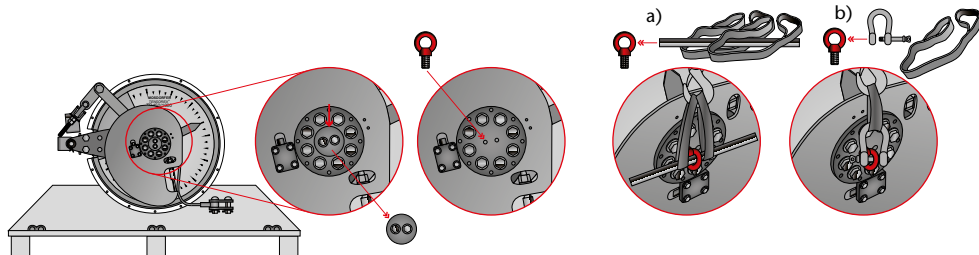
For lifting-turning a separate, additional eyebolt is required (see page 11). Size M8 (0.8 t) for 1-2-3-4 springs models and M20 (6 t) for 5 springs models.



To mount the eyebolt, remove the cap out of the center of the pulley and then screw the eyebolt there.

Either:

- a) Use rod and straps for lifting-turning. The rod must be and always stay horizontal, and the rod must not slide throughout the eyebolt.
- b) Use a shackle in the eyebolt and the strap in the shackle.



Using a crane or hoist to lift TENSOREX C+ a little until it turns on. TENSOREX C+ backside should stay out of the pallet, see sketch above.



At the end of the lifting-turning remove the eyebolt and refit the cap into the center of the pulley.

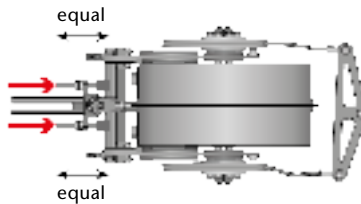
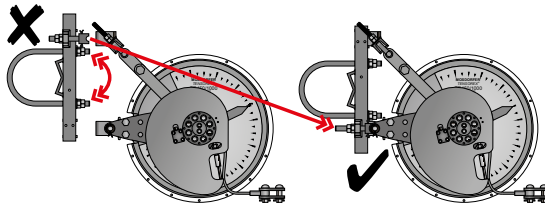
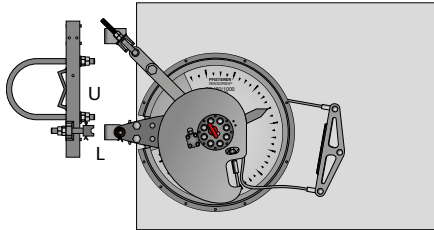
When installation is in tunnels, pallet together with TENSOREX C+ could be placed on the work train.

For installations on portals or outside tunnels, eyebolt could be used for lifting TENSOREX C+ at height.

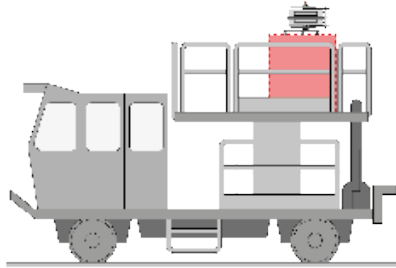


After this, remove the eyebolt and refit the cup in the center of the pulley.

- 3 After TENSOREX C+ has been turned-down on the correct side, proceed to mount the horizontal fixing bracket.

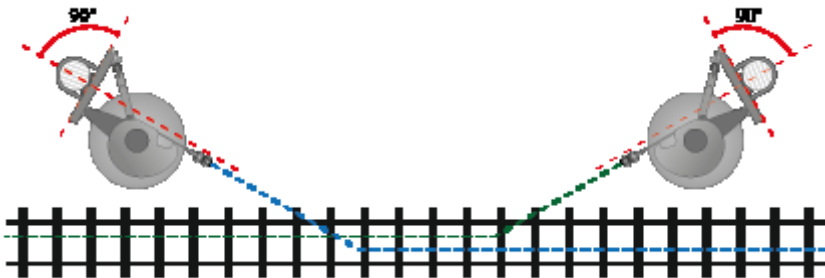
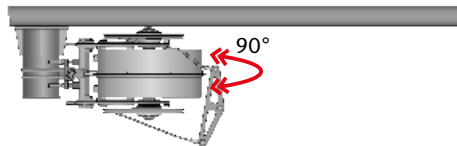


- 4 **Lifting (onto the worktrain):** lift TENSOREX C+ together with the pallet and place it on a raised block, located on the worktrain to facilitate installation.



8.2.3 Installation of TENSOREX C+ on operation site

- 5 Secure the horizontal bracket to the fixing structure, approximately perpendicular in the direction of the shot or the conductors, and the specified height from the top of the rail (G).

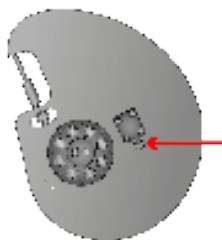


8.3 Further steps for installation

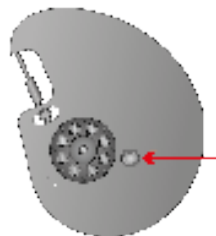
8.3.1 Pulley and end stops

End stops serve as working travel limitation and insure that springs are never overloaded. There by the functionality of TENSOREX C+ is ensured in case of anomalous overhead contact line contraction (e.g. very low temperature) or when the device is out of setting.

Pulley version 1: flip



Pulley version 2: bolt

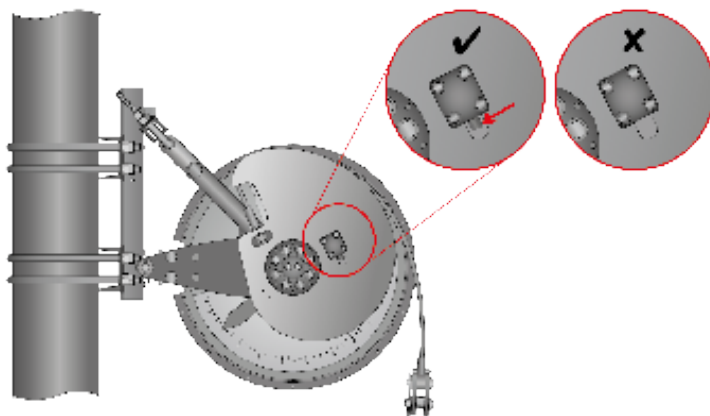


Only pulley version 1: flip

- 1 Make sure that the end stops are **not engaged**.

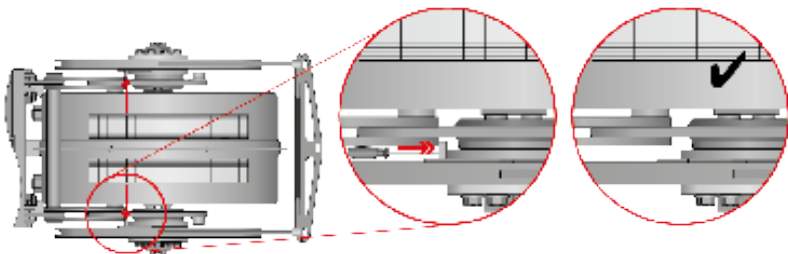


During installation and commissioning the end stops must not be engaged!





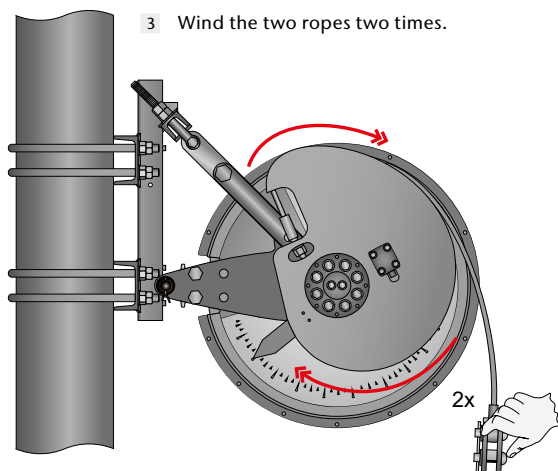
If end stops are engaged, disengage them on both pulleys by pushing the end stops outwards using a screwdriver.



- 2 Make sure that the each rope lay exactly in its groove.

Only pulley version 1: flip

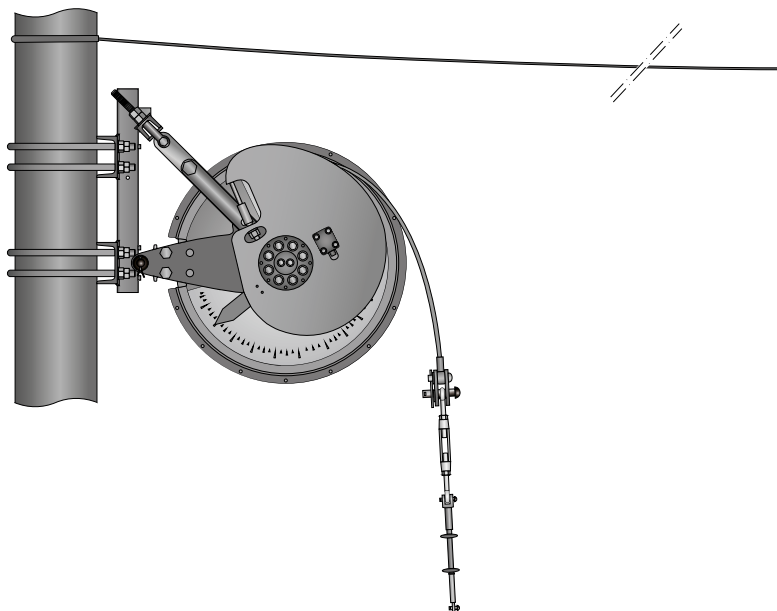
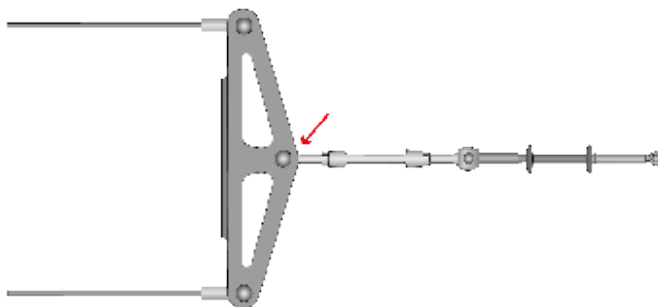
- 3 Wind the two ropes two times.



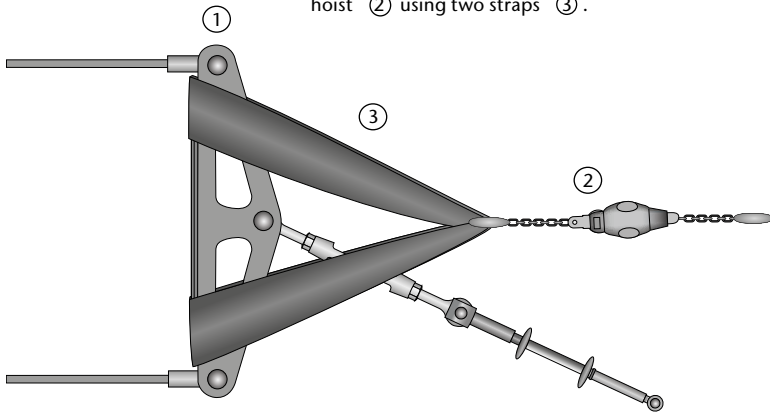
8.3.2 Connecting overhead contact line to TENSOREX C+

- 1 Attach all needed hardware (insulators, turnbuckles etc.) to the front balance (yoke), so that the subsequent anchoring of the overhead contact line to TENSOREX C+ can be facilitated. Use steel pin, washer and split pin.

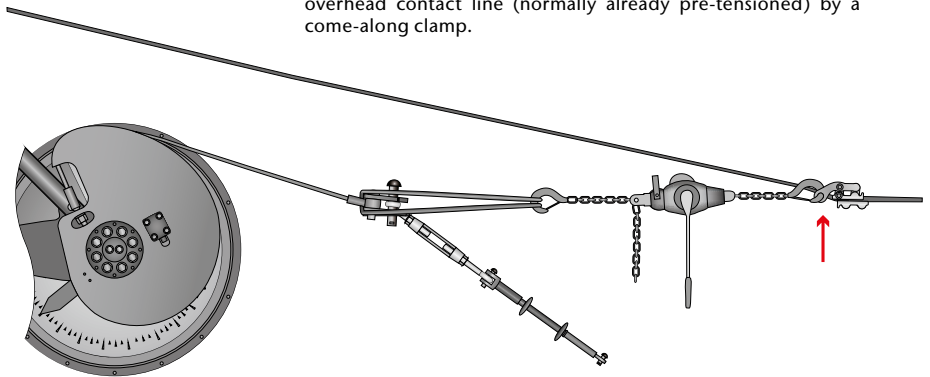
It is recommended to mount a compensating element between TENSOREX C+ and overhead contact line (e.g. a turnbuckle).



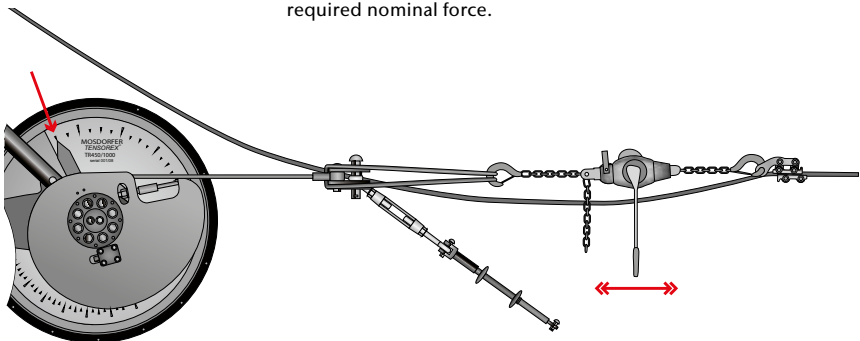
- 2 Connect the front balance (yoke) ① with the ratchet lever hoist ② using two straps ③.



- 3 Connect the other side of the ratchet lever hoist with the overhead contact line (normally already pre-tensioned) by a come-along clamp.



- 4 Tension the connection by ratchet lever hoist until the pointer is on the 0-point on the scale. Now TENSOREX C+ is exerting the required nominal force.



8.3.3 Adjustment of TENSOREX C+ inclination

Mostly for railway applications

Check that the terminal fork nuts are completely screwed at both sides of the terminal.

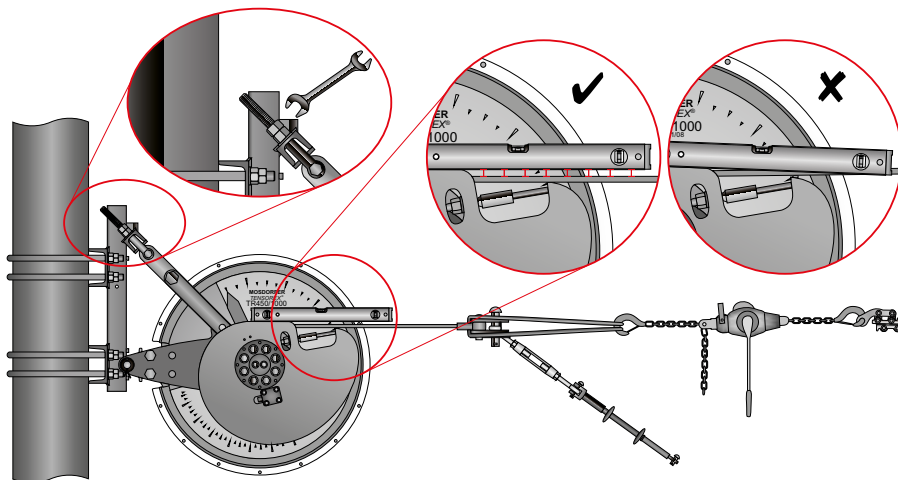
Mostly for tramway applications

For different environments, such as tramways in cities, the overhead contact line might have an important slope or a slant due to urban reasons. In such cases, TENSOREX C+ needs to be adjusted accordingly.

For horizontal installation

Adjustment is similar as with vertical installation.

- 1 Lay a water level or a flat steel rod (approx. 500 mm long) on the **flat top edge of the pulley** to check they are parallel to the ropes.
- 2 Adjust the double nuts on both the sides using an open-ended wrench of the corresponding size until the **top edge of the pulley is parallel to the ropes**.
Check if both threaded bars are protruding out in equal lengths.

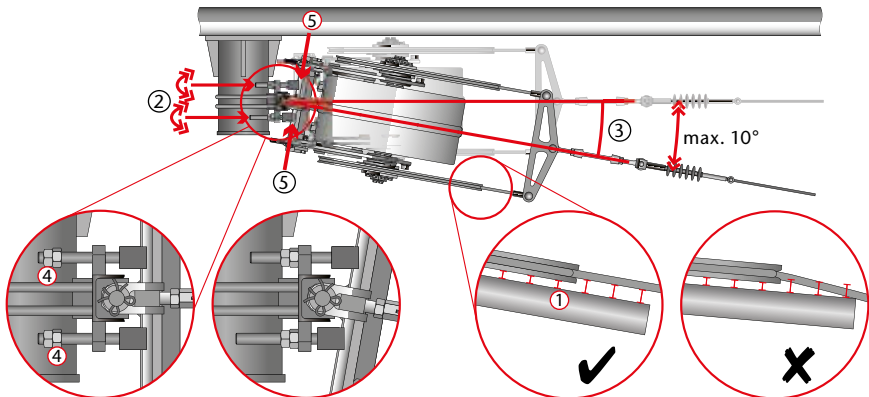


For horizontal installation – double alignment control

- In addition to the adjustment in step 2, the **pulley side** must be parallel to the TENSOREX C+ rope for horizontal installation. Use a flat rod (1) to control the alignment. Adjust the tilt downwards by turning the adjusting screw (2) and the fork, until a max. angle 10° (3).

Adjust the 2 forks (5) of the horizontal attachment to align the lateral plane of the pulley with the TENSOREX C+ rope. Using two wrenches, loosen the two nuts at each fork, fix them together at the end (4) to use them like a head to screw the fork.

When the pulley and the rope are aligned, bring the forks close to the lower TENSOREX C+ rod (5) and fix them with the two nuts in that position, again with two wrenches, so as not to rotate downwards TENSOREX C+.



9 Commissioning

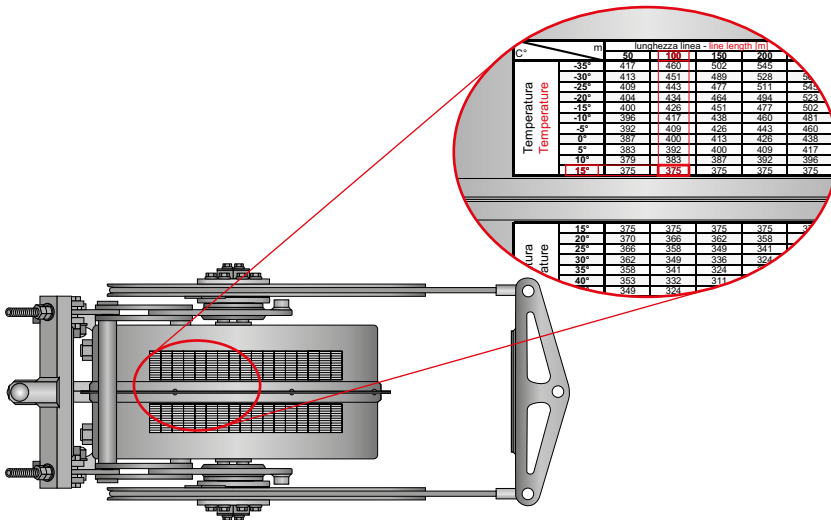
9.1 Setting

To commission TENSOREX C+ the current ambient temperature and the tension length are required. Different types of TENSOREX C+ could have different setting tables and setting scales. The relevant table with the required values sticks on top of TENSOREX C+. And it is also available from MOSDORFER.

- 1 Calculate the setting number by crossing the ambient temperature and the tension length. (For tension length see drawing in chapter 7.1, page 13.)



The drawing below is just an **example** to simplify the understanding of how to read the table. Use the table on top of TENSOREX C+.

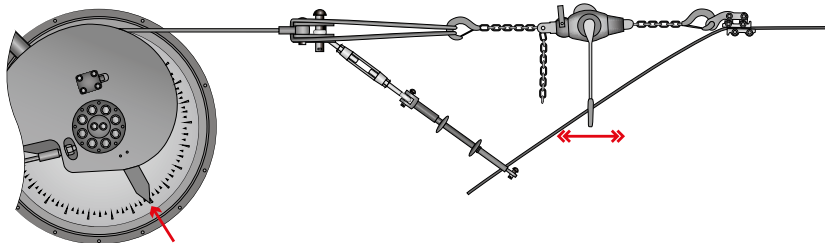


In this example, the tension length is **100 m** and the ambient temperature **15°C**. Hence, the setting number is **375**.

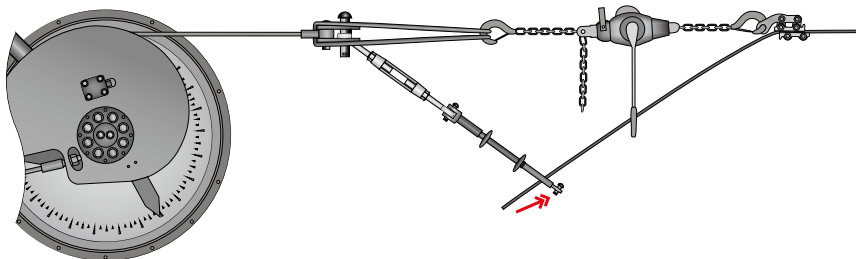
In order to avoid to go up to TENSOREX C+ during maintenance later on, a copy of the same temperature table should be given to the maintenance team.

9.2 Connecting overhead contact line with TENSOREX C+

- 1 Pull TENSOREX C+ until the pointer points to the desired setting number on the scale.

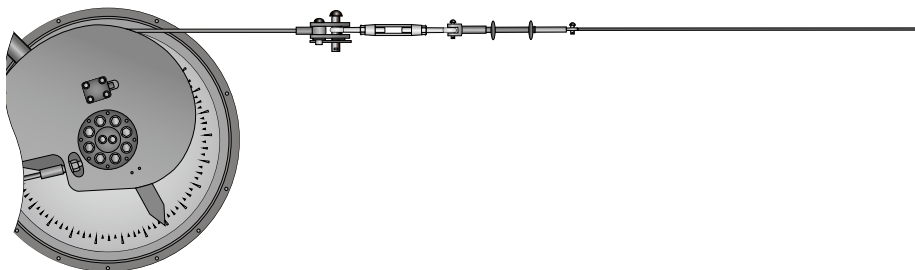


- 2 Hang up the overhead contact line centrally in the front balance (yoke) or to the fitting that had been mounted before.



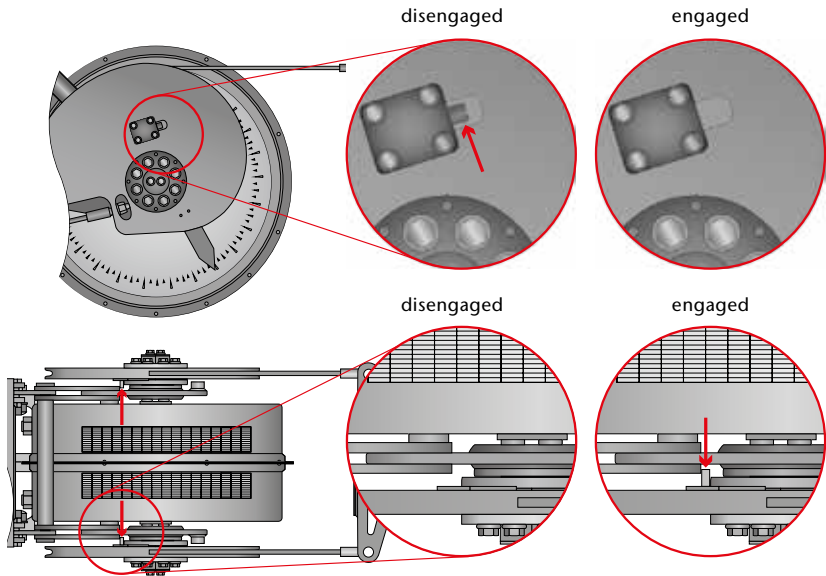
- 3 Release and disconnect the ratchet lever hoist.

A fine-tuning of TENSOREX C+ set up is possible by using the compensating element.

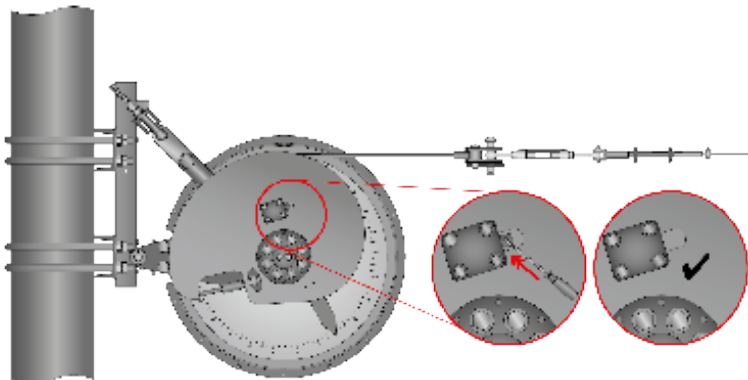


9.3 Engage end stops

Only pulley version 1: flip



- 1 When the installation and commissioning is completed, engage the end stops on **both pulleys** of TENSOREX C+ by pushing the end stops inwards using a screwdriver.



10 Maintenance and Control Procedure

Basically, TENSOREX C+ does not require any particular maintenance procedure, or operations. Ropes and their fittings are stainless steel made and do not require to be greased. Bearings are pre-greased and sealed. All components are corrosion free.

Nevertheless, it needs a visual inspection with a frequency in according to maintenance experience on that railway section.

In case of new installed lines / conductors or refurbished copper, check the setting monthly until conductor's lengths are asserted / stabilized.

In case of existing lines / conductors check the settings 1 or 2 times per year depending on traffic frequency, that is from consumption of the copper contact wire, and in according to customer's planning.

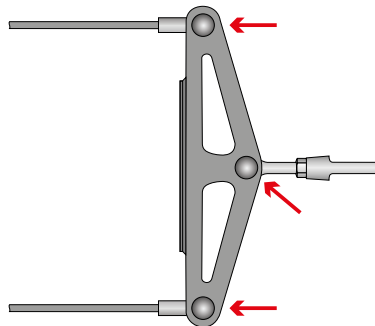
10.1 Checking of TENSOREX C+ functionality

It is possible to verify that TENSOREX C+ works correctly by checking the mid fix point and the pointer position.

- Mid fix point has to be geometrically symmetrical. It means that both tensioning devices are applying the same pull force and work properly.
- The setting scale indicates the movement of the contact line. By checking the pointer position in different temperatures you know if TENSOREX C+ is free and works properly.

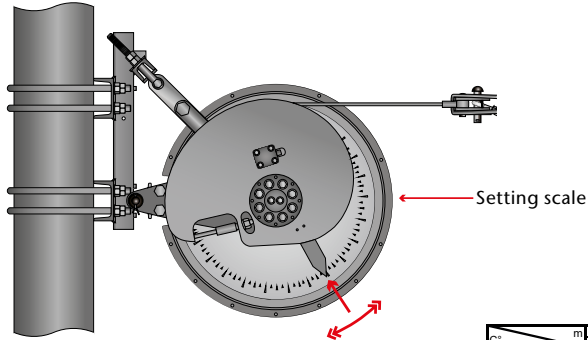
10.2 Front bolts

Check the correct mounting of the bolts on the triangular front balance (yoke), which is connected to the contact line.



10.3 Checking of the setting and recommissioning

- 1 Check whether the TENSOREX C+ pointer is on the correct setting number. For information about how to calculate it see chapter 9 (page 33).



- 2 If the pointer is on incorrect number:
Deduct the incorrect number from the correct one

Example: correct / calculated setting number is 375 mm

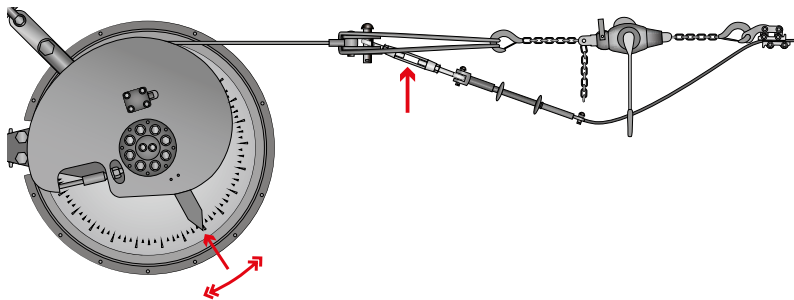
Pointer checked on site is on 330
 $375 - 330 = +45$

=>
 Adjust compensating fittings
 + 45 mm longer!

Pointer checked on site is on 400
 $375 - 400 = -25$

=>
 Adjust compensating fitting with
 - 25 mm shorter!

- 3 Install a hoist and unload the compensating fittings.
- 4 Adjust the turnbuckle or other compensating fittings to increase or reduce the length in according to the calculation.



- 5 Release the hoist and check the pointer position again.



Before to leave site check if cantilevers, arm, mid fix point are correctly set and work properly.

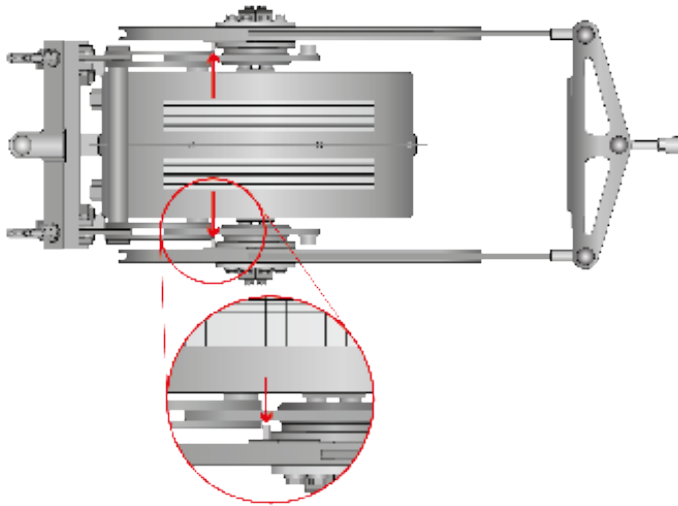
C°	m		lunghezza lin	
	50	1001	50	2002
-35°	417	2605	02	5455
-30°	4134	51	4895	28
-25°	4094	43	4775	11
-20°	404	4344	04	4945
-15°	4004	26	4514	77
-10°	3954	17	4384	60
-5°	392	4059	26	4434
0°	3874	00	4134	25
5°	3833	92	4004	09
10°	3793	83	3873	92
15°	3753	75	3753	75

C°	m		lunghezza lin	
	50	1001	50	2002
15°	3753	75	3753	75
20°	3703	66	3623	58
25°	3663	58	3493	41
30°	3623	49	3363	24
35°	3583	41	324	3072
40°	3533	32	3112	90
45°	349	324	2992	73
50°	3453	15	285	2562
55°	3413	07	2732	39
60°	336	298	2602	22
65°	3322	90	2472	05
70°	3282	81	2342	11
75°	3242	72	2212	24
80°	3202	63	2082	37
85°	3162	54	1952	50
90°	3122	45	1822	63
95°	3082	36	1692	76
100°	3042	27	1562	89
105°	3002	18	1432	102
110°	2962	9	1302	115
115°	2922	0	1172	128
120°	2882	-9	1042	141
125°	2842	-18	912	154
130°	2802	-27	782	167
135°	2762	-36	652	180
140°	2722	-45	522	193
145°	2682	-54	392	206
150°	2642	-63	262	219
155°	2602	-72	132	232
160°	2562	-81	2	245
165°	2522	-90	-108	258
170°	2482	-99	-238	271
175°	2442	-108	-368	284
180°	2402	-117	-498	297

10.4 Overhead Contact Line accident

If overhead contact line is broken as a consequence of dewirement or different accidents, proceed as follows:

- 1 Check the end stops.



In case the end stops are deformed or broken:

TENSOREX C+ needs to be uninstalled and substituted. See chapter 11 (page 39-43).

In case the end stops are not damaged and work properly:



End stops must be able to rotate freely.

- 2 Before commissioning TENSOREX C+ again, make a visual inspection. Check the stainless steel ropes carefully; they must not have any kinks or broken braids.
- 3 In case of any damages, replace both ropes (See instructions 000 300 408).
- 4 Now TENSOREX C+ must be commissioned again. Follow the steps in chapter 9 (page 33-35).



Keep in mind to engage the end stops again.

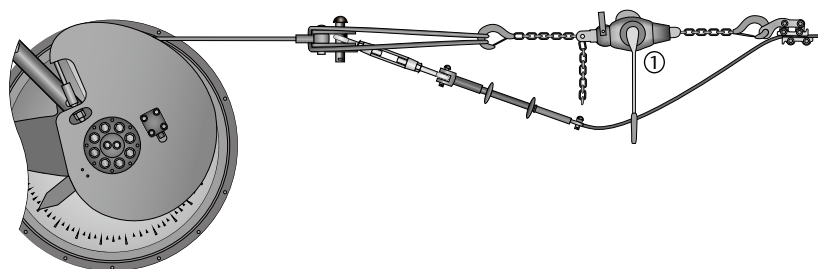
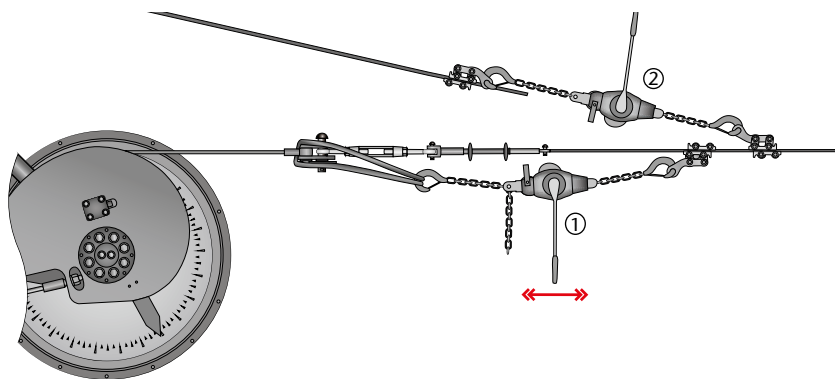
11 Uninstalling

Before uninstalling TENSOREX C+, make sure that the safety instructions in chapter 3.4 were respected.

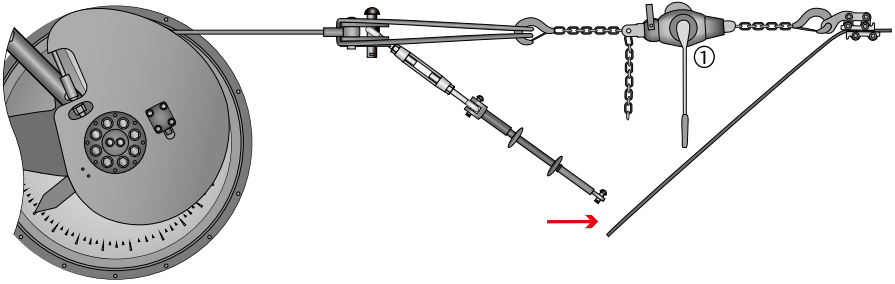


Overhead contact line under high mechanical tension!

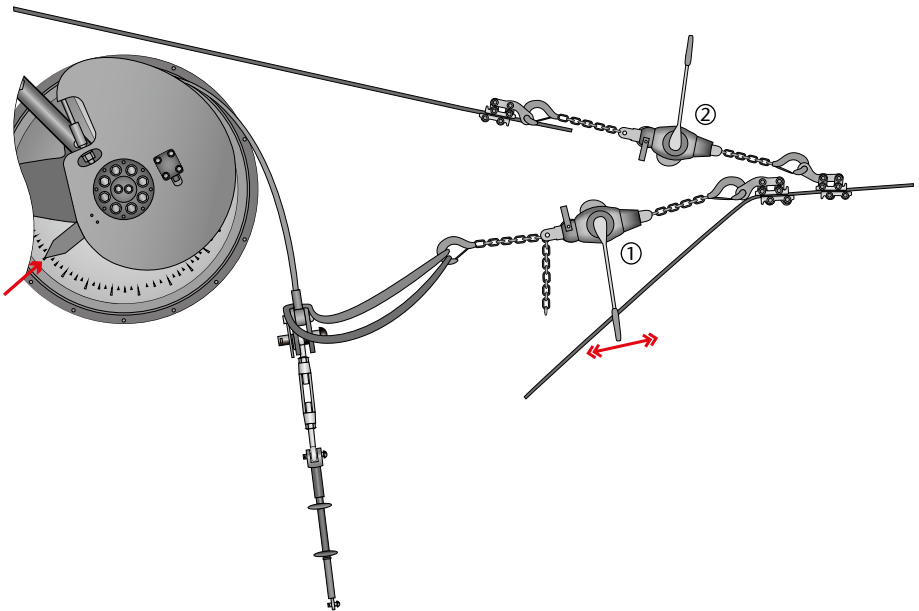
- 1 Connect the front balance (yoke) of TENSOREX C+ and the ratchet lever hoist ① with two strap slings. Connect the other side of the ratchet lever hoist to the overhead contact line.
- 2 Connect one side of the ratchet lever hoist ② to the pole and the other side to the overhead contact line.
- 3 Pull ratchet lever hoist ② until the pointer rotates some millimeters counter-clockwise.
- 4 Pull ratchet lever hoist ① until the section bands (second drawing). The pointer rotates clockwise.



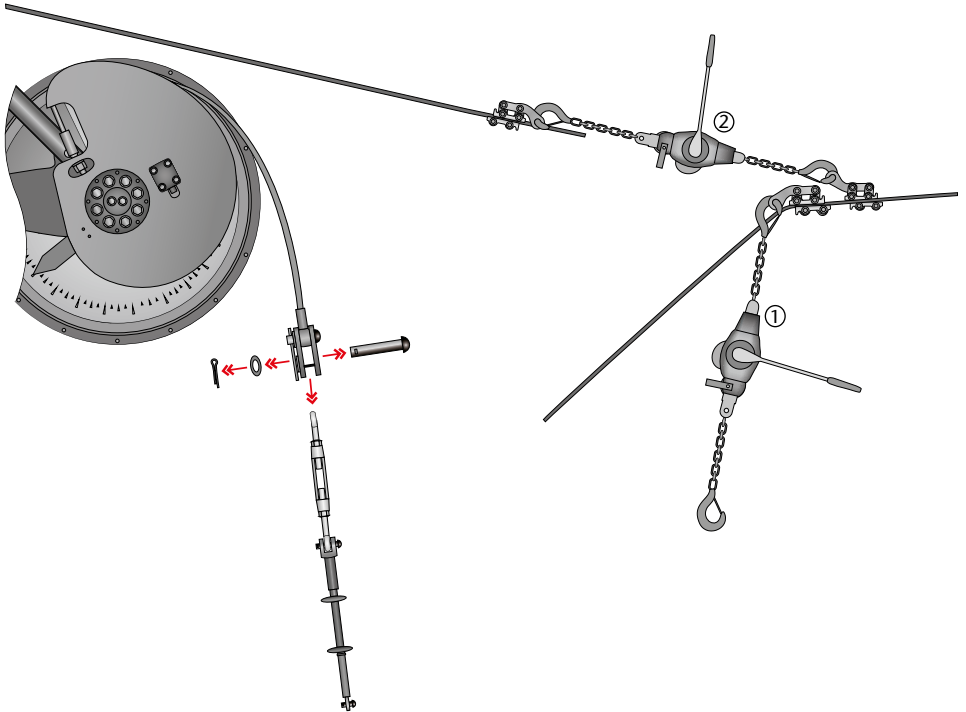
- 5 Disconnect TENSOREX C+ from the overhead contact line.



- 6 Release TENSOREX C+ by ratchet lever hoist ① until it is completely released back and it's not applying any force.



- 7 Remove fittings and ratchet lever hoist ①.





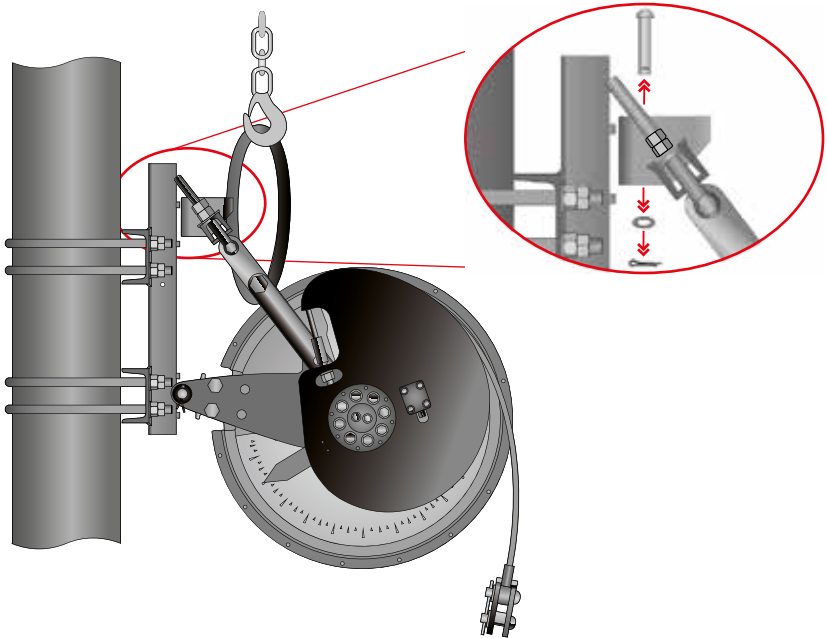
Before you proceed, make sure that TENSOREX C+ is not under tension! It must not apply any force!

- 8 Hang up TENSOREX C+ by crane or hoist as shown in the drawing below.

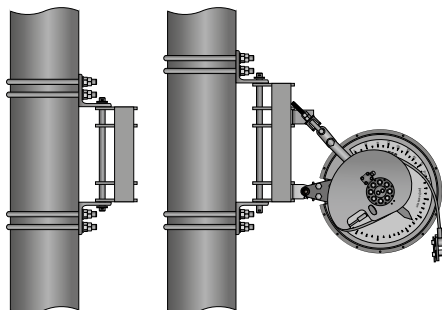


Don't use the lifting eye (if present) or other spots to hang up TENSOREX C+.

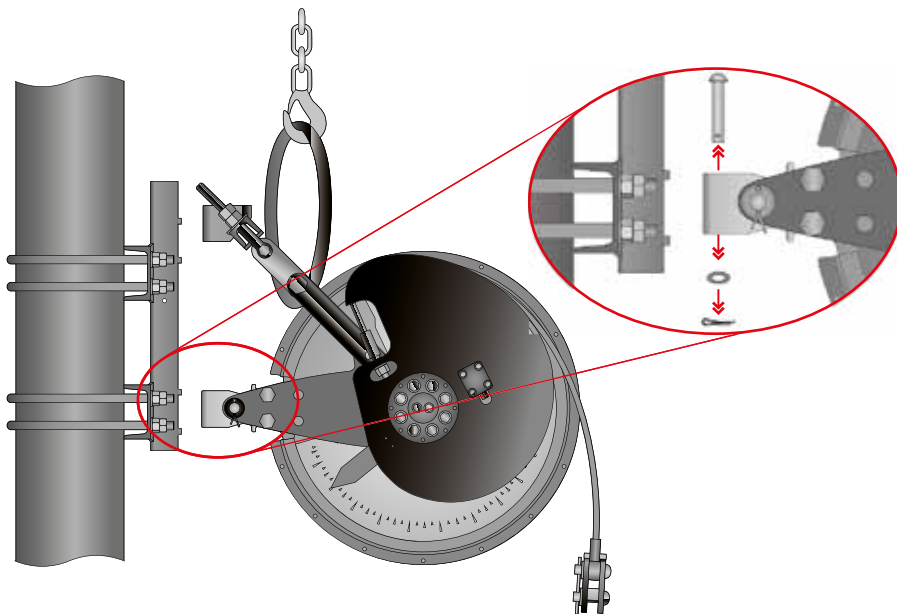
- 9 Remove the upper pin as can be seen in the drawing below.



Type B:
Same operation on the mounted adapter



- 10 Remove the lower pin as can be seen in the drawing below.



- 11 Remove TENSOREX C+ from the pole and put it into a crate.

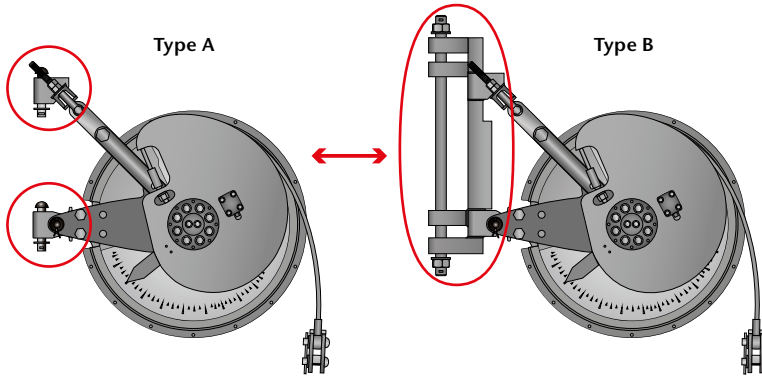
12 Further information

12.1 Back Interface Type B (obsolete version)

- It is possible to change the type of fixing bracket: Type A to Type B and vice-versa.

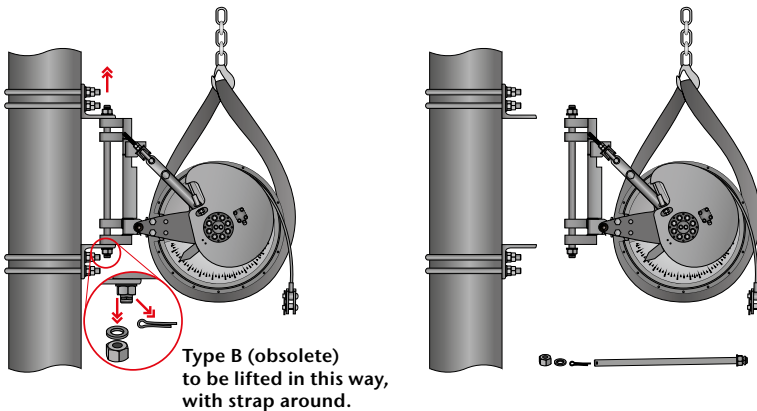
Additional installation instructions available
000 300 503 Changing Types of Back Interface

For comparing:



12.1.1 Dismounting Type B (obsolete version)

- 1 Follow chapter 11 Uninstalling, until step 7.
- 2 Wrap a lifting strap around TENSOREX C+. Hang it on a crane or hoist.
- 3 Remove split pin, nut and washer from the rod at the back interface, and then remove the rod.



12.2 Spare parts

Product	Item No.	Description / note
Ropes	...	<ul style="list-style-type: none"> with additional inst. instr. 000 300 408 Replacement of ropes



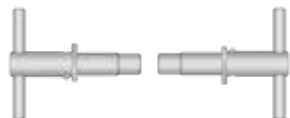
12.3 Helping device

- It is possible to block TENSOREX C+, e.g. in case of overhead contact line maintenance.

Blocking devices are applicable to certain TENSOREX C+ models only. Please contact the manufacturer to ascertain which blocking device you require. Instructions for use will be provided.

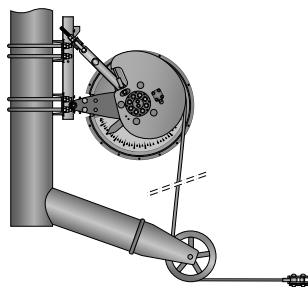
Blocking device	Item No.
Couple of blocking pins	000 701 170 var00

Installation instructions: 000 300 502 TENSOREX C+ Blocking Pin



12.4 Special configurations

- It is possible to install TENSOREX C+ in special configurations. Contact MOSDORFER for more information.



- There are available TENSOREX C+ with double units, metrics and imperial.

13 Note

ENERGY

Mosdorfer Rail S.R.L.
Via A. Grandi 46
20017 Rho (MI) - Italy
Phone +39 02 6408 8142
inforail.IT@mosdorfer.com

Mosdorfer Upresa Rail S.A.U.
C/Emporda 7 Pol. Ind. Congost
08403 Granollers - Spain
Phone +34 938 400 365
mosdorfer.upresa@mosdorfer.com

Mosdorfer Rail Ltd
2-4 Orgreave Place, Orgreave,
Sheffield S13 9LU - UK
Phone +44 114 3878370
OrdersRailUK@mosdorfer.com