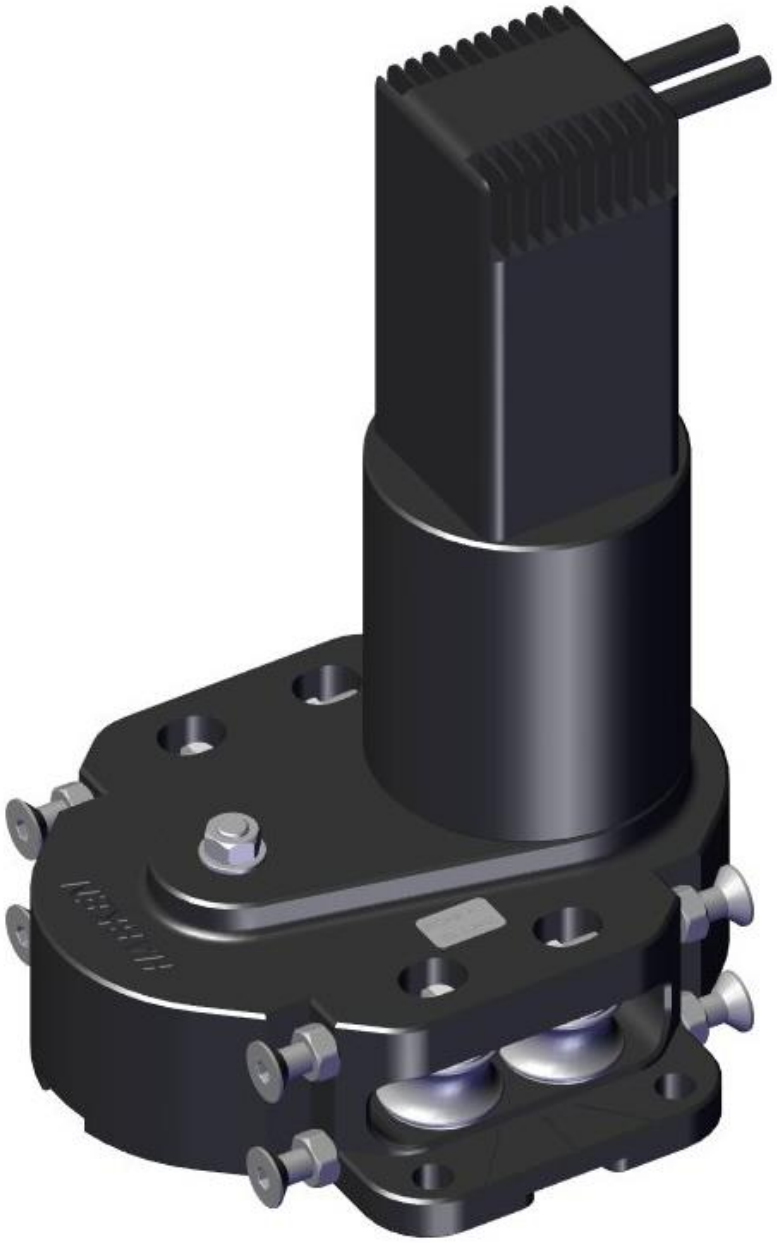
AT THE FRONT HARKEN®

Tensioner CT0



USER AND MAINTENANCE MANUAL

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1. Glossary

- Intended use: specific and proper use of the tensioner for which it is designed
- Improper use: use of the device in a different way from that indicated in the instructions for use specified in this manual
- Qualified operator: person who has attended specialisation and training about the use of the tensioner
- User: person who uses the winch and the tensioner regularly
- Maximum working load (MWL): maximum value of the load the tensioner can bear

2. Symbols

WARNING!

This denotes the existence of the potential danger, which could cause injury or damage if the information or instructions are not followed

NOTE!

This denotes important information concerning the device

3. Safety information

WARNING! Read this manual carefully and fully understood before using the system to avoid personal injury or property damage during system operation.

- This manual is an integral part of the device and aims to provide all the information needed for its safe and correct use and for proper maintenance.
- This manual gives technical information on installation and maintenance.
- This information is destined exclusively for qualified operators.
- Installation of the device by personnel who are not experts may cause serious damage to users and those in the proximity product.
- Install and use the tensioner only as described in the technical information supplied.
- Improper use can cause severe harms to users, equipment and the boat.
- Never substitute any tensioner part with one that is not original. Even though they look similar and are both made by Harken®, the non-original part may not be suitable and the warranty will be invalidated.
- Modifications carried out by the user, without explicit written authorization from the manufacturer, will invalidate the warranty and relieve the manufacturer of any responsibility for damage caused by the defective product.
- Failure to install the tensioner will void the warranty of the device itself and the Harken® product to which it is connected.
- Refer to the warranty on the web site www.harken.com
- Do not apply to the tensioner loads greater than the MWL (Maximum Working Load).
- If the tensioner is powered by a hydraulic motor:

• Do not operate the hydraulic motor during installation or maintenance

• Do not let the oil in the system come into contact with your eyes or skin. Harken cannot be responsible for damage or injury resulting from unsafe product use, lack of maintenance or incorrect product and /or system installation or operation.

- Wear suitable clothing when using the tensioner, to avoid loose ends of fabric becoming entangled in the tensioner.
- Periodical maintenance must be carried out regularly as specified in the chapter on Maintenance. In case of doubt, contact Harken Tech Service.
- This manual is available only in English. If you do not fully understand the English language, do not carry out the operations described in this Manual. For any doubts, questions or comments contact the Harken distributors nearest to you, Special Project assistance, or contact the Harken Italy Technical Service by e-mail: techservice@harken.it
- See www.harken.com for additional safety information.

4. General advice

Intended use

The Harken devices are designed and manufactured for a use on sailing boats to control ropes, halyards and related sail and rig systems. For any other usage, contact the Harken Italy Technical Service by e-mail: techservice@harken.it

Improper use

- The Harken device must not be used for purposes different from those outlined in 'Intended use' chapter, or for purposes not mentioned in this manual or different from those mentioned.
- The Harken device must not be used if unauthorized modifications or interventions have been carried out.
- Do not use the tensioner for hauling, mooring the boat or weighing the anchor.
- Do not use the tensioner to divert a line (cross-sheeting).

5. Harken® limited worldwide warranty

The Harken product is covered by a warranty: if during the warranty period the tensioner proves defective or suffers breakages, as indicated in the warranty, the manufacturer, after checking the device, will repair or replace the defective components.

NOTE!

Refer to the Harken® Limited Worldwide Warranty in the Harken Catalogue and on the website www.harken.com

6. Product information

Harken Tensioner CT0 is needed to a double purpose:

1. Avoid slack and the entanglement of the rope on the Captive drum.
2. Keep tension on the rope wrapped on the Captive drum.

The Tensioner removes the slack when loading and unloading line on the spool.

Two independently low friction rollers guide the rope along the entry line direction for constant and reliable tension.

Tensioner CT0 can be used with a maximum dynamic load of 3T.

One unit has two possible motor assemblies for flexible installation:

- by an electric motor
- by a hydraulic motor

Tensioner CT0 is used both for Hydraulic Captive Winch and for Electric Captive Winch.

As regards the differences, refer to:

- the installation procedures in the ‘Installation’ chapters of the Hydraulic Tensioner CT0 and of the Electric Tensioner CT0 of this manual;
- the performance graphs in the relative chapters of the electric and of the hydraulic versions of this manual.

7. Product identification

The product identification is based on its composition and technical functions:

Product	Size	Rope diameter	Motorization type	Voltage/displacement
Tensioner	CT0	XX	EL/HY	XXX

Legend
Rope diameter:
Ø10-12mm
Ø14-16mm
Motorization type:
EL = Electric motor
HY = Hydraulic motor
Voltage
EL → 24V
HY → 50cc

8. Maximum Loads

Loads associated to Tensioner CT0 are:

- Maximum tensioning load: 12Kg
- Maximum working load (MWL) on the rope: 3000 Kg (Maximum dynamic load)
- Maximum static load on the rope: 5000Kg

Tensioner CT0	Maximum working load (MWL)		Maximum static load		Maximum tensioning load	
	lb	Kg	lb	Kg	lb	Kg
	6600	3000	11000	5000	26,5	12

WARNING!

Subjecting the tensioner to loads above the Maximum Working Load can cause the winch to fail or pull off the deck suddenly and unexpectedly during high loads causing severe injury or death.

9. Weights

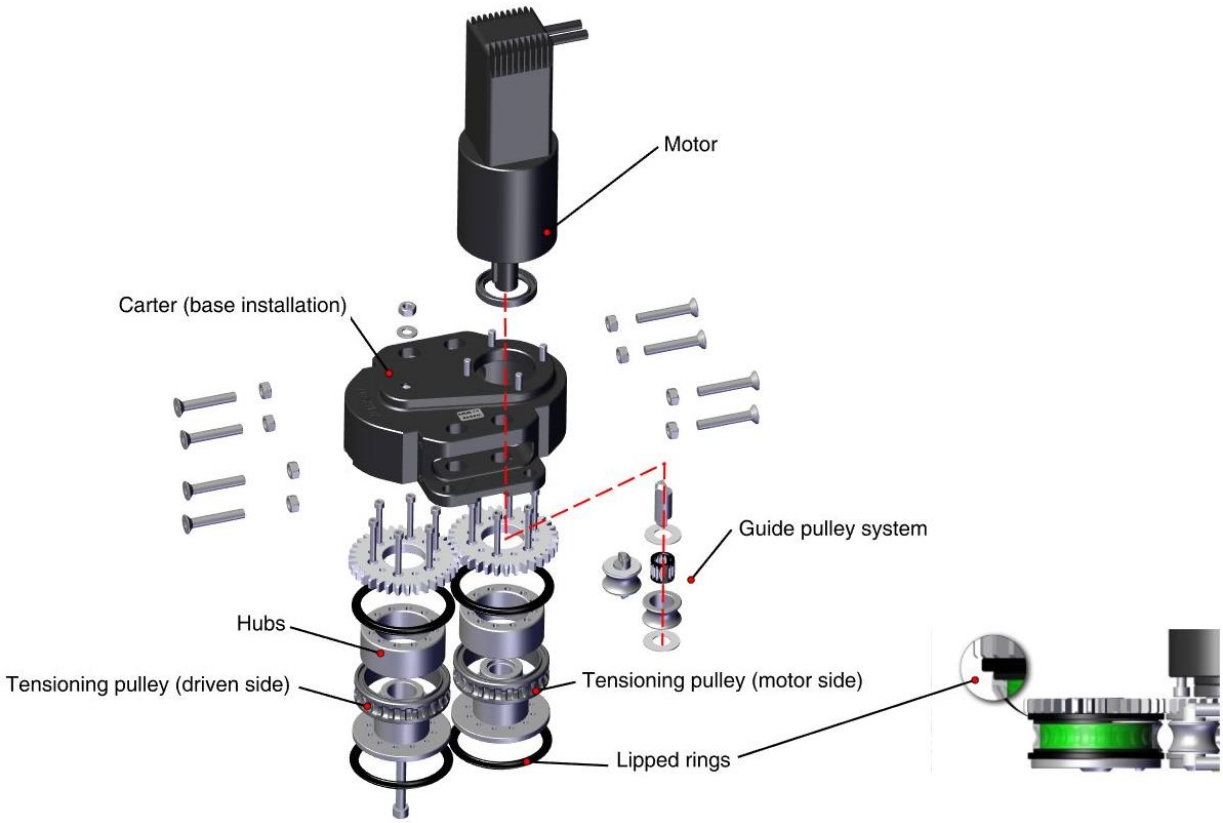
Version	Weight [Kg]
EL	3.8
HY	6.8

NOTE!

Weights refer to the tensioner with the motorization.

10. Product composition

Tensioner CT0 is composed by the following groups:



11. Rope diameter

WARNING!

For safety and correct performances, use ropes of the diameters indicated below.

NOTE!

For safety and for correct performance of the Tensioner use only rope of the best brands.
The rope diameter when is not stretched cannot exceed the 5% of the nominal value specified at the Captive order.

Two configurations of Tensioner CT0 are available in function of the rope diameter: Ø10-12mm and Ø14-16mm.

Every Tensioner is assembled considering the specific rope diameter defined at the order.

The parts that change between the two configurations are the hubs and the lipped rings:

Tensioner description	Ø rope				Hub code	Lipped ring code
	min		max			
	in	mm	in	mm		
Tensioner CT0 10-12	0.39	10	0.47	12	S734630052	S737290080
Tensioner CT0 16-18	0.55	14	0.63	16	S734620052	S737300080

8. Installation procedure

To install the device, please follow the steps shown below of the installation procedure, taking into account the outline, the mounting template and several technical info needed.

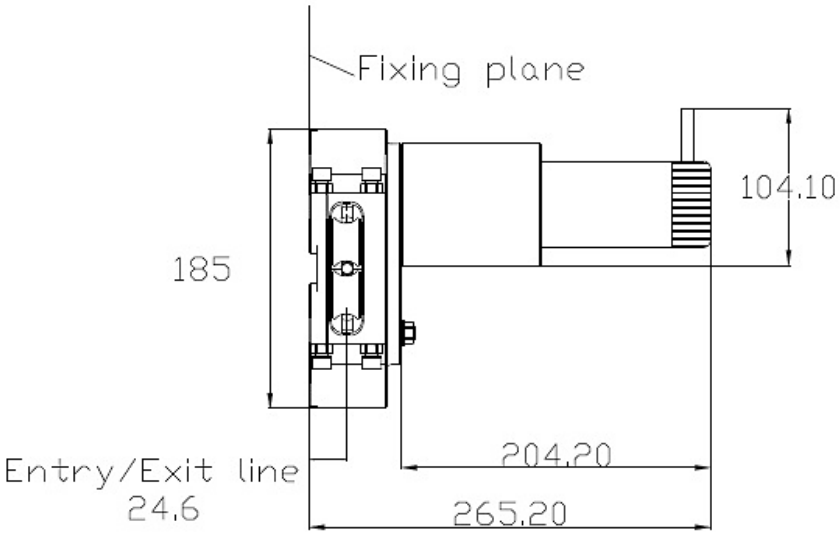
8.1 Electric Tensioner Outline

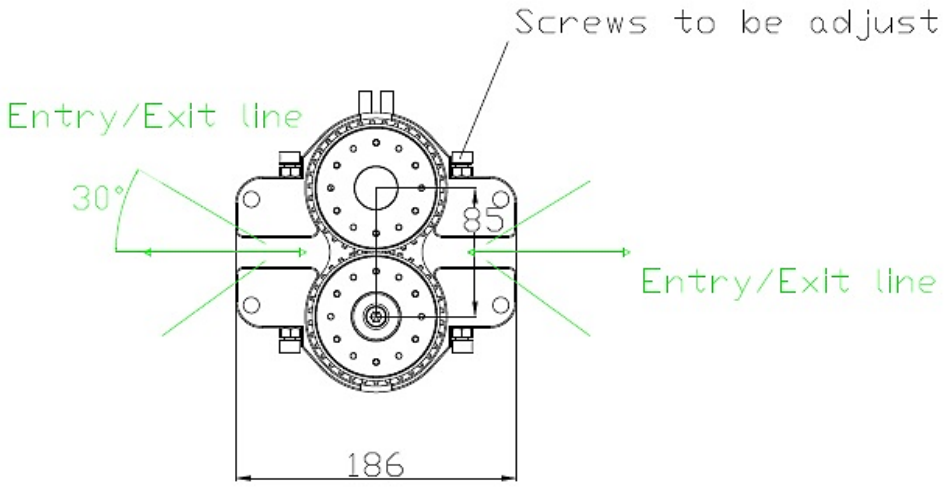
Harken supplies to the customer the outline drawing of the product and the minimum space around necessary for making the inspection and maintenance of the product.

NOTE!

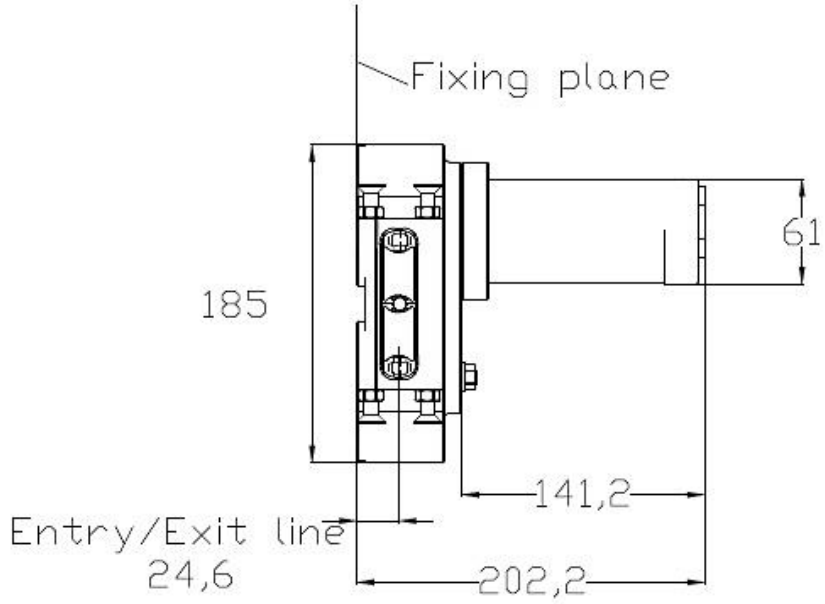
The following dimensions refer to electric motorized Tensioner (all configurations).

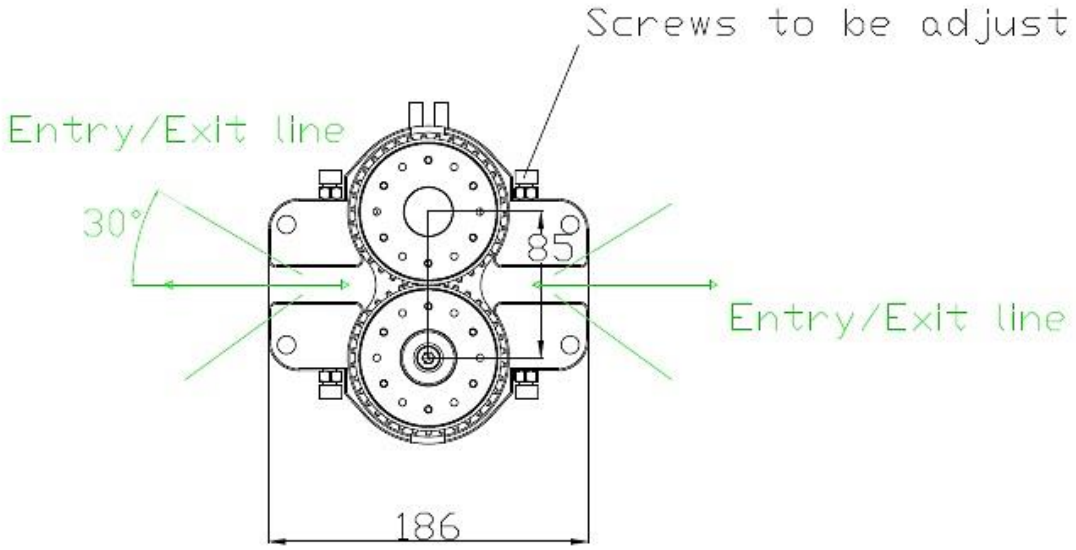
All dimensions are in [mm]





8.2 Hydraulic Tensioner Outline





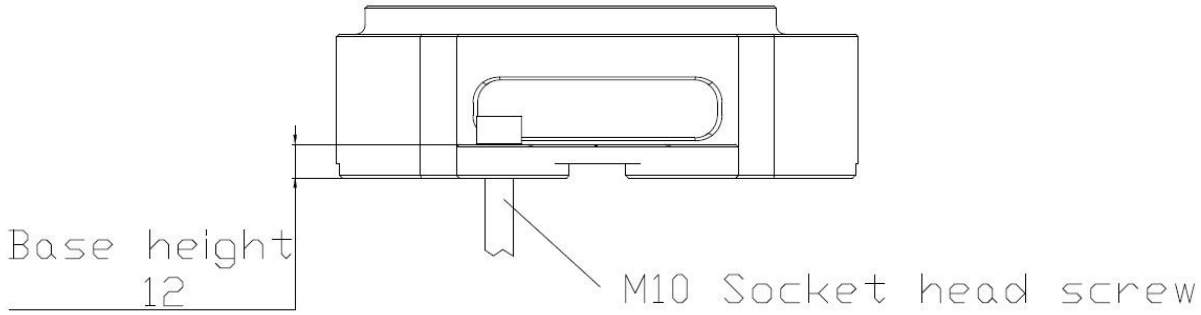
8.4 Installation - Technical info

WARNING! - The mounting surface requires a flat area of 0.5mm tolerance under the Tensioner base plate.

WARNING! - The Tensioner must be aligned with the Captive Winch and/or turning block respecting the entry/exit angle (see outline, on the base of the Tensioner are marked with engraved line) and the height of the line (24,6mm from the fixing surface to the centre of the rope).

It is installer's responsibility to carry out all structural tests needed to ensure that the deck can bear the load.

To install the Tensioner CT0 to the deck, use 4xM10bolts, steel class A4 70:



NOTE! Harken does not supply the fasteners needed to install the Tensioner since these may vary depending on the deck on which it is to be installed. It is the installer's responsibility to choose the correct fasteners taking account of the loads they will have to bear.

Harken assumes no responsibility for incorrect installation of its devices or for an incorrect choice of mounting fasteners.

WARNING! - Use only the bolt size and number specified in the outline drawings. Failure to use the correct number and size of mounting fasteners or failure to ensure the correct deck strength can cause damages or severe injury during high loads.

WARNING! - Incorrect installation of the Tensioner may cause severe injury.

The mounting bolts must be isolated with anti-corrosive lubricants (i.e. DURALAC or TEFGEL). It is mandatory to prevent any direct contact between the aluminum Tensioner frame from other conductive materials such as carbon fiber (deck or hull); in that case a fiberglass lamination is required to avoid any galvanic corrosion.

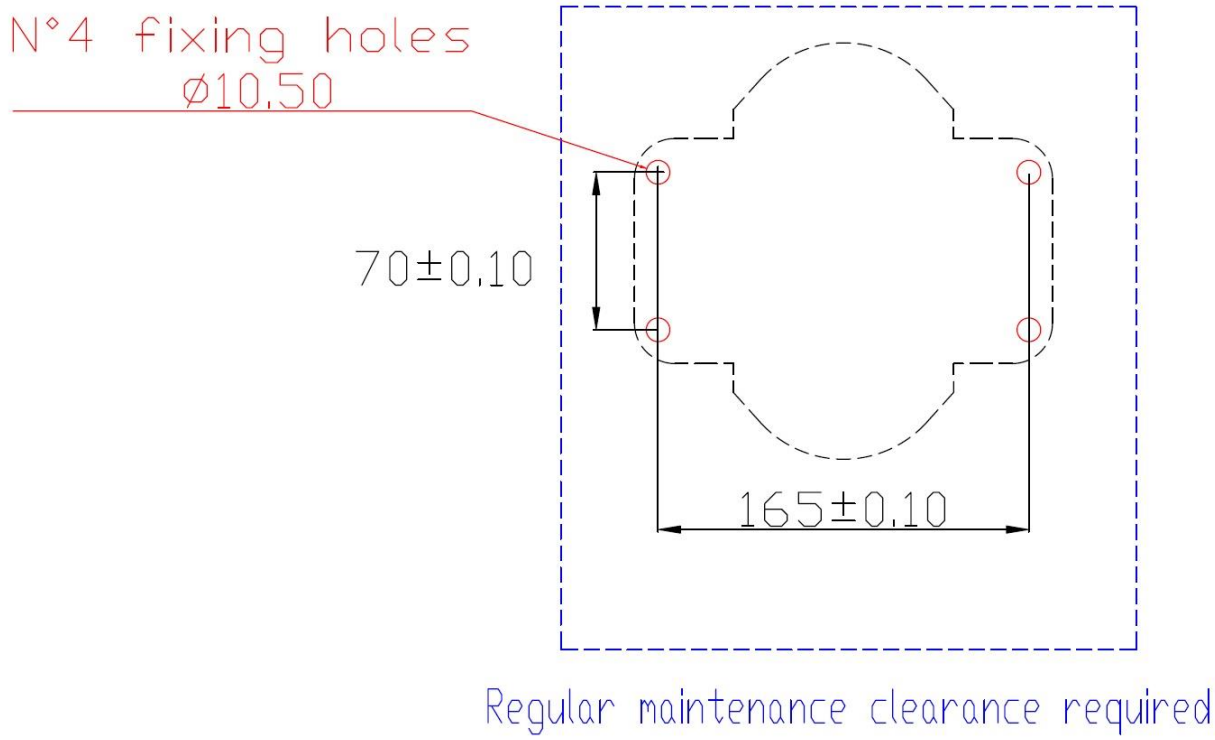
8.5 Tensioner Mounting Template

To operate the installation, follow the steps below (alphabetic indexes):

A. Place the drilling cut-out template over the point chosen for installation.

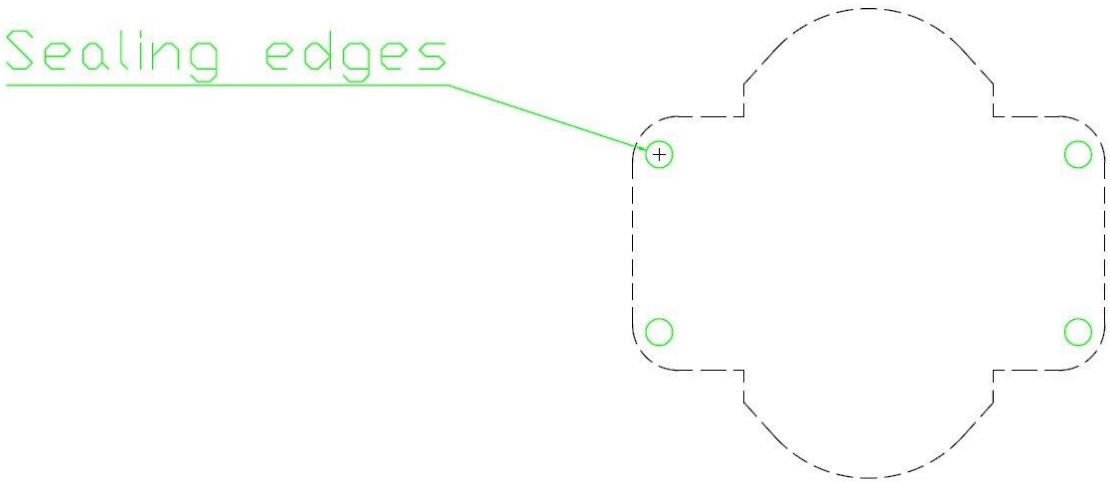
The template in DWG format and 1:1 scaled is available on request from the Harken Italy Tech Service at techservice@harken.it.

Small-scaled mounting template for Tensioner CT0 is shown below.



B. Mark the position of the holes to be drilled in the deck.
C. Drill the holes.
D. Seal the external part of the main holes and all the fixing holes with a suitable marine adhesive sealant as shown in the following image (green lines).
To apply the adhesive sealant: clean and remove all grease from the bottom surface and apply the sealant.

SEALING TEMPLATE



NOTE!

Make sure the drainage holes in the base of the tensioner are not obstructed by the sealant.

E. Remove excess marine sealant.

9 Motorized use

9.1 Hydraulic equipment (HY)

9.1.1 Motor

Hydraulically operated, Tensioners have a load capacity proportional to the pressure set up on the manifold, while the recovery speed of the Tensioner is proportional to the oil flow.

The hydraulic motor oil must reflect the ISO VG 46 characteristics. It must be filtered with a maximum grade of 10 micron and with a contamination level equal to or inferior to class (according to NAS 1638 or 22/18/15 according ISO/DIN 4406), the temperature range of the hydraulic oil during operation have to be within 25°C and 90°C.

Motor ports that have to be connected to the manifold are 2 main ports:

- Size: G 3/8”
- Depth: 12mm

Motor displacement is 50cc.

9.1.2 Manifold

The Tensioner manifold is plumbed independently and does not rely on the winch for oil flow.

The manifold includes a solenoid valve that should be energized while paying-out (easing out). The independence of this valve from the Captive winch directional valve, allows to optimize timing between winch and Tensioner.

The Pay-out circuit includes a pressure-reducing valve, allowing the users to adjust Tensioner pull force.

During pay-in (trimming in) the Tensioner motor is allowed to freewheel. The pay-in circuit includes a low-pressure relief valve so the user can adjust drag while trimming in. This is important when there is no sheet load to help prevent overrides on the winch drum.

All work ports are BSPP type (ISO/DIS1179-1).

All components and work ports are clearly marked with engraved labels.

9.1.2 Manifold performance data

Specifications of the hydraulic motors used to power the hydraulic Tensioner CT0:

Tensioner CT0	recommended pressure range		Max recommended flow	
	PSI	bar	gal/min	l/min
	From 725 to 2030	From 50 to 140	3,73	14

9.1.3 Hydraulic motor installation procedure

The pressure lines must be connected to the motor using the approved size and type hydraulic hose.

WARNING! - Do not remove the plugs on the Tensioner motor connections until absolutely necessary to prevent contamination.

Each 90° hose bend causes pressure loss and decreases performance - avoid where possible. If a 90° bend is needed, use a 90° swept hose fitting not a 90°elbow. Do not exceed the minimum bend radius specified by the hose manufacturer.

9.1.3 Tensioner manifold installation procedure

Manifold can be mounted near the Tensioner or in a remote location.

The various functions must be connected to the manifold using approved size and type hydraulic hose.

Before connecting make sure insides of hoses tubes are clean and free of debris that can damage valves.

WARNING! - Do not remove the plugs on the manifold hydraulic connections until absolutely necessary to prevent contamination.

Each 90° bend causes pressure loss and decreases performance - avoid where possible. If a 90° bend is needed, use a 90° swept hose fitting not a 90°elbow. Do not exceed the minimum bend radius specified by the hose manufacturer.

Manifolds drilled through for 2xM8 mounting fasteners.

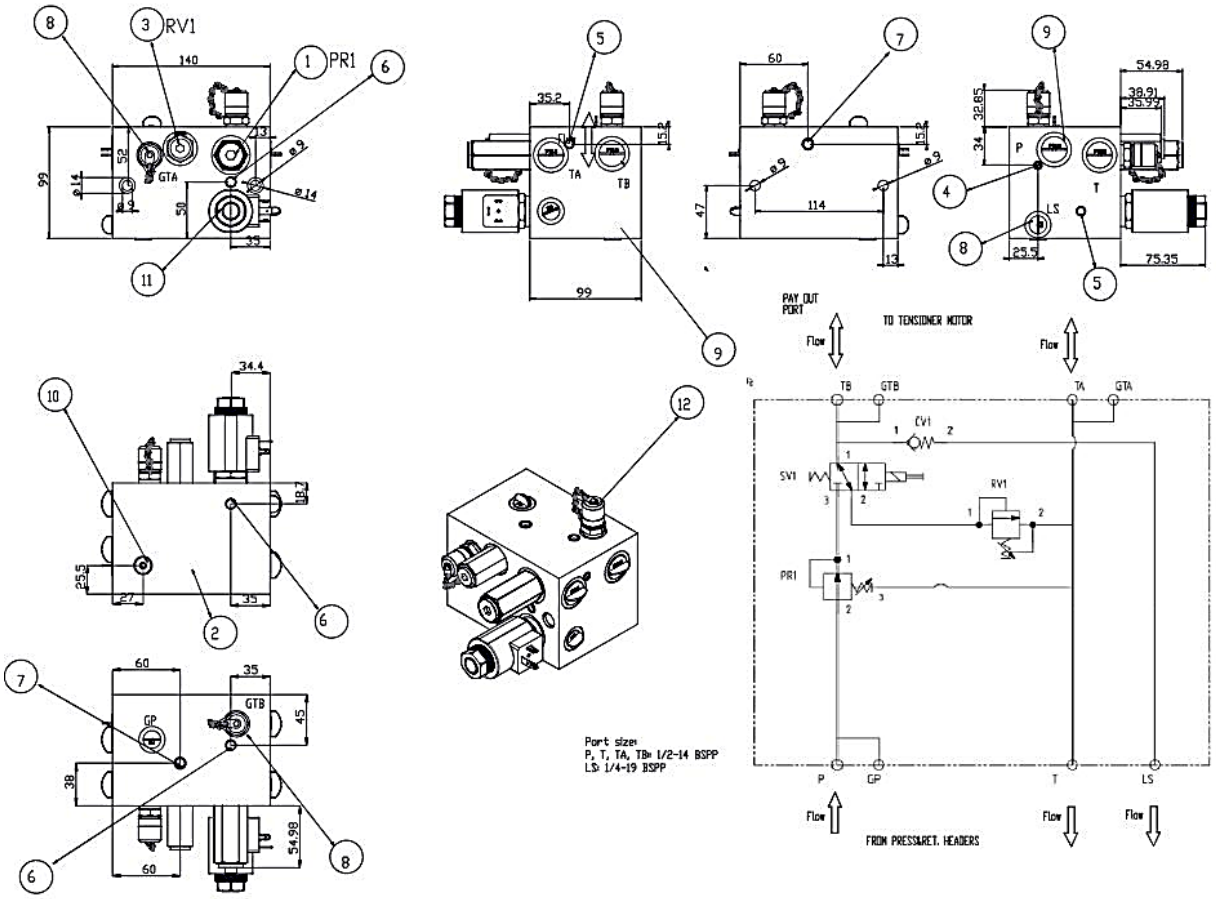
The max pressure is set on the valve PR1 on the Tensioner manifold, during the commissioning of the system, it should be verified that during the pay-out the sheave does not slip on the rope: in this case, reduce the pressure.

The drag of the Tensioner during the pay-in is set by the valve RV1 on the manifold, to increase the drag screw the valve (to reduce unscrew), also in this case verify that in all conditions the sheave does not slip on the rope.

9.1.4 PLC Control requirements

- The Hydraulic Tensioner manifold needs to be connected to the PLC for the solenoid valve control. In the pay-in direction the Tensioner motor is not powered, the Tensioner is freewheeled by the pull of the Captive.
  On the pay-out, the solenoid valve should be activated.
- Tensioner should be operated for a slightly longer period than the winch. It should be switched on 0.5 seconds before releasing the winch brake and deactivated 0.5 second after the brake is engaged again.

9.1.5 Tensioner Manifold structure

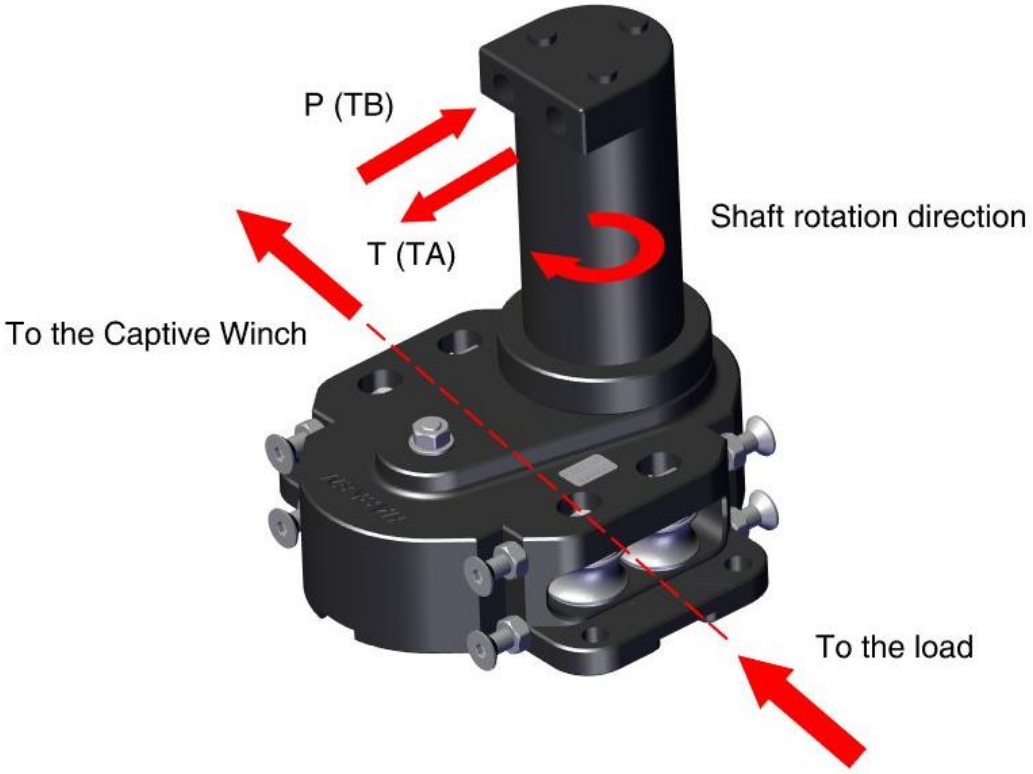


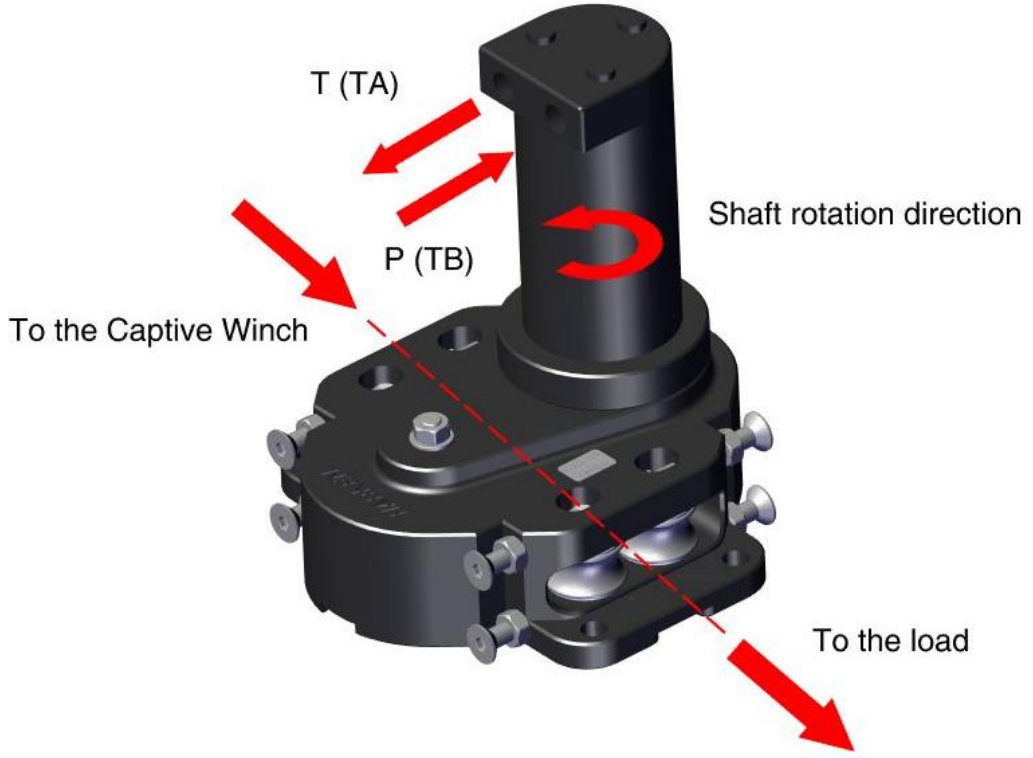
NOTE
During PAY-OUT of the captive the SV1 is activaed
PR1 tensioner PAY-OUT reducing valve, shall be set high enough to maintain preper sheet tensioning while paying-out

During PAY-IN of the captive the SV1 is not activated
RV1 tensioner PAY-IN relief valve, is set to allow some back pressure on the motor while paying-in

Num. articolo	Num. parte	Descrizione	Quantità	Set-up
1	1101131 (PR1)	CP230-2-B-0-A-C-050	1	70 (bar)
2	1159044	Blocco	1	
3	131244026 (RV1)	CP208-3-B-0-A-C-050	1	7 (bar)
4	545C30230	Tappo Koenig M8 070	1	
5	545C30240	Tappo Koenig M8 080	2	
6	545C30250	Tappo Koenig M8 090	3	
7	545C30260	Tappo Koenig M8 100	2	
8	5460000020	Plug LPN G1/4	4	
9	5460000040	Plug LPN G1/2	4	
10	83013206 (CV1)	CV04-NB-0.3-B-00	1	
11	83038065 (SV1)	SV10-23-01-24D-DN-SPS-B-00	1	
12	2103-01-18.00IN	Minimess	2	

9.1.6 Hydraulic Motor connections





PORT ID TABLE		
ID	**DESCRIPTION**	**SIZE**
P	Pressure IN	G1/2” BSPP
T	Tank OUT	G1/2” BSPP
TA	Pay IN, Tensioner motor	G1/2” BSPP
TB	Pay OUT, Tensioner motor	G1/2” BSPP
GTA	Gauge, Tensioner motor Pay IN	G1/4” BSPP
GTB	Gauge, Tensioner motor Pay OUT	G1/4” BSPP
GP	Gauge, pressure IN	G1/4” BSPP
LS	Load sense	G1/4” BSPP

CAVITY/DEVICE ID TABLE	
HYD. ID	**DESCRIPTION**
SV1	Tensioner valve, Pay OUT
PR1	Tensioner reducing valve, Pay OUT
CV1	Check valve, Tensioner load sense
RV1	Tensioner Pay IN relief valve

WARNING! - Do not overdo with pressure at start-up operations.

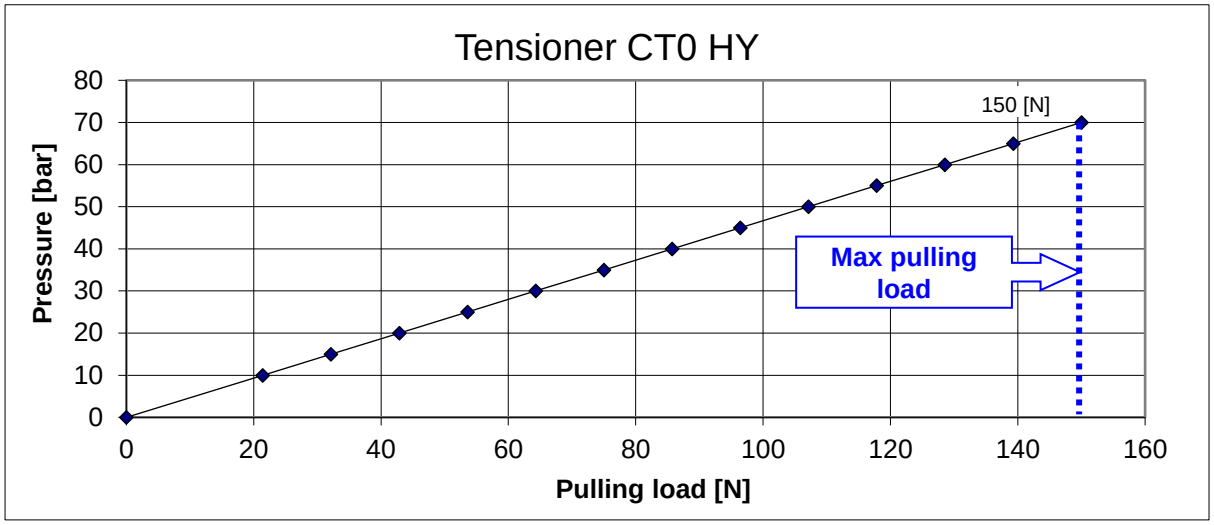
Here below the suggested maximum pressures at first activation:

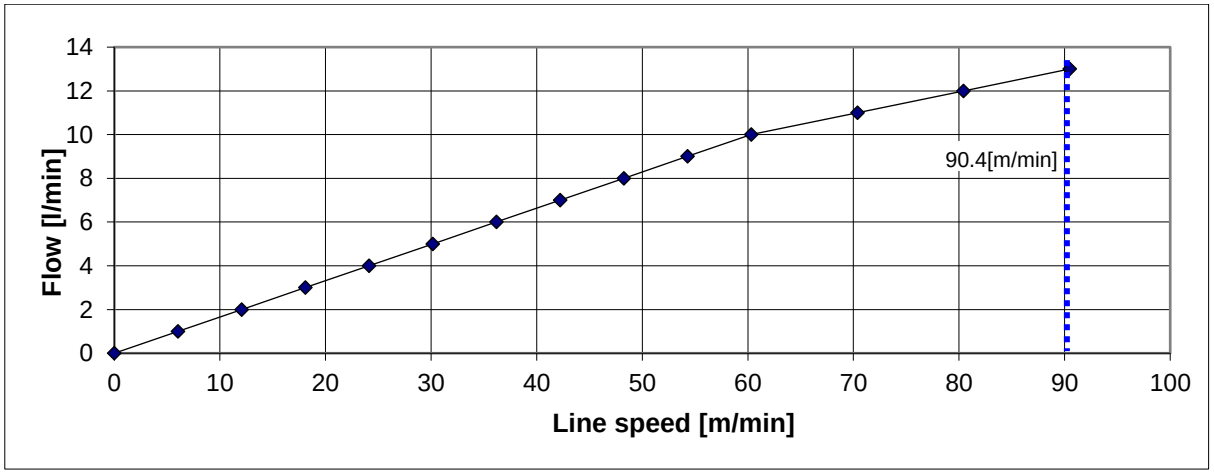
Start-up pressure			
HYD. ID	**DESCRIPTION**	**PSI**	**bar**
PR1	Tensioner reducing valve, Pay OUT	870	60
CV1	Check valve, Tensioner load sense	218	15

NOTE!

The maximum flow and pressure must be in accordance to graphic performance.
Wrong dimensioning of components can void warranty.
For any other information, contact Harken Tech Service at techservice@harken.it

9.2 Hydraulic performance graph





Notes:

The pressure on the graph is the pressure drop between in and out motor ports.

The performance is evaluated measuring the pressure and flow on the motor ports.

Performance data based on oil with a viscosity of 35 mm^2/s [165 SUS] and temperature of 50° [120° F].

9.3 Electric equipment (EL)

The Electric Tensioner CT0 is equipped with an electric unit, composed of electric motor, electric cables and connectors:

Harken provides the electric unit assembled with the Tensioner device or as a spare part.

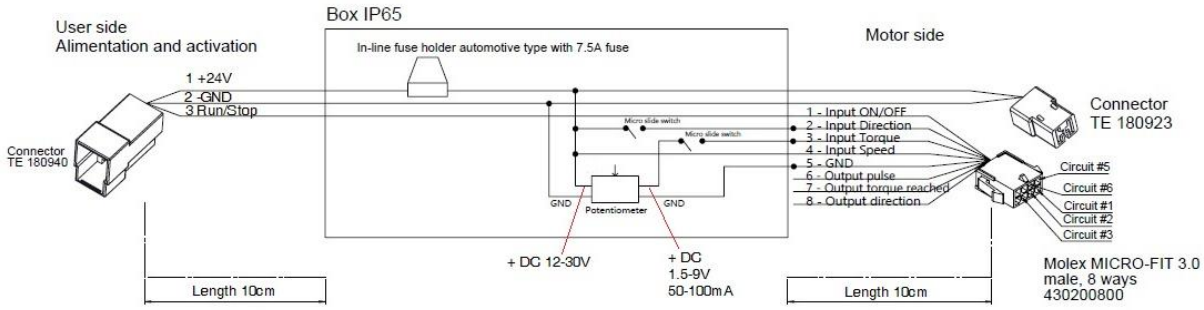
Harken also provides the counterparts of the 3-way Fast-on connectors and of the boat-side connector: a 3-way male connector, used for the parallel connection with the pay-out coil of the directional valve of the hydraulic Captive Winch version and for the parallel connection with the Dual Function Control Box of the electric Captive Winch version (for the details of the connections, see the ‘Electric unit wirings’ chapter of this manual).

9.3.1 Electric motor

Electric motor data	Cables
24V DC	Length: 500mm
Output power: 133W	

For wirings and connections, see the following ‘electric unit wirings’ chapter.

9.3.2 Electric unit wirings



NOTE!

Potentiometer range: from 1.5V to 9V; at 1.5V it outputs a 100% power; at 9V it outputs a 0% power.

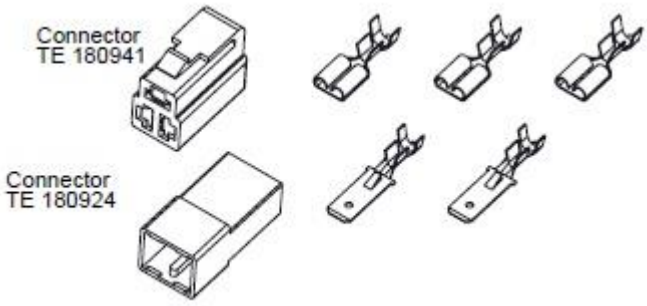
9.3.3 Electric unit equipment use

To have a maximum tensioning load of 12Kg, potentiometer has to be set at 6V.

Micro slide switch on line 2 for the reverse direction, to pull the rope out from Captive.

For the Fast-on connectors of 2 and 3 poles, provide also the counterpart and the pin to connect.
For the mating connectors as table and figure below:

Connector	Mating
TE 180923	TE 180924
TE 180940	TE 180941
Molex 430200800	Molex 430250800



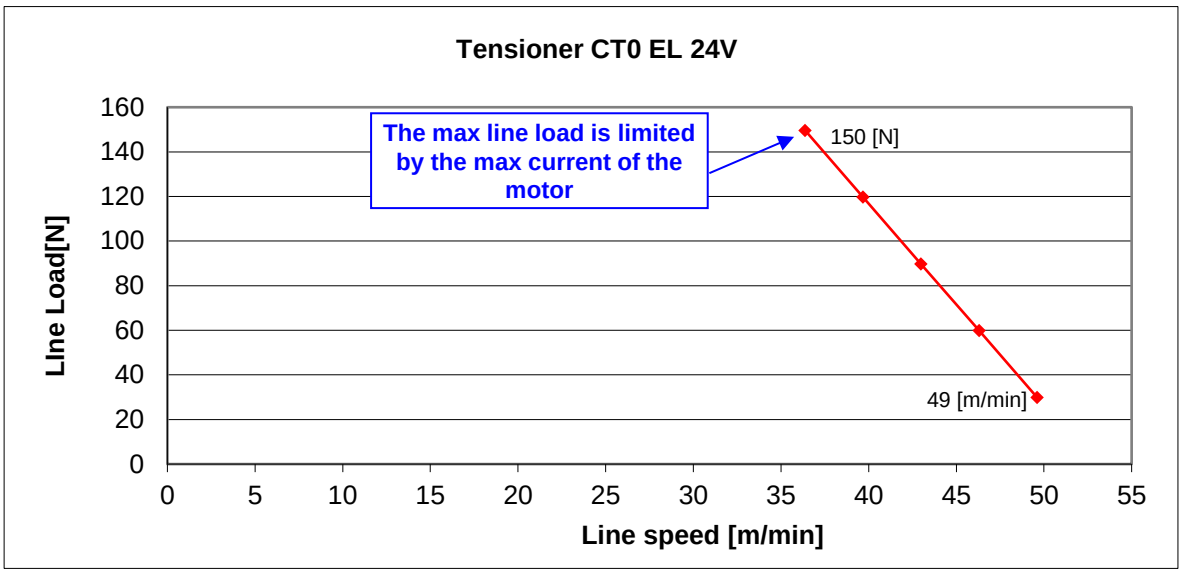
9.3.2 Performance data

Specifications of the electric motors used to power the electric Tensioner CT0 are the following:

Tensioner CT0	Operating Tension (V)	Max current absorption (A)
	24	15

Electrically operated, Tensioners have a load capacity proportional to the line speed.

9.3.3 Electric performance graph



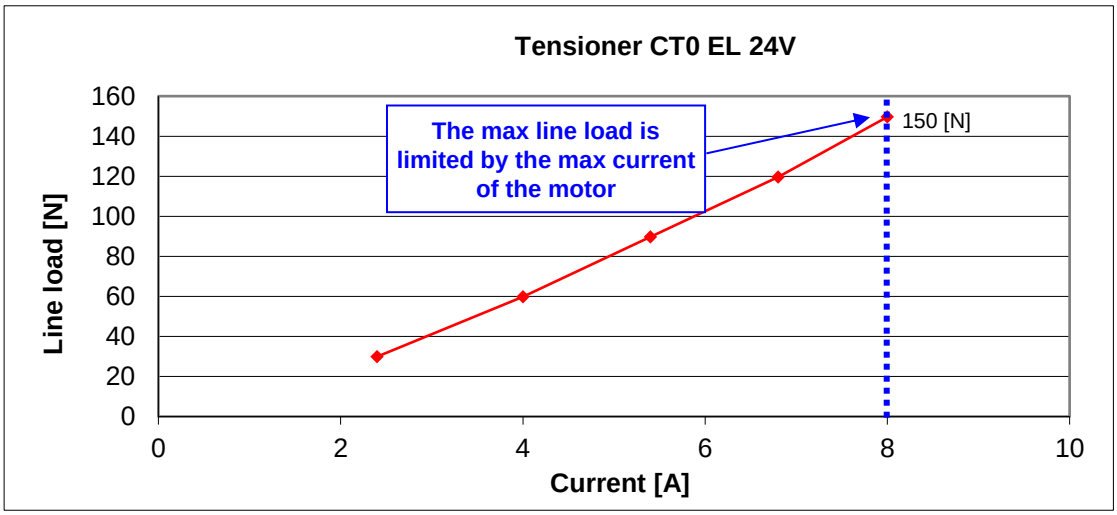
Performance evaluated using the following system:

- two batteries 12V 230Ah connected in series;

- cable length 2m

- cable section 50mm²;

Load and speed measured at tensioner



10. Installation procedure

10.1 Cleaning and maintenance

The more the tensioner is used, the more frequent it will be its maintenance and cleaning: environmental conditions and use influence the usury of the components and directly the maintenance and cleaning frequency by the user.

Complete maintenance, cleaning and lubrication must be performed every 12 months.

In particularly severe applications, check the greasing of the gears at the end of each day's racing.

WARNING!

Do not use solvents, polish or abrasive pastes on logos, silicones and stickers.
Do not use polishes or abrasive pastes on silicones or anodised, chromed plated or plastic surfaces.
Do not allow teak cleaning products or other cleaning substances containing caustic solutions to come into contact with the tensioner.

WARNING!

Use a soft cloth for all cleaning and polishing operations.
Do not use abrasive cloths on any component.

WARNING!

Do not replace or modify any part of the product with a part that is not original.
Lack of adequate maintenance shortens the life of the tensioner and may cause serious accidents and invalidate the device warranty.

NOTE!

Once the tensioner is completely disassembled (refer to the 'Disassembly procedure' chapter of this manual), clean the parts with a degreasing that does not leave residues, proper to clean metal and silicone components; rinse plastic and silicone parts in fresh water. Once you have done this, dry the parts with cloths that do not leave residue.
Inspect gears, bearings and pins for any signs of wear or corrosion.
Carefully check the teeth of gears and ring gears to make sure there are no traces of wear.
Check the roller bearings wearing status and check there are no breaks in the bearing cages.

Replace worn or damaged components.

To replace the silicone pulleys, follow steps from #1 to #11 of the 'Disassemble procedure' chapter of this manual.

10.2 Internal maintenance procedure

10.2.1 Maintenance product

The maintenance products listed below must be used:

Strong threadlocker – Green (i.e. LOCTITE® 270)

Clean the parts and apply the product, spreading it all over the thread as shown.

Assemble the parts and wait at least 45 minutes before use. To remove screws sealed with threadlocker, you may need to heat the parts to reduce the effect.

WARNING!

Do not apply this product to screws driven into carbon components.

Medium threadlocker – Blue (i.e. LOCTITE® 243)

Clean the parts and apply the product, spreading it all over the thread as shown.

Assemble the parts and wait at least 45 minutes before use.

Generally, for use on all screws, requires no heating before removal.

Synthetic GREASE Harken - BK4513

Apply a film of grease with a brush to all the parts indicated, and make sure that the film is visible. Take special care when greasing the teeth of the ring gears, the gears and the roller bearings.

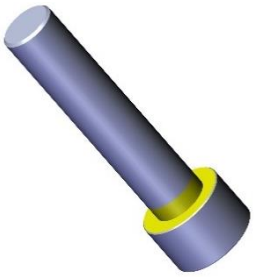
It is important to keep the teeth of the ring gears of our products greased to increase their efficiency and life.

WARNING!

Parts, and especially the gears of the tensioner that are not sufficiently greased will undergo irreversible wear that is not covered by the warranty.

Anti-corrosive lubricants (i.e. TEFGEL® or similar)

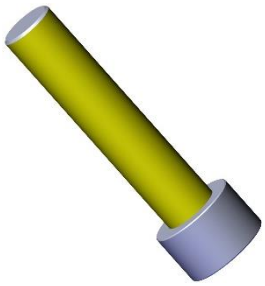
Apply sacrificial anodes or anti corrosive lubricants to prevent electrolytic corrosion between different metals in contact with one another.



NOTE! Apply the anti-corrosive lubricant with a brush on clean surfaces.

Anti-seizing (i.e. SAF-T-EZE® or similar)

This product is used to prevent problems of seizing caused by oxidation. We recommend using this or similar products on stainless steel screws where the use of Loctite is not specifically requested.



NOTE! Apply the anti-seize with a brush.

Light oil (Vaseline oil or McLube One drop®)

This product is used to lubricate balls and plastic roller bearings.

WARNING!

Do not use Vaseline oil on the pawls

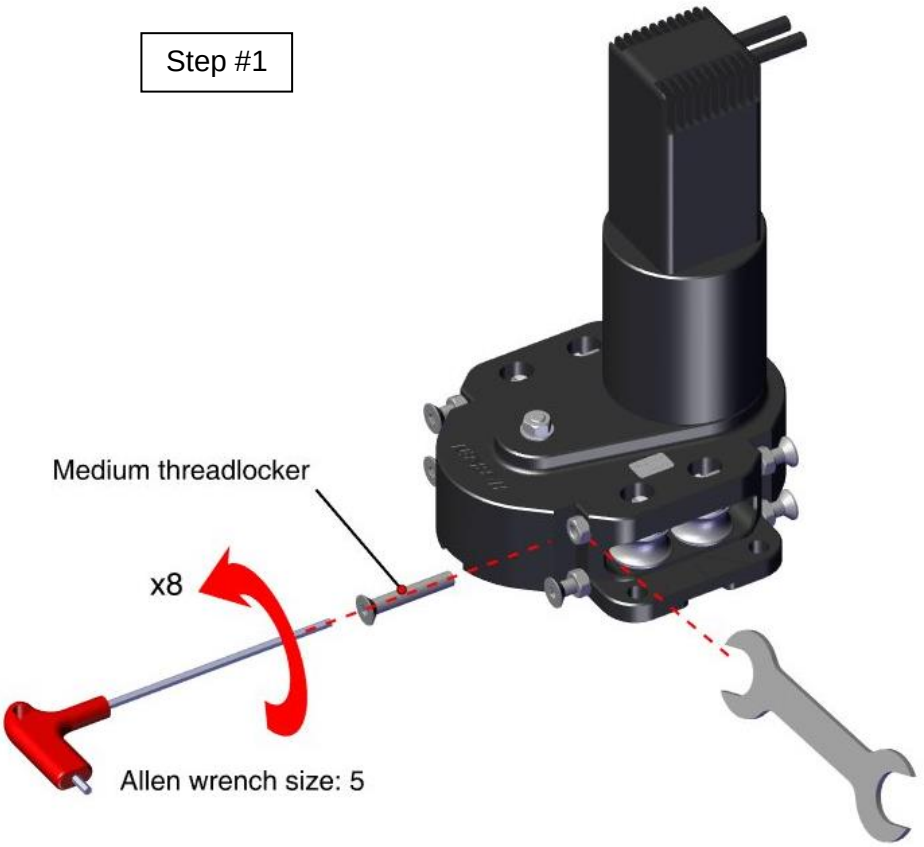
10.2.2 Tools

Make sure having the correct tools needed to disassemble the tensioner:

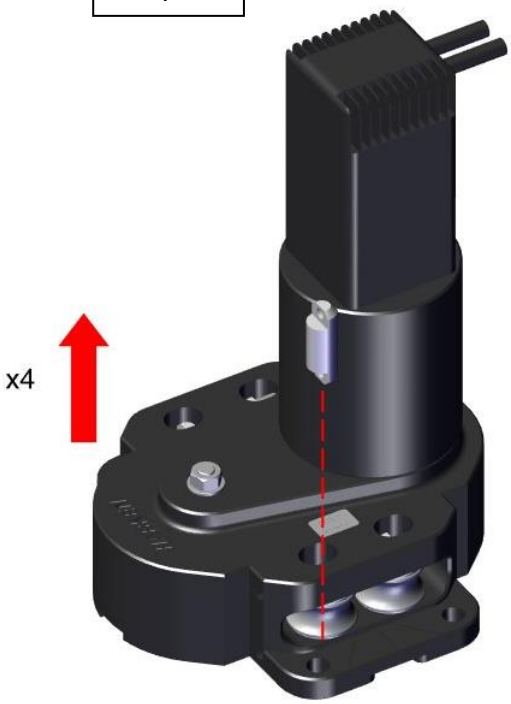
- Set of allen wrenches: n°4; 5; 6
- Hammer with rubber head
- Rags

10.2.3 Disassemble procedure

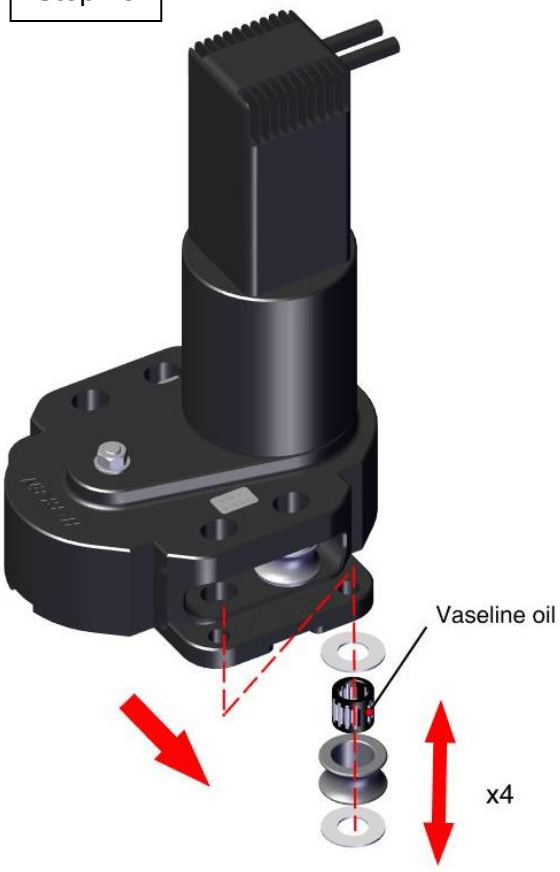
Step #1



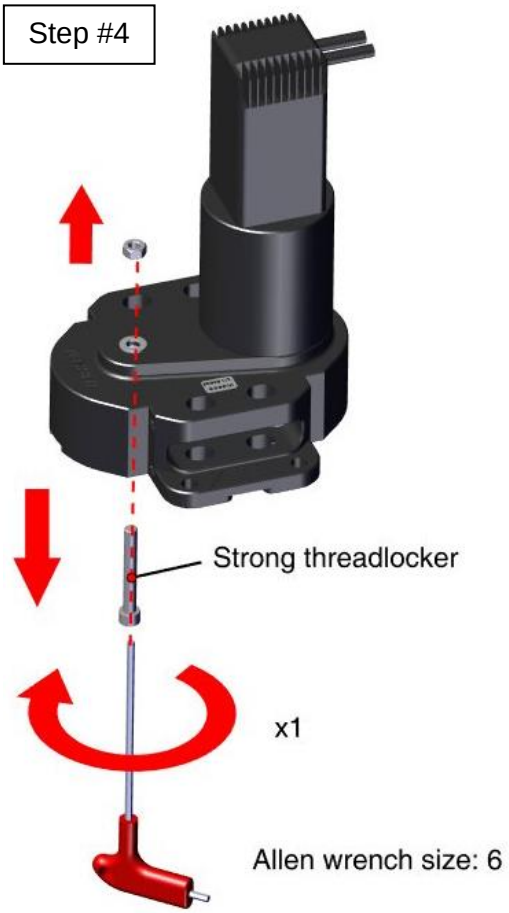
Step #2



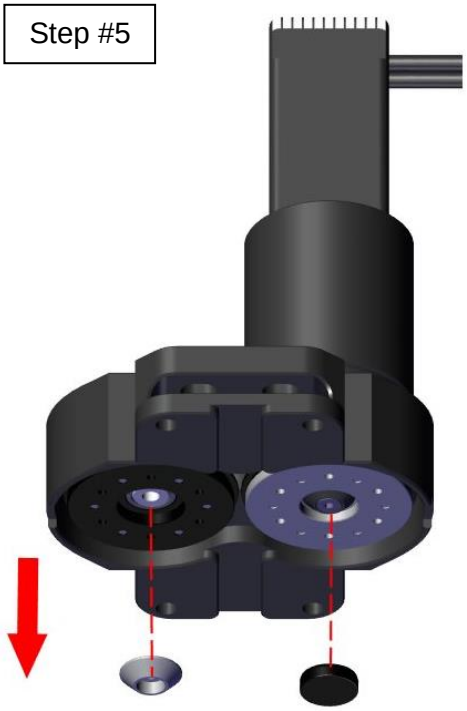
Step #3



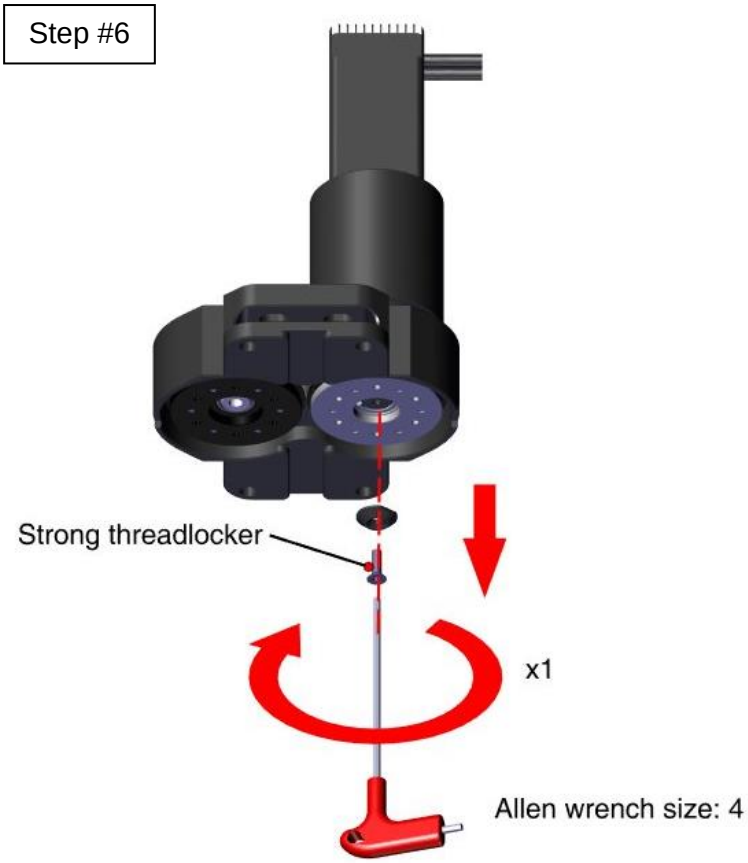
Step #4



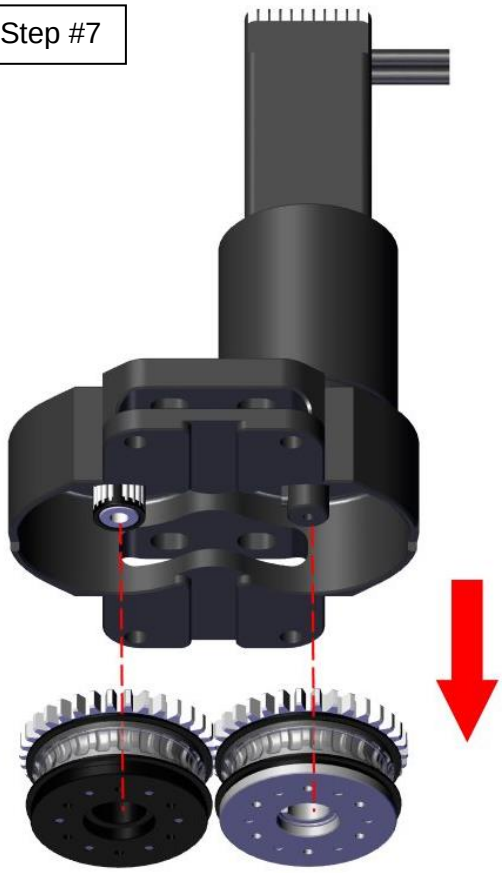
Step #5



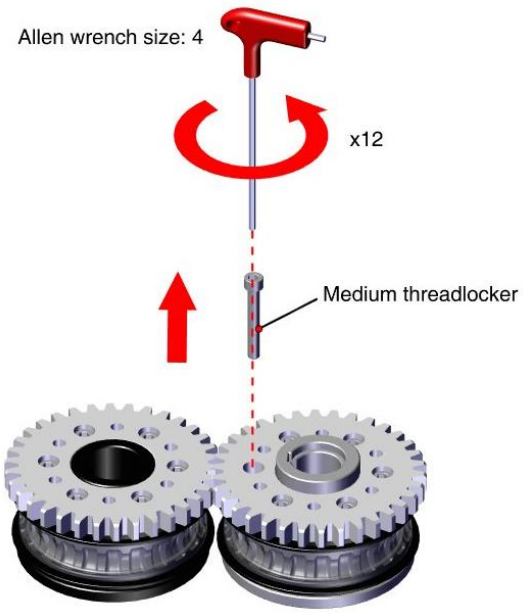
Step #6



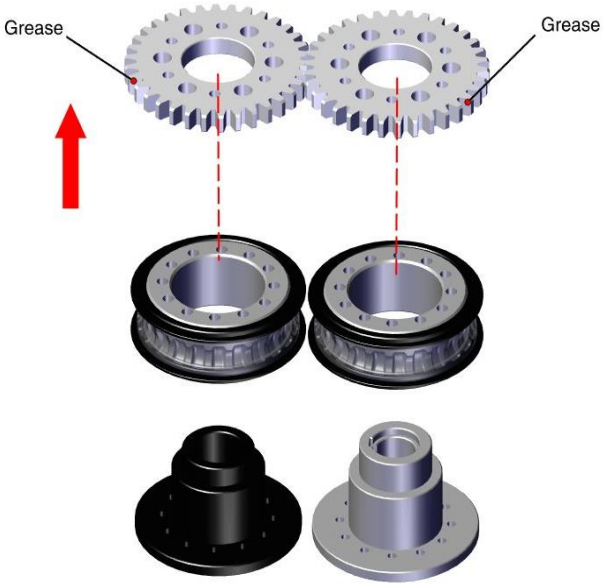
Step #7



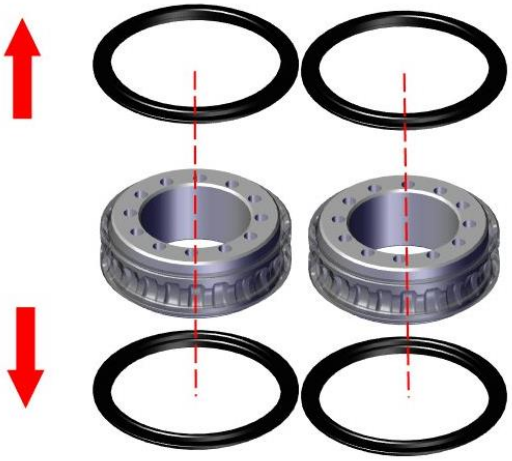
Step #8



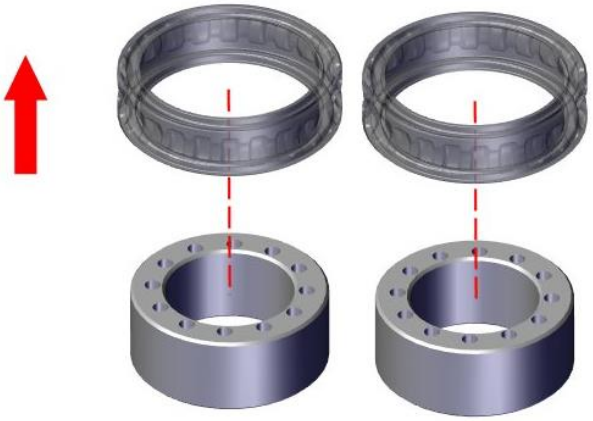
Step #9



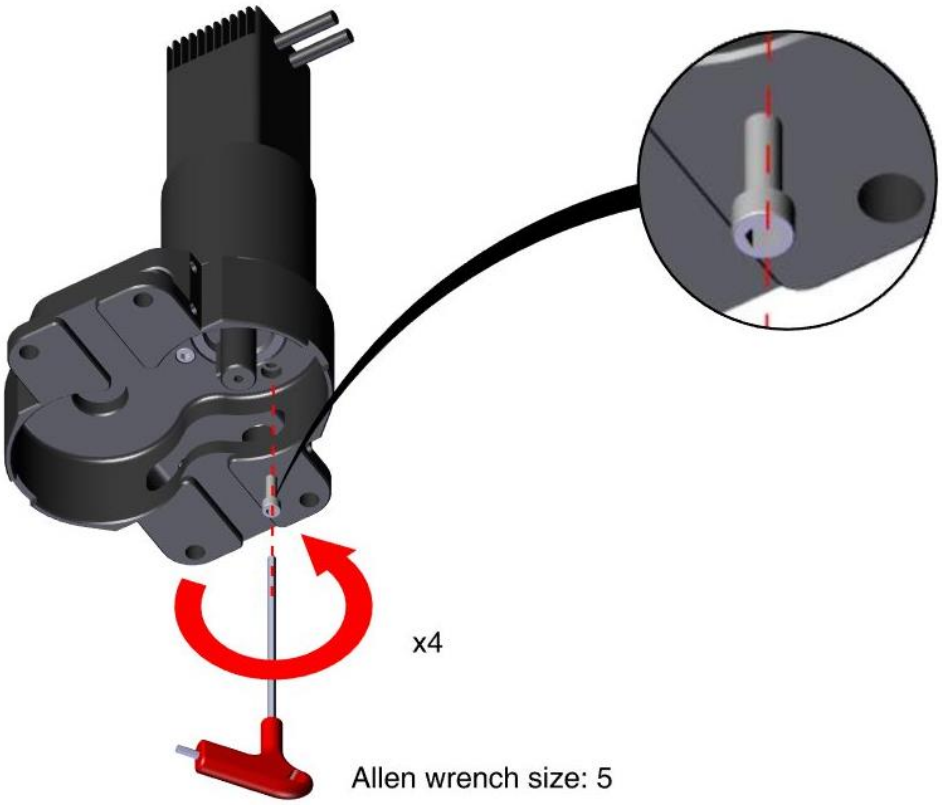
Step #10



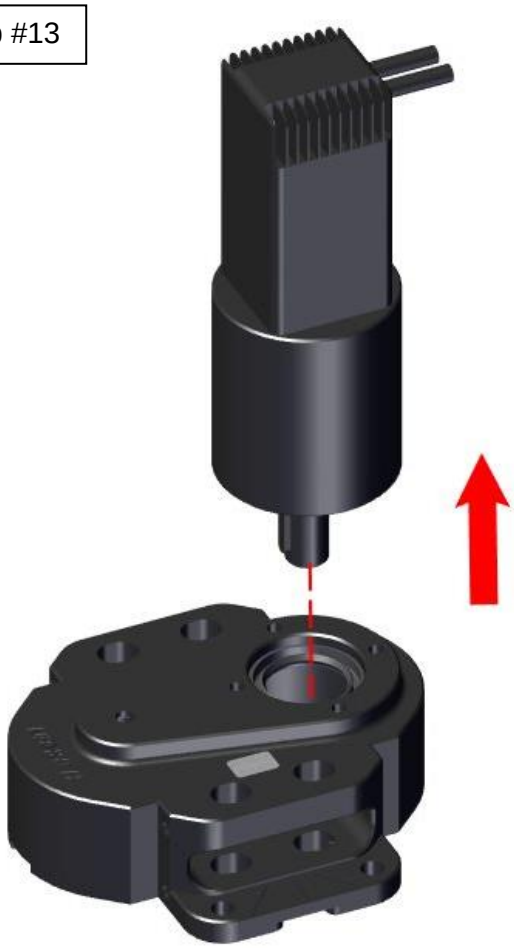
Step #11



Step #12



Step #13



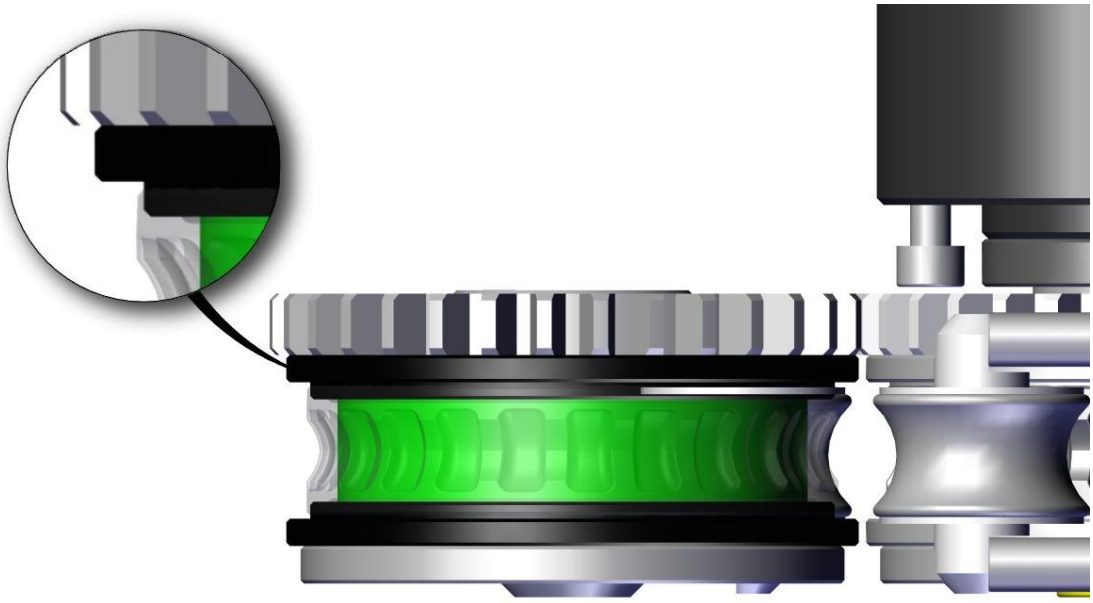
11. Assembly

Once maintenance is finished, reassemble the tensioner in reverse order with respect to the sequence described above and using the maintenance products and taking into account the following aspects:

1. Inserting of the lipped rings into the slots of the pulley
2. Screwing torques to apply
3. Marking the screwed bolts

11.1 Lipped rings

Pay attention to insert the lip of the ring into the slot of the pulley:



11.2 Torque

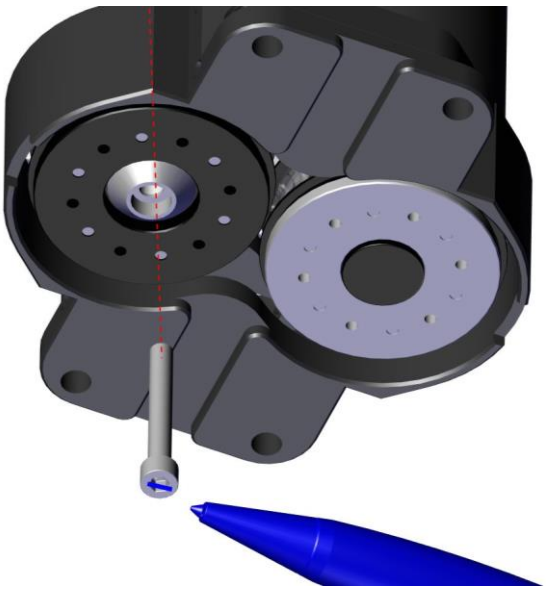
NOTE!

Pay special attention to screw bolts with the proper torque, as indicated in the maintenance steps #4, #6 and #12.

11.3 Marking

NOTE!

For the bolts of maintenance steps #4, #6 and #12 after screwing pay special attention to mark the screwed bolts with a coloured sign, similar to the following one:



12. Troubleshooting

To identify the various components, refer to figures of the disassemble procedure for the tensioner maintenance.

PROBLEMS	POSSIBLE CAUSES	POSSIBLE SOLUTIONS

13. Ordering spare parts

Spare parts can be requested from Harken® as described in the Harken® Limited Worldwide Warranty available on the web site http://www.harken.com/

14. Contact us

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