HARKEN®

MKIV HYDRAULIC JIB REEFING & FURLING

Unit 3

Installation Manual – Intended for specialized personnel or expert users

4379 v1 08/21



Preassembly

Introduction and safety precautions	2
Part descriptions	2 - 3
Sizing check	3
Parts	4 - 5
Rigging parts check/tools	6
Hydraulic system	7 - 8
Toggle deductions/stay into foil options	9
Top foil lengths	10 - 11
Short top foil	11
Confirm foil length	12

Assembly

Foils/connectors	13 - 18
Bottom foil/connectors/halyard swivel	19
Lower unit to foil	20
Rod rigging: rod adapter stud	21
Attach turnbuckle/toggle	22 - 23
Attach hydraulic cylinder	23 - 24
Feeder/final	25

Commissioning

Turnbuckle on boat	26
Halyard swivel height/lead angle	27
Halyard restrainer/tension	28

Operation

Halyard: headstay tension	29
Reefing/secure sail	30
Manual operation	31
Race conversion	32

Maintenance/Inspection/Decommissioning 33

Troubleshoot/Warranty 34

Appendix

Component part number list	35 - 37
Toggle dimensions	38
Dimensions/sailmaker's instructions	39

Please read these instructions carefully before installing, servicing, or operating the equipment.
This manual may be modified without notice. See: www.harken.com/manuals for updated versions.
PLEASE SAVE THESE INSTRUCTIONS

Introduction

This manual gives technical information on installation and service. The information is ***destined exclusively*** for specialized personnel or expert users. Installation, disassembling, and reassembling by personnel who are not experts may cause serious damage to property, or injury to users and those in the vicinity of the product. If you do not understand an instruction, contact Harken.

The user must have appropriate training in order to use this product.

Harken accepts no responsibility for damage or harm caused by not observing the safety requirements and instructions in this manual. See limited warranty, general warnings and instructions in www.harken.com/manuals.

Purpose

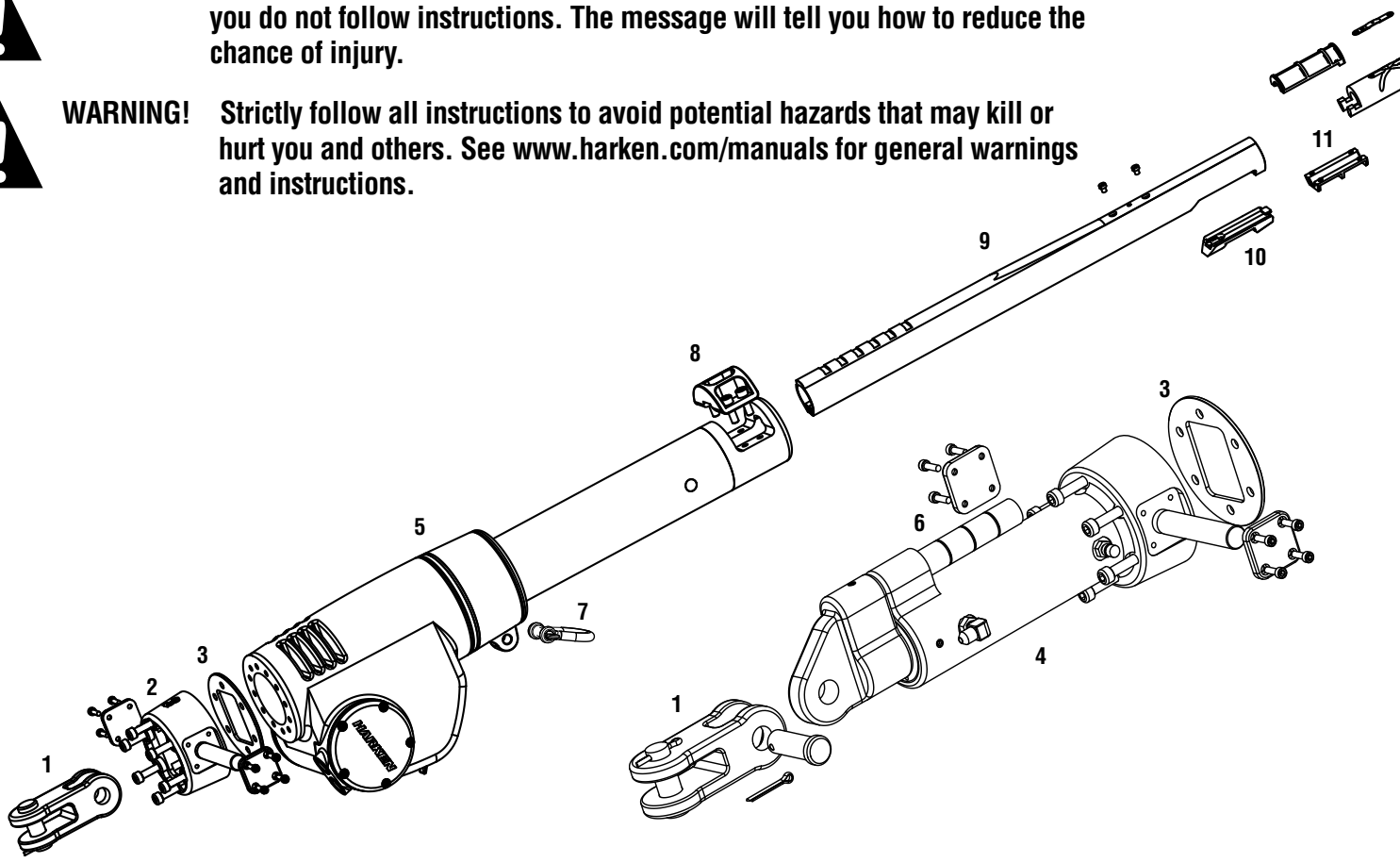
Harken® jib reefing and furling is designed for rolling sails on sailboats to reduce sail size or to completely roll the sail so wind has little effect. Use of this product for other than normal sailboat applications is not covered by the limited warranty.

Safety precautions

WARNING! This symbol alerts you to potential hazards that may kill or hurt you and others if you don't follow instructions. The message will tell you how to reduce the chance of injury.

CAUTION! This symbol alerts you to potential hazards that may hurt you and others if you do not follow instructions. The message will tell you how to reduce the chance of injury.

WARNING! Strictly follow all instructions to avoid potential hazards that may kill or hurt you and others. See www.harken.com/manuals for general warnings and instructions.



Part Descriptions

1) Jaw/jaw toggle
2) Toggle housing
3) Toggle housing insulator
4) Hydraulic cylinder
5) Lower unit
6) Calibrated guide
7) Shackles
8) Foil clamp
9) 610 mm (2') bottom foil
10) Feeder
11) Connector bushing
12) Bottom connector
13) 2.13 m (7') foil
14) Connector screws
15) Connector wedge
16) Connector
17) Halyard swivel
18) Trim cap
19) Trim cap screws



This manual shows both black and clear foils. In April 2021 MKIV furlers began shipping with black foils. Clear anodized foils also available.

See page 39 for all toggle dimensions

Sizing check

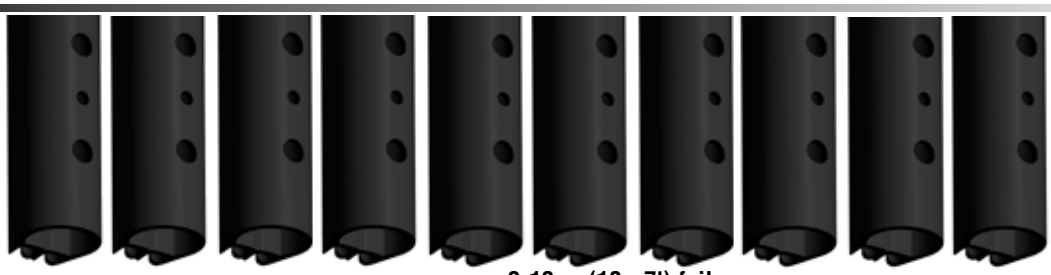
1. Check headstay and clevis pin dimensions in chart below.

2. Harken does not recommend drilling boat's chainplate or toggle. Bushings may be required to fit boats with smaller clevis pin sizes.

WARNING! Do not drill boat's chainplate or toggle. This may result in rig failure. Use the correct size toggle and clevis pin.

3. Will lower unit fit on bow? See page 9. If necessary, use an additional toggle to slightly raise unit.

	Unit part no.	Description	Wire Ø	
UNIT 3	7413.15	**MKIV hydraulic unit 3 (aluminum foils)** Note: Black foils standard. Silver foils available.	7/16", 1/2"	11 mm, 12 mm
			Rod Ø	
	7413.16	**MKIV hydraulic unit 3 (carbon foils)**	-22, -30	9.53 mm, 11.10 mm
	Toggle part no.	Description	Toggle clevis Ø	
	7413.25 3/4	Toggle assembly	3/4"	19.1 mm
	7413.25 7/8	Toggle assembly	7/8"	22.2 mm
	7413.26 3/4	Hydraulic cylinder/toggle	3/4"	19.1 mm
	7413.26 7/8	Hydraulic cylinder/toggle	7/8"	22.2 mm



2.13 m (10 - 7') foils
Unit 3, 4



2' (610 mm)
Bottom Foil



Silver foils available



Halyard swivel
unit 3H



Lower unit
unit 3H



Drill adapter for
manual drive



Emergency
crank handle

Main components

Description	Part no.	Qty
Lower unit	**See parts list**	1
7'(2.13 m) foil, black anodized, standard	**7413.30.BLACK**	10
2'(610 mm) bottom foil, black ano, standard	**7413.33.BLACK**	1
7'(2.13 m) foil, clear anodized, special order	**7413.30.CLEAR**	10
2'(610 mm) bottom foil, clear, special order	**7413.33.CLEAR**	1
Halyard swivel	**H-39392**	1
Emergency crank handle	**7430**	1
Drill adapter for manual drive	**7431**	1



Connector bushings



Bottom connector

Connectors



Plastic connector wedges



Foil screws



Trim cap



Trim cap screws



Feeder



Prefeeder



Bow shackles



Red Loctite® adhesive



Blue Loctite adhesive



5200 adhesive

Injector



3, 4, 6, 10 mm

Loctite is a registered trademark of Henkel AG & Company KGaA.

Other components

Description	Unit	Part no.	Qty	Size
Connectors	3	**7413.31F**	9	9.75" (248 mm)
Bottom connector		**7413.32F**	1	14" (356 mm)
Connector bushing set		**HFG297** (20 EA H-42073/H-42074)	1	—
Plastic connector wedge set		**HFG324** (22 EA H-39487)	1	—
Foil screw set		**HFG349** (46 EA HFS1106)	1	—
Trim cap set		**HFG682** (H-39751 / H-39752)	1	—
Trim cap screw set		**HFG672** (3 EA HFS1127)	1	—
Prefeeder		**947**	1	—
Feeder with screw and tab		**H-39756**	1	—
10 mm bow shackle		**2124**	3	10 mm
Red Loctite		**HFG739**	2	.017 oz.
Blue Loctite		**833**	1	.017 oz.
Injector, 1 oz. 5200 adhesive		**HFG725**	1	1 oz.

Tools

Description	Unit	Qty
3, 4, 6, 10 mm hex wrenches	3	1 each

Toggle assembly

1. Harken toggle assembly or hydraulic cylinder required. Sold separately.
2. Mating turnbuckle components with eye at lower end must be purchased separately. See page 10.
3. Headstay may require cutting and shortening to fit Harken toggle. Some headstays may remain uncut by replacing lower stud of turnbuckle with stud/eye, eliminating extra toggle.
4. Rod rigging requires Harken rod adapter stud.

WARNING! A stay that is old or damaged may break suddenly, causing an accident. Headstay condition should be checked by a professional rigger before reusing.

Hydraulic hoses and adapters

Hoses and adapters are not supplied with furler. See next page for specifications.

Hydraulic length-adjusting cylinder (sold separately)



Unit	Part no.
3H	7413.26 3/4
	7413.26 7/8

Harken toggle assembly housing (sold separately)



Unit	Part no.
3H	7413.25 3/4
	7413.25 7/8

Rod rigging Harken rod adapter stud required (sold separately)



Unit	Part no.
3H	7426 -22
	7427 -30

Tools required



1. Long tape measure	6. Side cutters	11. Center punch
2. Short tape measure	7. Rat-tail file	12. Rigging or black tape
3. Power drill	8. Hex wrenches (provided)	13. Scissors
4. Drill bit – 5/32" (4 mm)	9. Slotted/Phillips screwdrivers	14. Metal straight edge
5. Hacksaw	10. Needle-nose pliers	15. Hammer
16. Metric ball-end hex wrenches (recommended but not required)		

Adhesive alert

MKIV furlers are shipped with 3M 5200 adhesive. Use adhesives on dry connectors and foils using the special injection system described in the assembly section. Parts may immediately be exposed to rain. Cure is best at 70° F (22° C) with 50% humidity. Do not apply at temperatures below 40° F (5° C) and above 100° F (38° C).

Although adhesive has not cured, it will remain in place on foil joints whether they are left on the ground or raised up on boat. Foils can be raised immediately after assembly and sails fitted.

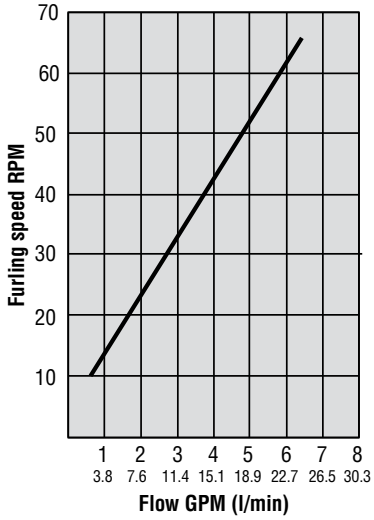
Note: A small amount of adhesive may bulge out of injection ports. If possible, let system sit for several days before sailing. If adhesive gets on sails, remove using acetone. For faster-curing adhesive, purchase 4200 Fast Cure adhesive sealant.

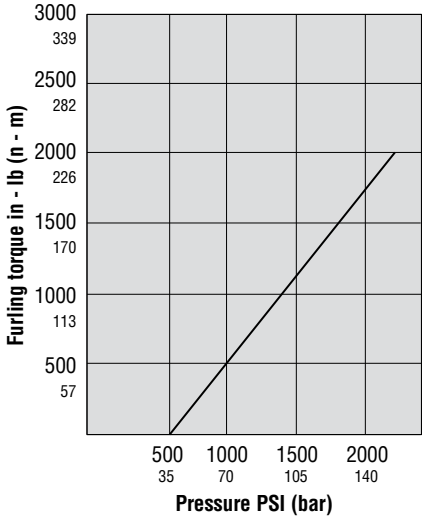
Note: Damaged foils can be repaired. Use a hand-held propane torch to heat joints until foils can be pulled apart.

Furler power requirements

The furling unit and hydraulic tensioning cylinder will work with all current Harken hydraulic power plants.

Unit	Recommended flow rate
3	4 g/m 15 l/m





Maximum operating pressure

Set relief valve on power plant at 140 bar or 2000 PSI. Harken powerpacks ship with valves set at 140 bar.

Valves on power unit

Furler can be used with open or closed center, 4-way, 3-position control valves.

Gear oil specifications

Unit is sealed with a light bath of ISO 68 gear oil.

IMPORTANT! The only parts of furler to be disassembled by installer are the torque tube clamp and toggle housing. All other work should be performed by factory-authorized personnel. Work performed by unauthorized personnel may void the Harken limited warranty.

Hose and fitting selection recommendation

Hose type - SAE 100 R8 hose. Alternatively SAE 100 R2 may be used.
Hose size - Use -6 hose (3/8" ID). Long runs may require larger hoses.
Hose end fitting, furler end - Female swivel hose end to mate with adapter.
Note: See *hydraulic connection to furling unit*, next page.

Measure hydraulic hose runs

Remember these important points when measuring runs.

1) Short straight runs between HPU and function are best.
2) Avoid sharp edges which may chafe the hose.
3) Minimize fittings/connections throughout the run to avoid possible leak points.
4) Minimize 90° bends. They increase system losses and decrease performance. If unavoidable, use a 90° swept fitting. Do not use a 90° elbow fitting.

CAUTION! Do not exceed the manufacturer specified minimum bend radius.

When ordering, specify that all hoses are flushed, filled with clean oil, and capped at point of purchase. HARKEN recommends ISO 46 grade oil. If hoses are shipped, they may not contain oil.

CAUTION! Always ensure pressure rating for selected hose is equal to or greater than 2000 psi/140 bar.

Note: Hose shortening - Hydraulic hoses typically shorten 2% to 4% of total length when pressurized. When routing and measuring hose lines, ensure extra hose length is added to compensate.

Hydraulic connection to furling unit

Furling unit has SAE female straight thread ports to accept -6 ORB fittings. Use male to male adapters in the furler so you can use female swivel hose ends. Use -6 JIC X -6 ORB adapters - Stainless steel

IMPORTANT! Do not use PTFE tape or sealant on threaded connections to Harken ports. Using PTFE tape can damage threads.

Hydraulic oil

Use only hydraulic oil ISO 46 grade or equivalent.

CAUTION! Hydraulic oil may cause skin irritation.

IMPORTANT! Hydraulic oil may damage paint and some surfaces.

Leak check

To perform leak check, run furler in a single direction for 5 – 10 seconds. If installation was completed with empty hoses, increase the run time to 10 – 30 seconds. Perform the following:

1) Confirm hose run is correct by verifying operation of intended function.

2) Inspect each fitting for leakage.

3) Tighten fitting as necessary.

4) Repeat procedure for all functions.

IMPORTANT! If installation was completed with empty hoses, check the oil level indicator, and add oil as necessary.

One-way function flush

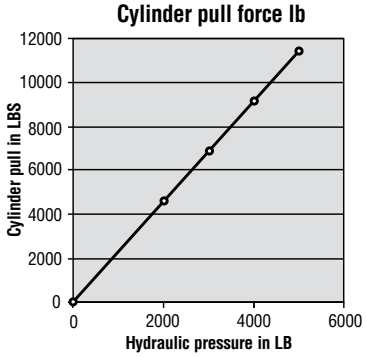
Flush the pump motor through the power unit system filter by running furler in a single direction. Run in same direction as previous step. This process helps ensure system cleanliness by depositing contaminates into the power unit system filter.

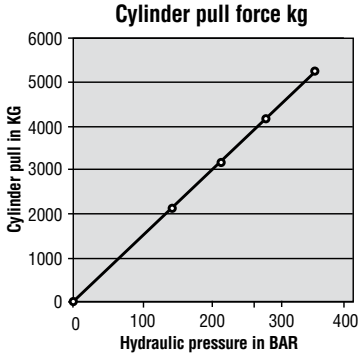
Hydraulic length adjusting cylinder (optional)

Specifications:

Stroke: Unit 3: 100 mm (4")

Performance:





Pressure requirements

The hydraulic length adjusting cylinder requires a pressure of max 5000 lb (350 bar) to develop rated pull force on the headstay. The hydraulic pressure for the cylinder can be provided by a high pressure manual system or the boats power unit. If the cylinder is used with a power unit that provides less than 5000 psi (350 bar), a hydraulic intensifier is required to step up the pressure. Either power source requires the use of a zero-leak control valve so the pressure to the cylinder doesn't bleed down over time.

WARNING! Relieve all pressure prior to disconnecting. Only work on cylinder and connections if you are a hydraulic technician.

Hydraulic cylinder hose connection

The cylinder has a -4 JIC fitting. Choose appropriate hose and end fitting.

Cylinder gas

Cylinder is shipped without gas. Fill fitting is a Schroeder type. For best clean performance use nitrogen or argon gas pressurized to 50 - 60 psi (3.45 - 4.48 bar).

Use dimensions of Harken toggles or cylinders shown below to build stay to correct length.

Toggle assembly

Turnbuckles should be one-half (1/2) to two-thirds (2/3) open to allow shortening for new wire stretch, for fine-tuning mast rake,
and to help connect the stay.

Hydraulic cylinder

Length for hydraulic cylinder can be determined at one-half (1/2) to two-thirds (2/3) open to allow shortening for new wire stretch for fine-tuning mast rake, and to help connect the stay. Stroke length for unit 3 cylinder is 100 mm (4").



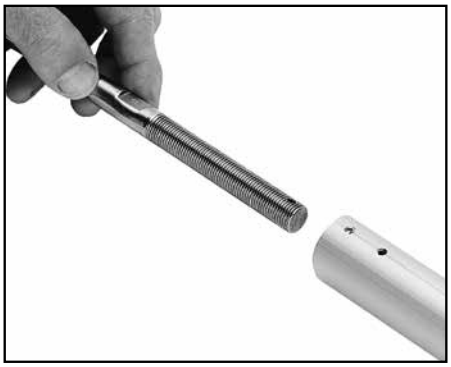
Toggle part no.	Clevis pin Ø	Pin-to-pin length
7413.25 3/4	3/4" (19.1 mm)	3 1/4" (83 mm)
7413.25 7/8	7/8" (22.2 mm)	3 7/8" (98 mm)



Hydraulic cylinder part no.	Clevis pin Ø	Max pin-to-pin length	Min pin-to-pin length
7413.26 3/4	3/4" (19.1 mm)	20" (50 mm)	16" (400 mm)
7413.26 7/8	7/8" (22.2 mm)	20 1/2" (525 mm)	16 1/2" (420 mm)

Options for snaking stay into foils

1. Swage stud at end of wire.
2. Open end of wire and install Norseman or Sta-Lok® stud after foil is assembled.
3. Rod adapter fitting (not supplied by Harken).



WARNING! Using a threaded nosepiece with only adhesive at the upper rod eye terminal may result in headstay failure. Make sure there is a mechanical lock.



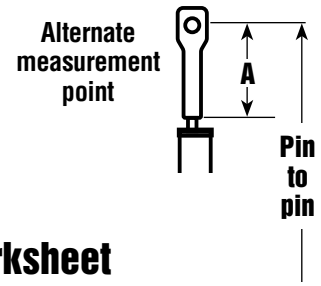


STA-LOK is a registered trademark of STA-LOK terminals.

Top Foil Length

Measure A and add to this chart and length chart below		
	Inches	mm
A		
B	1	25
E	24	610
F	23.18	589
G		
Total A+B+E+F+G		

Make sure upper measurement points of A and pin-to-pin are the same.



UNIT 3H

Top Foil Length Worksheet

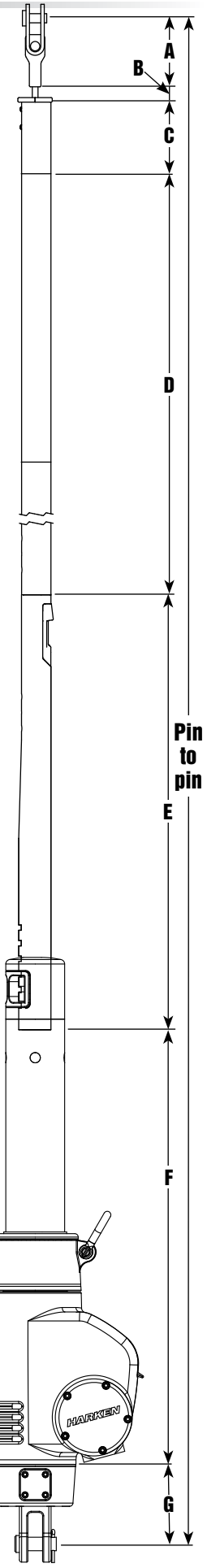
1	Pin-to-pin length	
2	Subtract ABEFG	–
3	Result (pin-to-pin – ABEFG)	
4	Subtract D	–

To find D pick number from chart below that is closest to, but not greater than total from step 3.

Inches	mm
7 x 84 = 588	7 x 2133.6 = 14935.2
8 x 84 = 672	8 x 2133.6 = 17068.8
9 x 84 = 756	9 x 2133.6 = 19202.4
10 x 84 = 840	10 x 2133.6 = 21336
11 x 84 = 924	11 x 2133.6 = 23470

Example–if result from Step 3 is:
800 inches D = 756 inches 20000 mm D = 19202 mm

5	Result (C) top foil length	



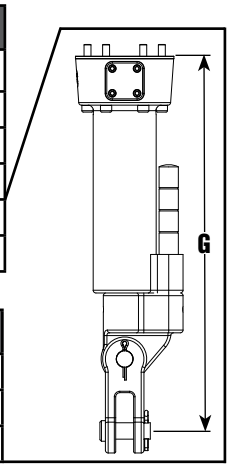
Length check

After completing worksheet above, fill in A, C, D and G below. Add A through G to confirm total equals your pin-to-pin measurement.

Length chart		
Dimensions	Inches	mm
A Center of pin to bottom of terminal		
B Bottom of terminal to top of foil	1.00	25
C Top foil length		
D Number of foils _____ x 84" (2133.6 mm)		
E Bottom foil	24.00	610
F Bottom of foil to top of toggle housing insulator	23.18	589
G Top of toggle housing insulator to clevis pin		
Pin-to-pin length		

G toggle distance from lower clevis pin to top of toggle housing insulator					
Toggle part no.	Type	Clevis pin		G distance	
		in	mm	in	mm
7413.25 3/4	Toggle assembly	3/4	19.1	4.39	112
7313.25 7/8	Toggle assembly	7/8	22.2	4.98	126
7413.26 3/4	Hydraulic cylinder/toggle	3/4	19.1	19.32*	491*
7313.26 7/8	Hydraulic cylinder/toggle	7/8	22.2	19.99*	508*

*Dimensions with cylinder 58% open



Cylinder pin Ø	G distance (closed)		G distance (open)	
	in	mm	in	mm
3/4	17.00	432	21.00	533
7/8	17.67	449	21.67	550

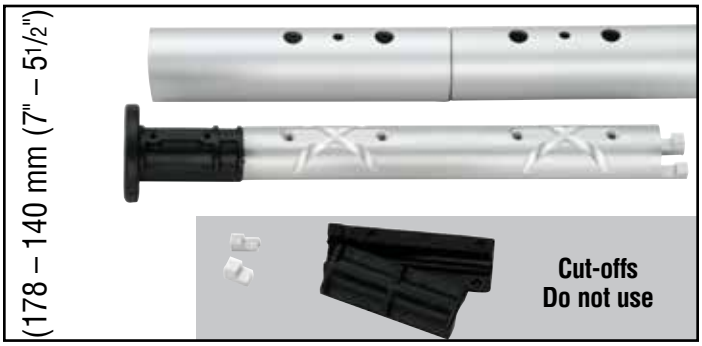
If top foil is shorter than 248 mm (9 3/4") , use one of the following techniques to ensure sufficient bearing surface for the foil in the area of the halyard swivel.



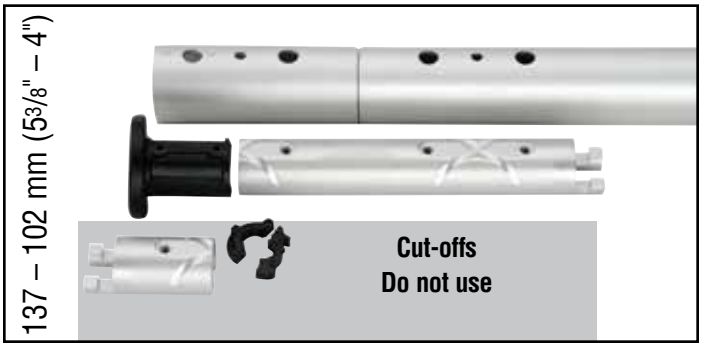
248 mm (9 3/4") No special treatment required.



244 – 181 mm (9 5/8" – 7 1/8") Do not use plastic bushing above top connector.



178 – 140 mm (7" – 5 1/2") Do not use plastic bushing above top connector. Shorten top of connector and if necessary shorten trim cap.

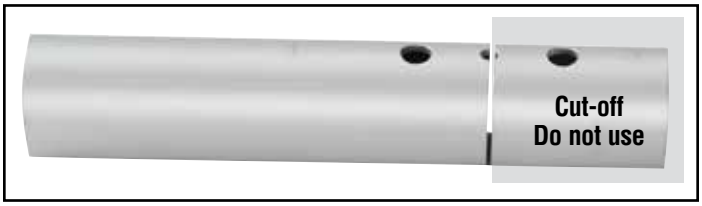


137 – 102 mm (5 3/8" – 4") Do not use plastic bushing above top connector. Cut connector right at cross formed by glue dispersion channels. Use single (1) foil screw in top foil only.



89 – 38 mm (3 1/2" – 1 1/2") Shorten top foil and adjoining full length foil so two (2) screws are used to assemble joint instead of four (4). Do not use plastic bushings above top connector.

Top foil length from worksheet	1. Initial top foil cut length	2. Cut through middle hole in top foil* Resulting top foil length	3. Shorten full length adjoining foil by cutting through middle hole*	4. Shorten connector Length	5. Shorten trim cap
3 1/2" (89 mm)	6 9/16" (167 mm)	5" (127 mm)		4 7/8" (124 mm)	No
3" (76 mm)	6 1/16" (154 mm)	4 1/2" (114 mm)		4 7/8" (124 mm)	No
2 1/2" (64 mm)	6 9/16" (167 mm)	4" (102 mm)		4 7/8" (124 mm)	No
2" (51 mm)	5 1/16" (129 mm)	3 1/2" (89 mm)		4 3/8" (111 mm)	Yes
1 1/2" (38 mm)	4 9/16" (116 mm)	3" (76 mm)		3 3/4" (95 mm)	Yes



*To allow for saw cut, position blade so upper half of middle hole is preserved.



Under 38 mm (1 1/2") eliminate top foil and run foil higher in foil clamp.

Confirm foil length by laying foils alongside stay with turnbuckle components. Pull stay out so it is straight. Attach Harken toggle to bottom of stay using cross pin. Adjust turnbuckle so that length of stay with Harken toggle will fit boat. Ideally, turnbuckle will be one-half (1/2) to two-thirds (2/3) open to allow for rig adjustment.

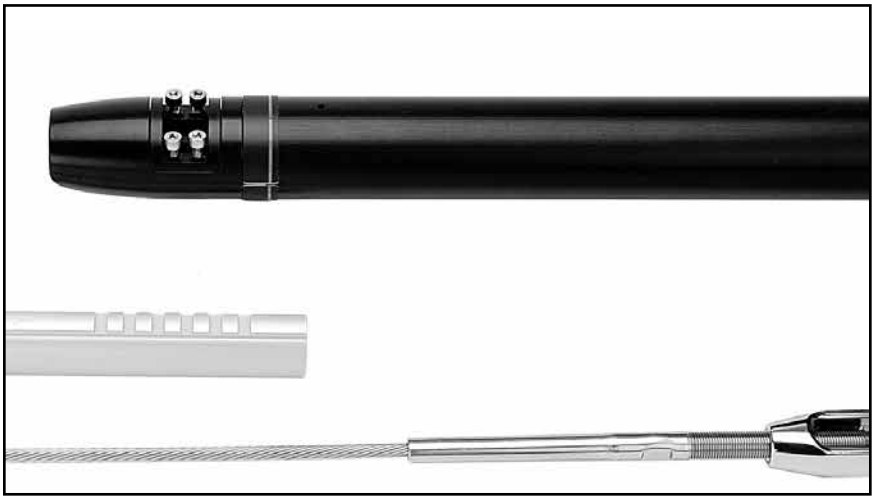
Line up lower unit so base of unit lines up with toggle housing.

Attach one (1) link plate to lower unit. Line up lower unit so link plate hole lines up with cross pin in Harken toggle. Make sure toggle is tensioned when measuring.





Line up bottom foil so foil clamp is centered or just below center of notches in bottom foil.



Note: Position top foil so that with top cap the foil will ride 25 mm (1") below terminal. If wire fitting at top of stay is swage, foil must ride just below shoulder of swage. Mark cut line on foil. Wrap tape around foil as a guide so cut is straight.

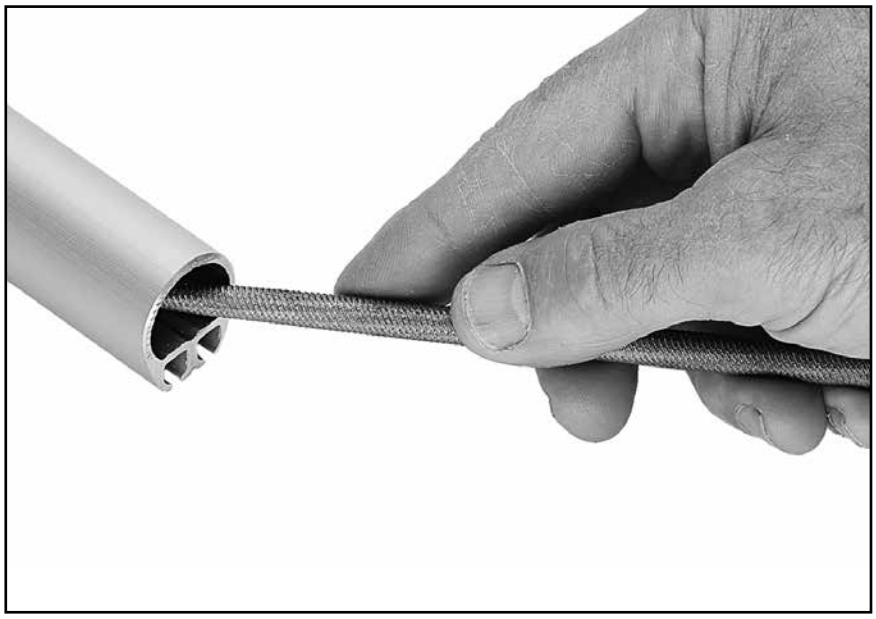
If 7304 halyard deflector is used, add 25 mm (1")



Cut foil to length using hacksaw.



Deburr inside edge using rat-tail file.



Prepare top foil for drilling.

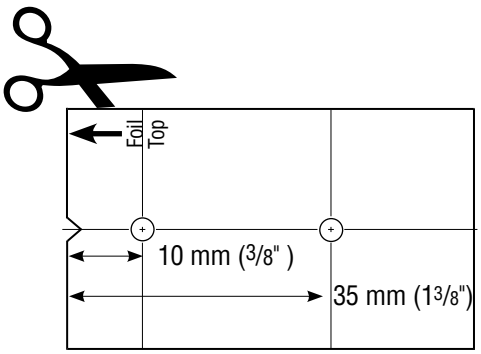
Tip: Mark top foil to distinguish from cutoff piece.

Scribe line on top of foil to mark drill holes. Lay top foil alongside cut off piece and use a flat metal object (i.e. metal ruler) to scribe top line of foil.



Cut out template at right. Line up template with top of foil and scribed line. Tape in place. Use center punch to mark holes.

Check center punch marks to confirm they are 10 mm (3/8") and 35 mm (1 3/8") from top of foil.



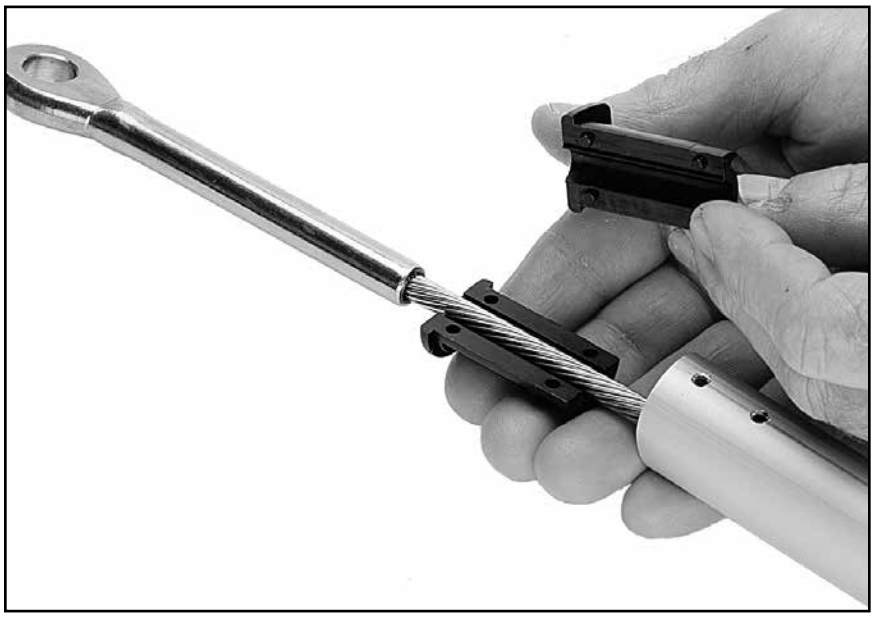
Drill two (2) 4 mm (5/32") holes for trim cap.



Lay top foil in line with others. Slide stay into top foil and down line of foils or slide each foil up stay.



Install trim cap. Place each side over wire.



Push trim cap into foil to start, then tap in using hammer.

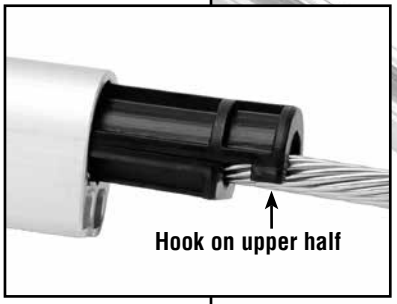
Install trim cap screws.



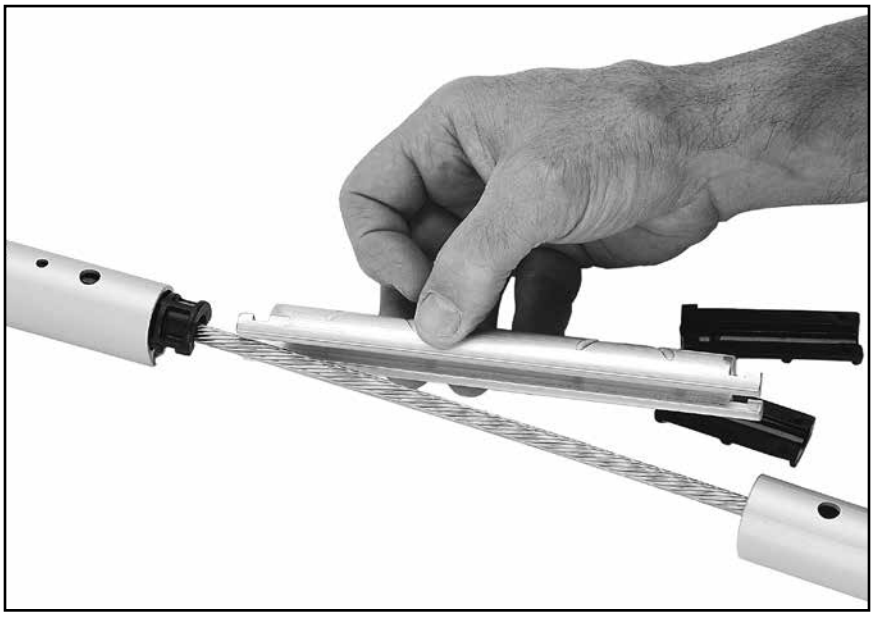
Place halves of plastic bushings on stay so hooked part of longer section faces out.

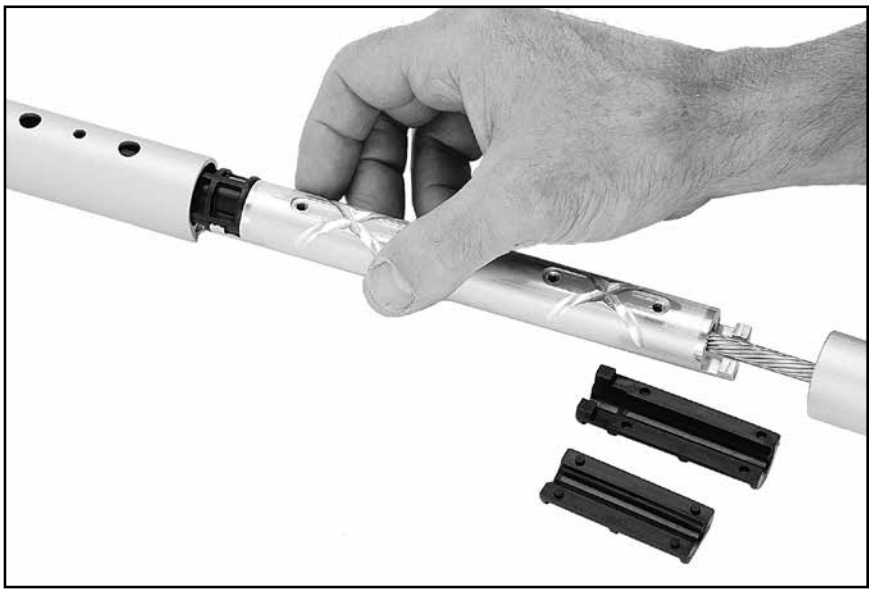
Tip: With foil screw holes up (shown below), place longer half of bushing with hook on upper half.



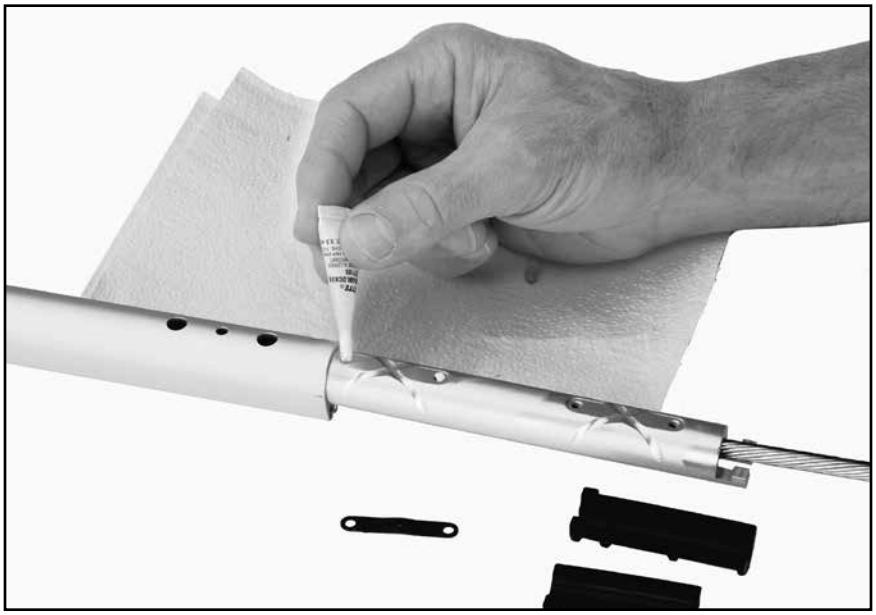


Slip connector on wire, mating hook of plastic bushing with connector.





Put a drop of red Loctite® adhesive into screw holes.



Loctite is a registered trademark of Henkel AG & Company KGaA.

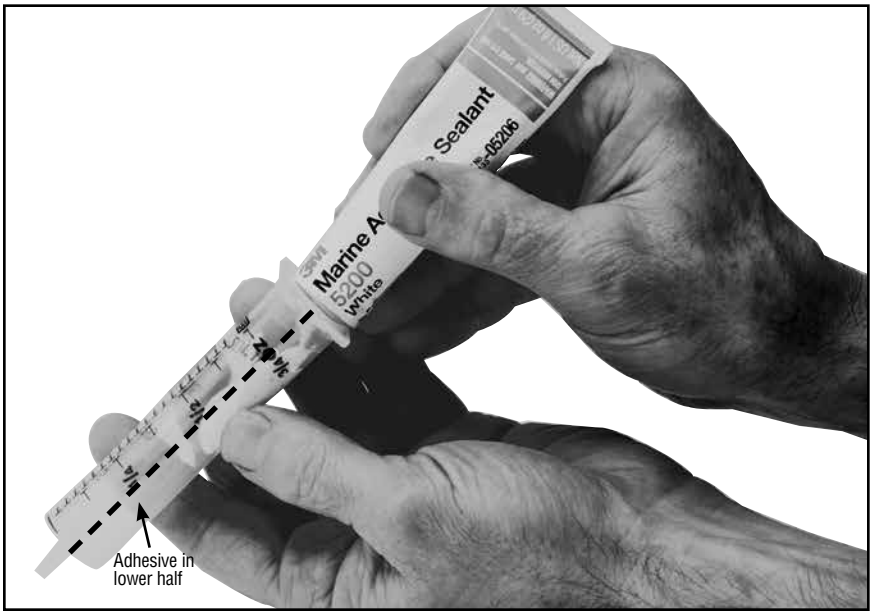
Hold plastic wedge in place with thumb as you insert into foil. Line foil holes with connector screw holes.



Loading injector with adhesive

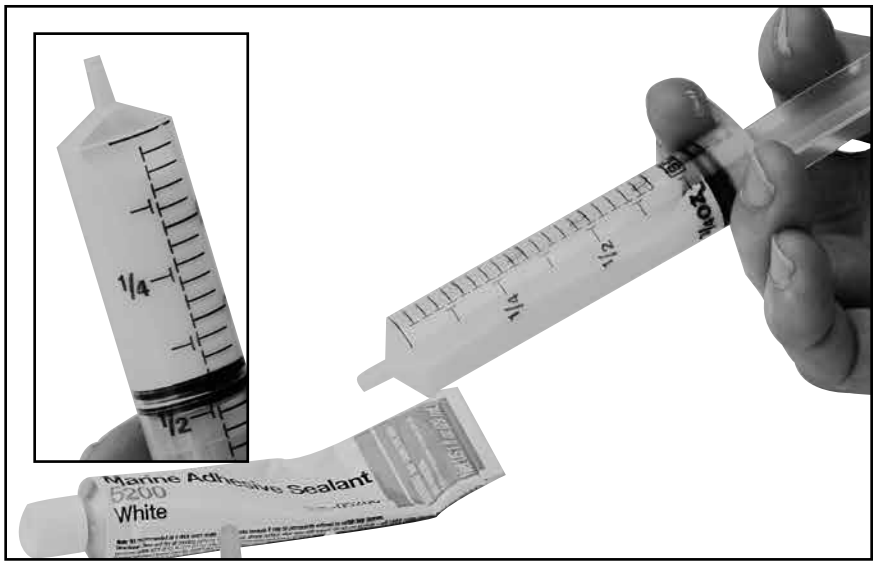
Tip: In cooler weather, keep sealed adhesive in pocket to keep warm. Use instructions below to fill injector less than half way; you will only use a small amount of adhesive. Refill if needed but do not keep open sealant for long periods. Use adhesive within three (3) hours.

Use cap of adhesive to break seal. Remove injector tip cap and plunger. Hold injector at an angle with applicator tip facing down. Squeeze adhesive into tube so lower half of injector is full. Keep tip free of sealant to let air inside.



Start plunger into injector and immediately hold upright so plunger is down and applicator tip is up.

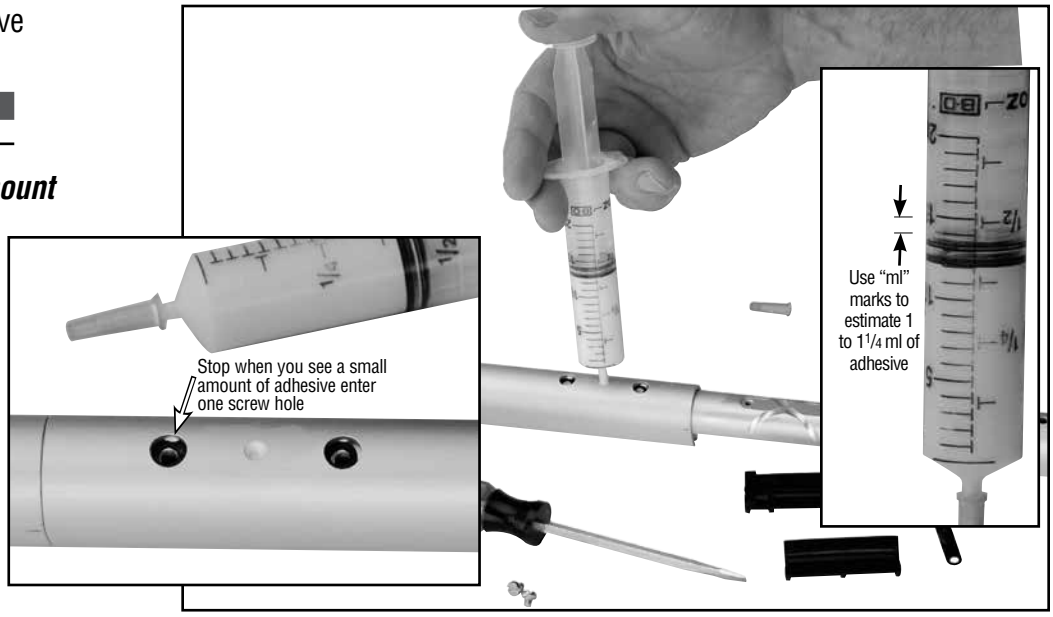
As sealant runs down toward plunger an air pocket will form near tip. Push plunger to evacuate air. Begin injecting adhesive.



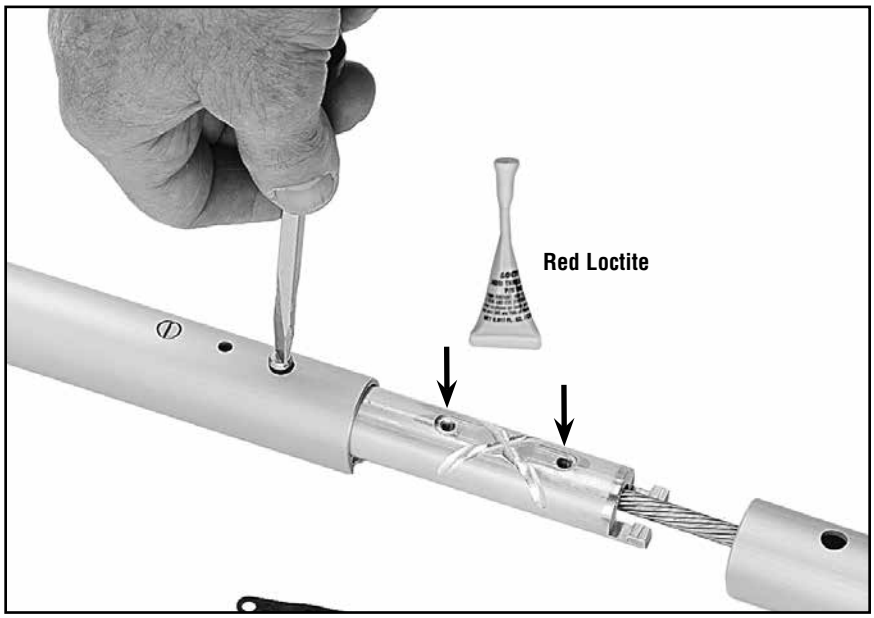
Inject a small amount of adhesive into middle hole.

Unit	Adhesive
3	1 to 1 1/4 ml

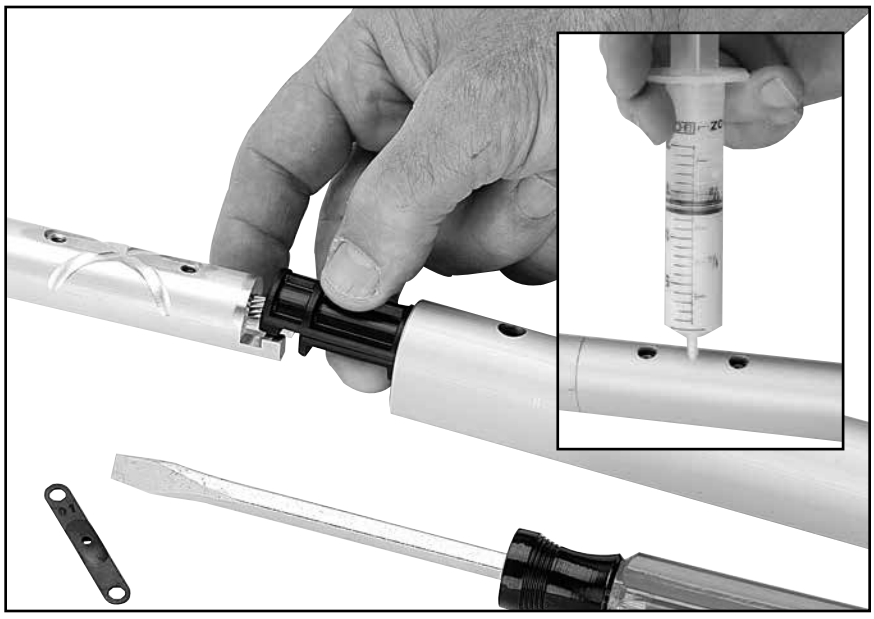
Tip: When you see a small amount of adhesive enter one screw hole, stop. You have applied enough adhesive.



Tighten screws into connector holes. Make sure a drop of red Loctite® adhesive entered each screw hole. If not, apply to screw.

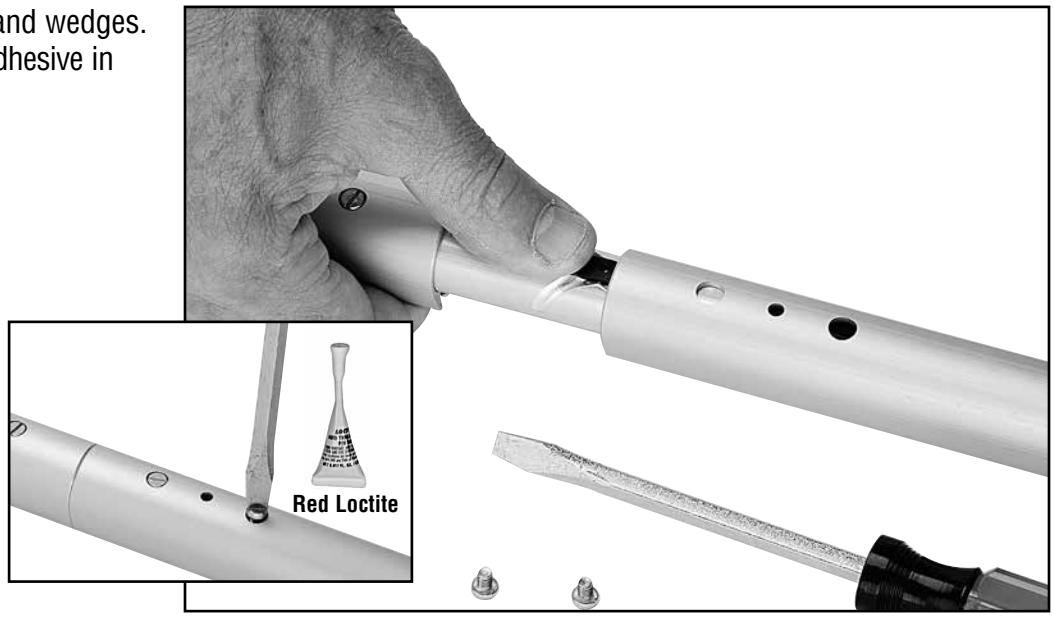


Use bushings, connector, wedge, and adhesive in other screw hole and insert into other foil. Use 1 to 1 1/4 ml of adhesive.

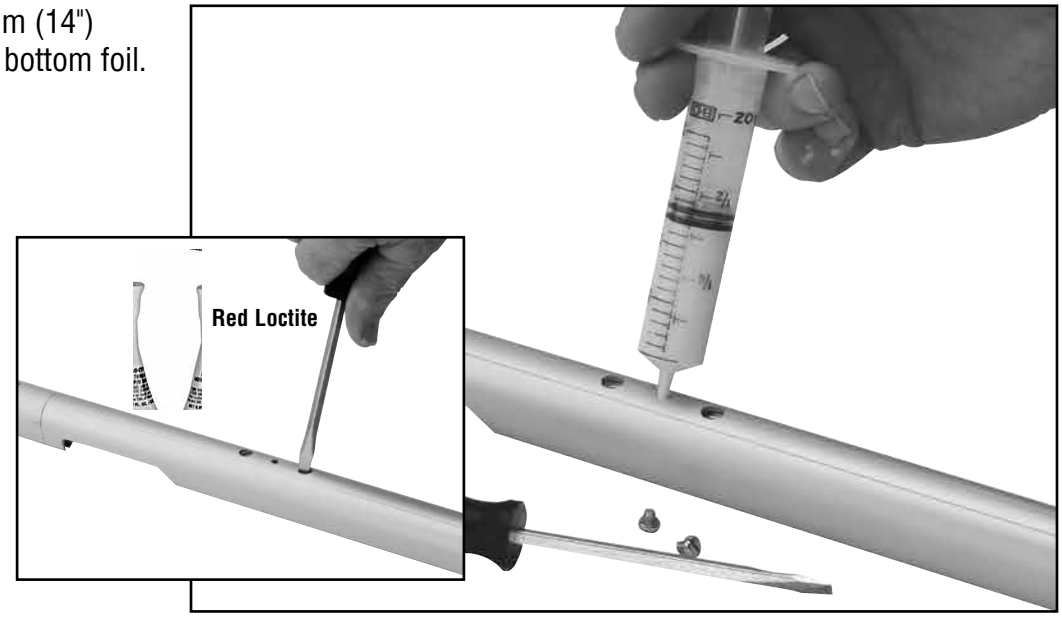


Loctite is a registered trademark of Henkel AG & Company KGaA.

Continue installing connectors and wedges. Make sure to use red Loctite® adhesive in screw holes.



Continue assembly. Use 356 mm (14") bottom connector to assemble bottom foil.



Slide halyard swivel onto foil above feeder window. Make sure taller “half” is up as shown.



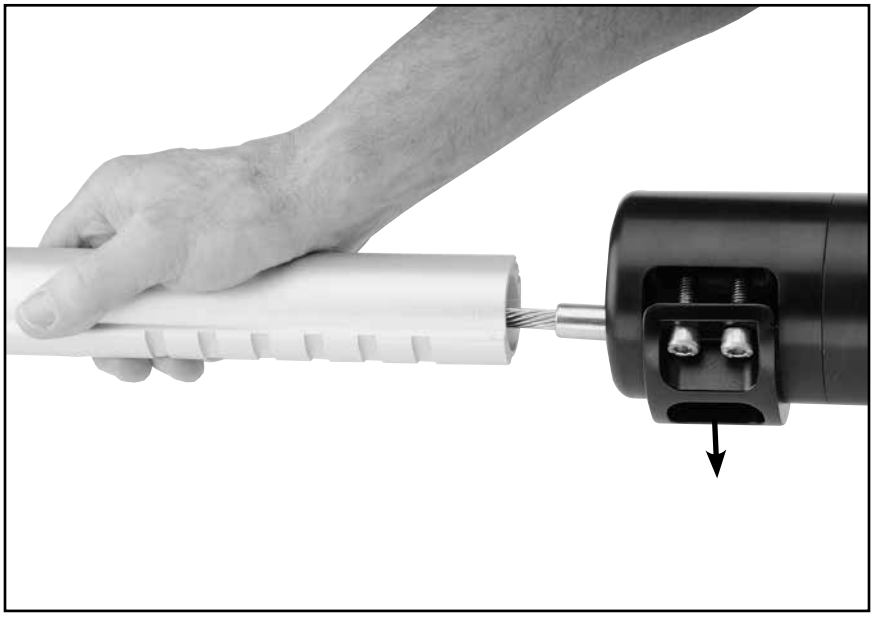
Loctite is a registered trademark of Henkel AG & Company KGaA.

Loosen foil clamp screws at top of lower unit assembly.



Slide assembly onto foils.

Tip: Face clamp downward so it clears foil notches during installation.

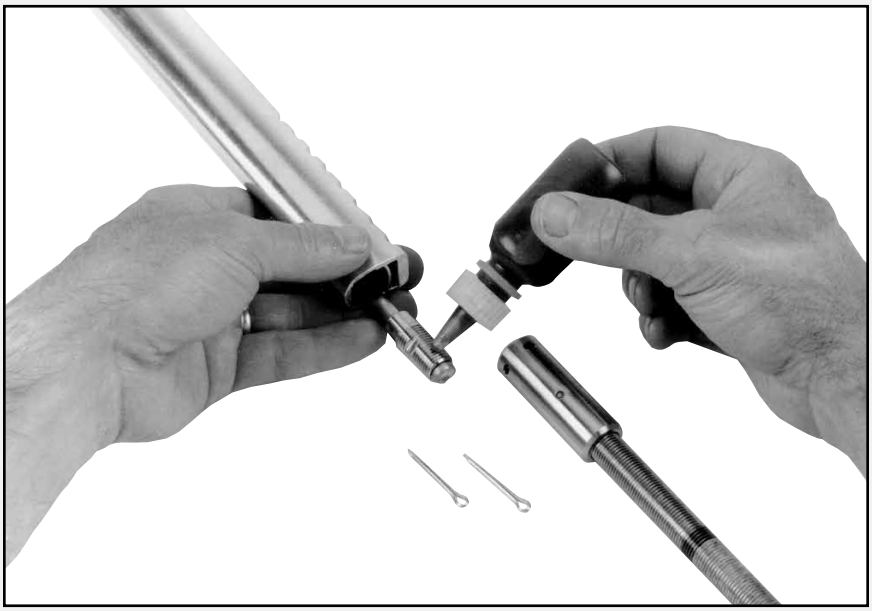


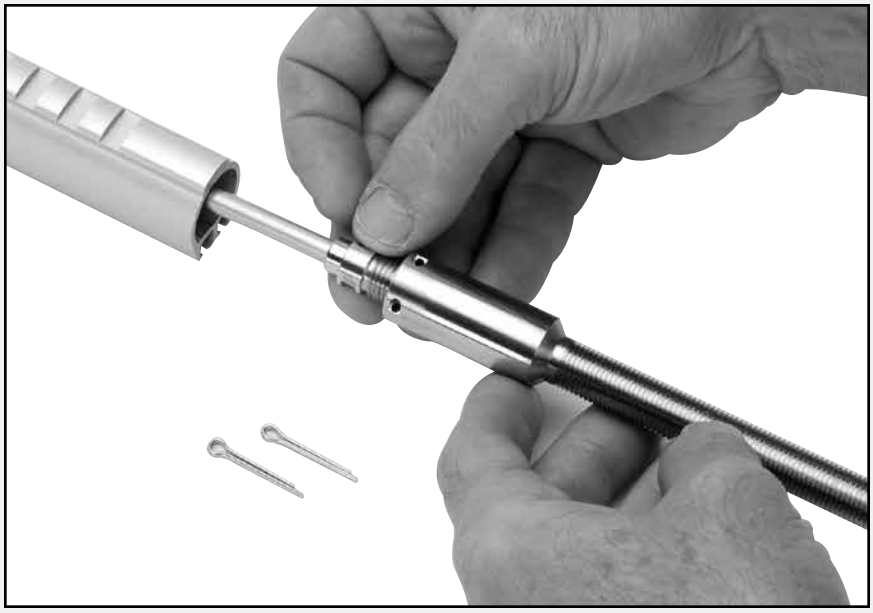
ROD RIGGING

Apply a few drops of red Loctite® adhesive to threads of nosepiece.

Screw main threaded stud portion onto bronze nosepiece until flats align with two cotter pin holes in terminal body.

Tip: Turn nosepiece completely into threaded stud portion. Flats will be close and may only require a small half turn to align with cotter pin holes.





Insert two cotter pins and spread. Clean excess Loctite from terminal body using special care to ensure that there is no Loctite on threaded stud.



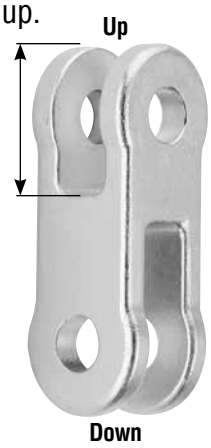
Loctite is a registered trademark of Henkel AG & Company KGaA.

Assemble turnbuckle. Slip toggle housing insulator onto threaded eye. Remove toggle plate. Use cross pin to capture eye and toggle in toggle housing.

Note: If using Sta-Lok® or Norseman stud, you must use a washer above stud as shown below.



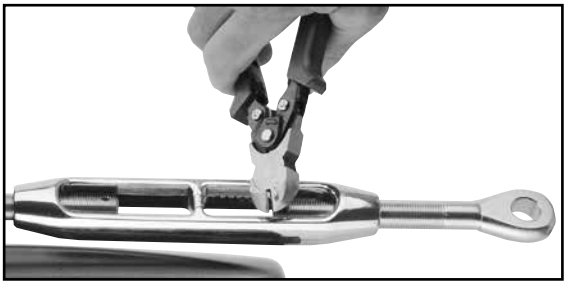
Make sure shallow jaw is up.

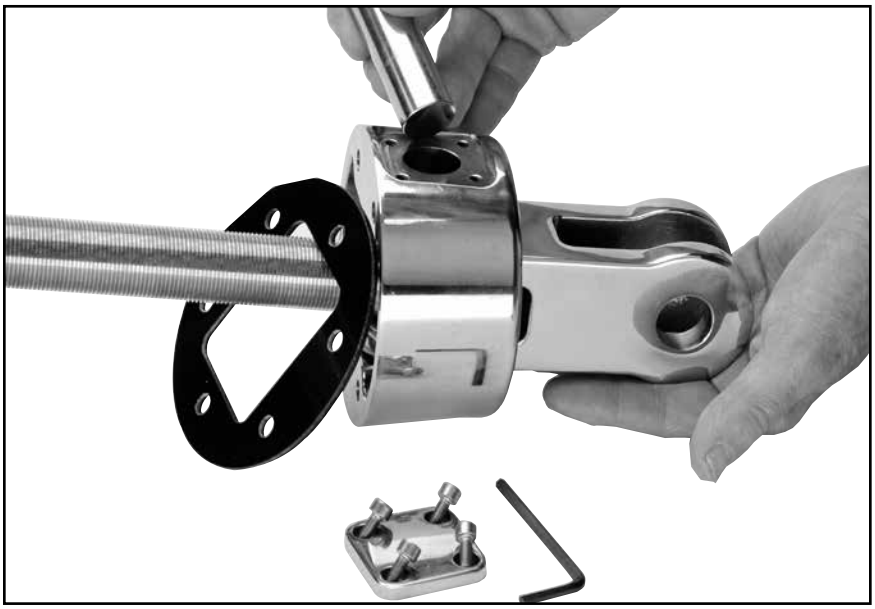


Install cover plate using blue Loctite® adhesive on screws.

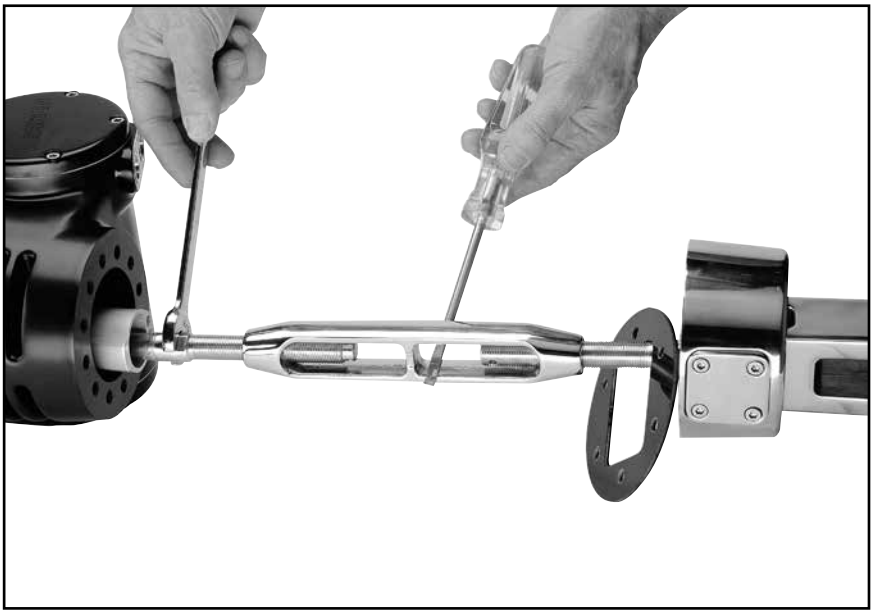
If stay length is set, use side cutters or needle-nose pliers to bend cotter pin to secure turnbuckle.

Loctite is a registered trademark of Henkel AG & Company KGaA.
Sta-Lok is a registered trademark of Sta-Lok Terminals, Ltd.





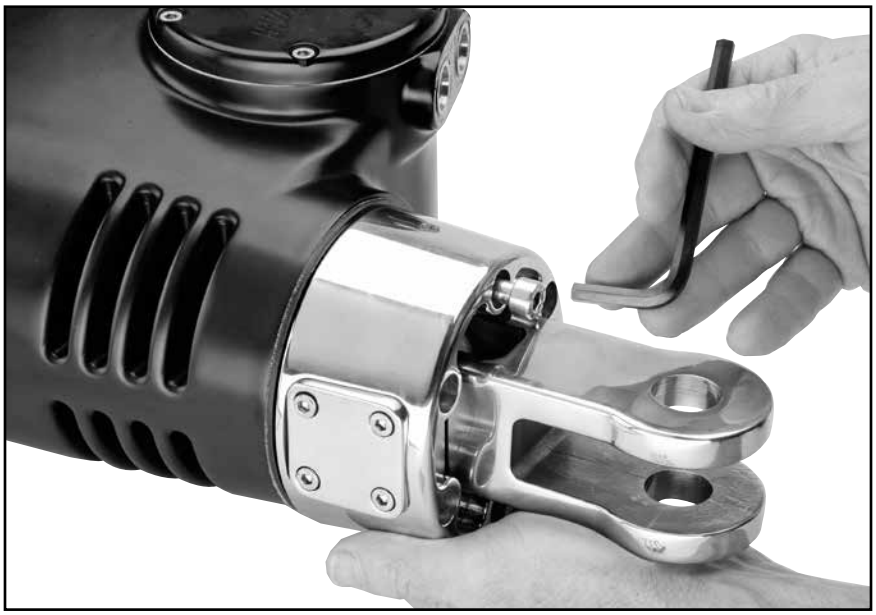




Attach Toggle

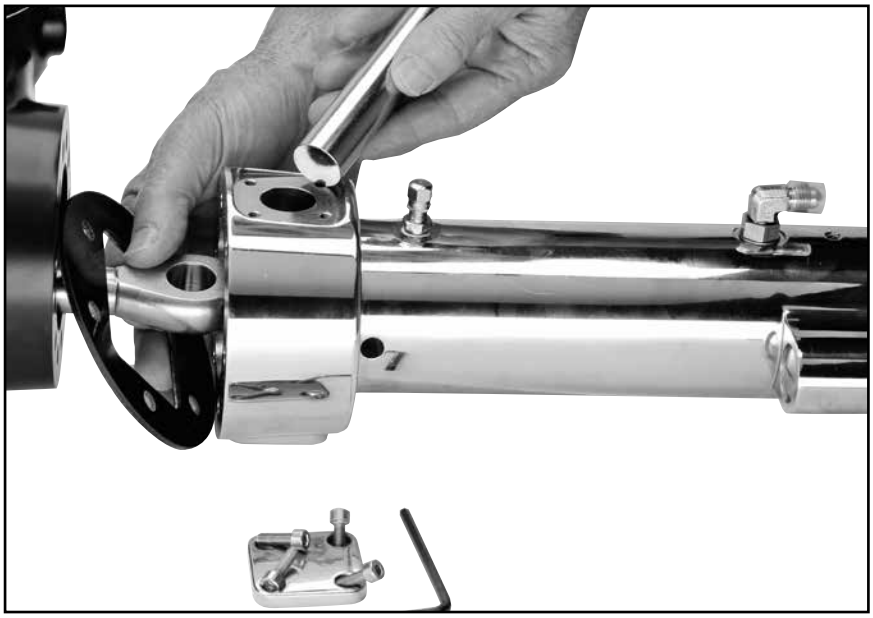
Choose toggle orientation to match chainplate—fore/aft or athwartships.

Line up insulator and secure toggle assembly to lower unit using blue Loctite® adhesive on screws.



Attach hydraulic cylinder

Slip toggle housing insulator onto eye terminal. Remove toggle plate. Use cross pin to capture eye and toggle in housing.



Install cover plate using blue Loctite on screws.



Loctite is a registered trademark of Henkel AG & Company KGaA.

Position cylinder to match chainplate direction.

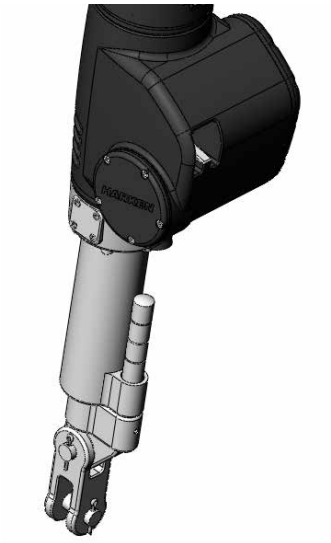
Chainplate runs fore/aft: Position the guide rod so it is to the port side.

Hydraulic connections will be on the aft side. Line up insulator and secure cylinder assembly to lower unit using blue Loctite® adhesive on screws.

Chainplate runs athwartships: Position the calibrated guide rod so it is aft. Hydraulic connections will be on the starboard side.



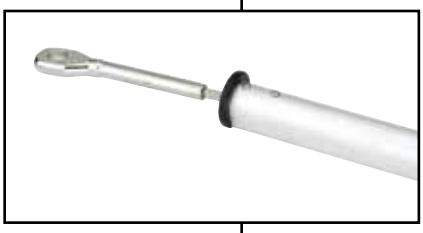
Chainplate fore/aft orientation

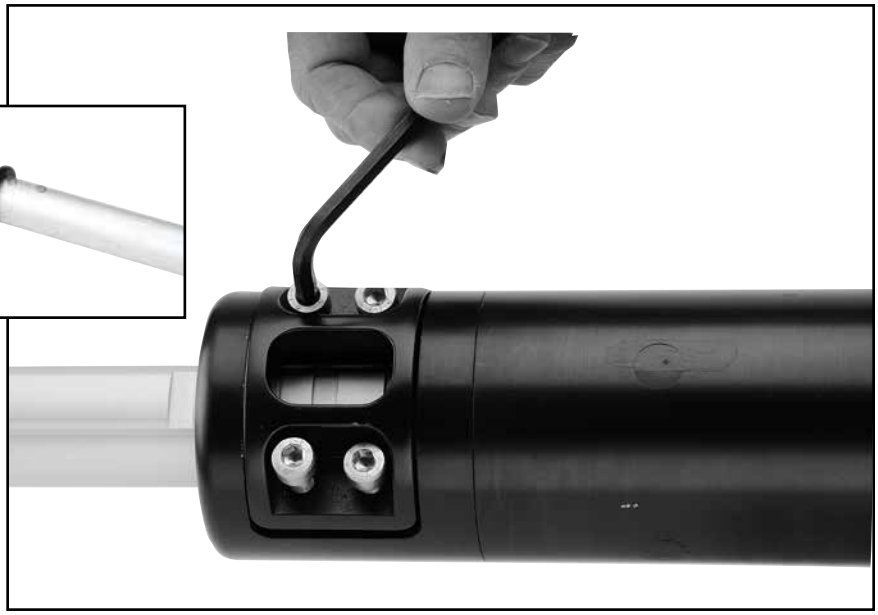


Chainplate athwartships orientation

Loctite is a registered trademark of Henkel AG & Company KGaA.

Check foil height at top. Set and secure using hex wrench.

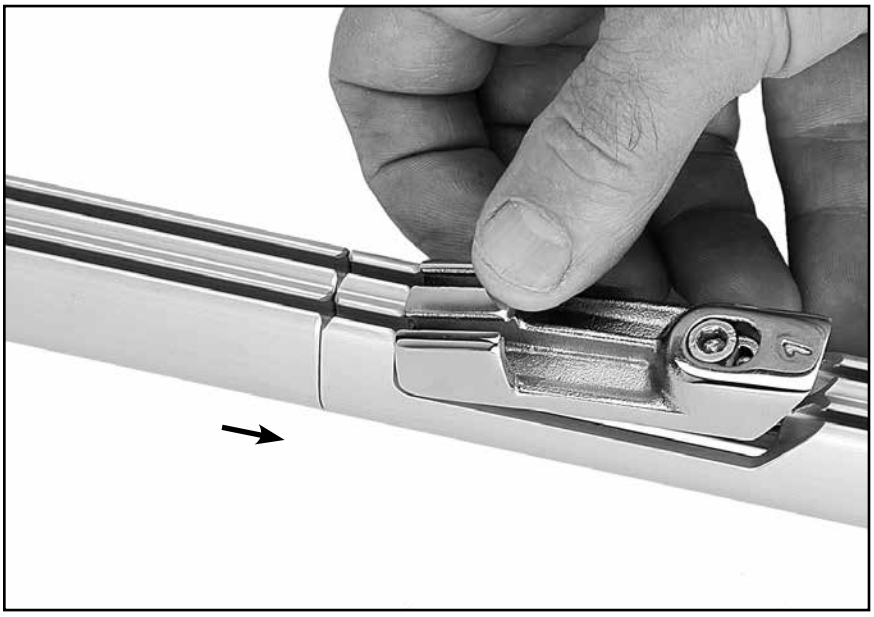




Slide halyard swivel above feeder. Place feeder in foil recess. Push screw down so tab catches under foil. Tighten screw.

Note: Screw will turn with some difficulty. It is plastic coated to prevent loosening from vibration.

Important! When removing screw, loosen no more than one full turn. Slide screw up and remove feeder.





Have extra cotter pins and locknuts on hand to replace used ones at base of unit and for turnbuckle.

Hold foils and loosen foil clamp screws until you can pull clamp out to lower foils.

Lower foils.

Remove six (6) toggle housing screws. Use halyards to securely lift and hold foils and lower unit.

WARNING! Foils are heavy and can drop suddenly on fingers. Only do this work at the dock, not underway.

Adjust turnbuckle.

Replace used cotter pins and locknuts. Lower unit and install clevis pin and new cotter pin.

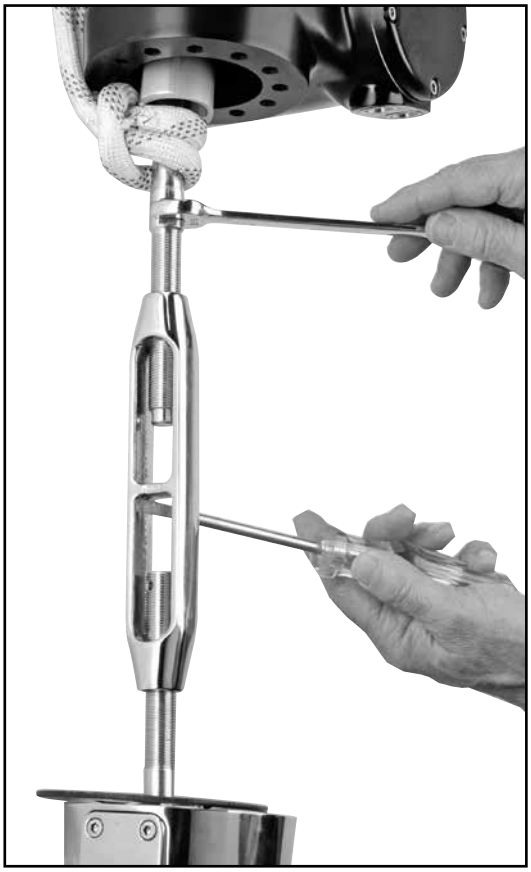
Lift foils so top is 25 mm (1") below upper terminal.



Raise lower unit and use halyard to lift and hold it about 1.5 m (5'). Raise foils using second halyard and secure. Allow room above for turnbuckle take up.







Halyard wrap

The most serious problem with furling systems occurs when the jib halyard wraps around the headstay foil. Halyard wraps will keep you from furling or unfurling and can cause serious damage to the unit and the halyard.

WARNING! In severe cases, a halyard wrap can cause loss of control of boat and/or headstay can break suddenly. Make sure halyard is clear of top foil before using system.

To prevent wraps, the halyard must exert a slight pull to the rear. This allows the foils to turn while halyard remains stationary.

Prevent halyard wraps

WARNING! Sail must be fitted to foil length before using to prevent headstay loss which will cause an accident.

1. Halyard swivel should be within top 100 - 152 mm (4 - 6") of foil unless a halyard restrainer is used.
2. Halyard must pull slightly to rear (8 - 10°).
3. Halyard must be snug, but not too tight.

If halyard wraps, do not force unit to turn. Attempt to open sail by carefully furling in and out a little at a time. If sail will unfurl, lower it by releasing jib halyard. Severe halyard wraps can only be cleared by going aloft and freeing halyard.

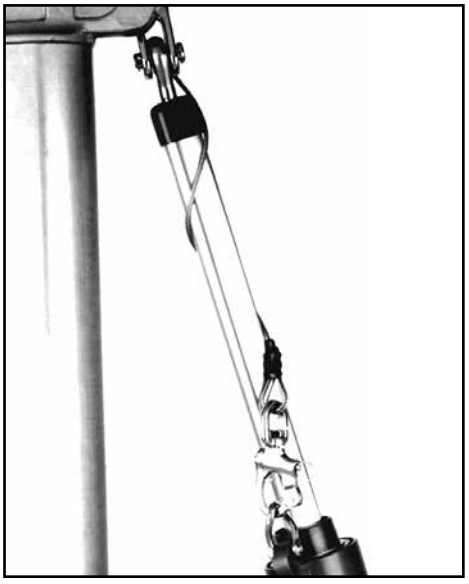
If sail will not furl or unfurl, try removing jib sheets and manually wrapping sail around headstay.

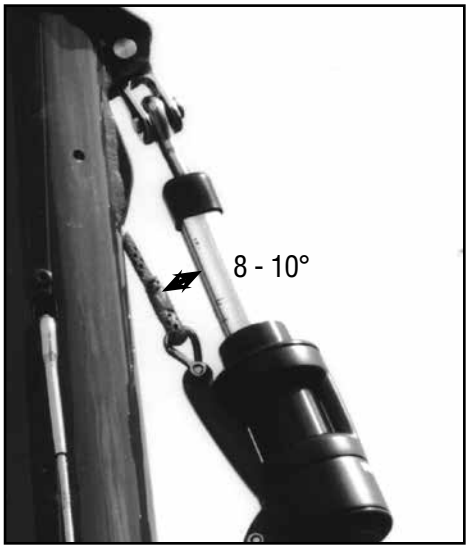
Testing at dock does not indicate halyard angle is correct. In wave action, halyard can wrap if lead angle is not correct. The 8-10° diverging angle shown at right is critical.

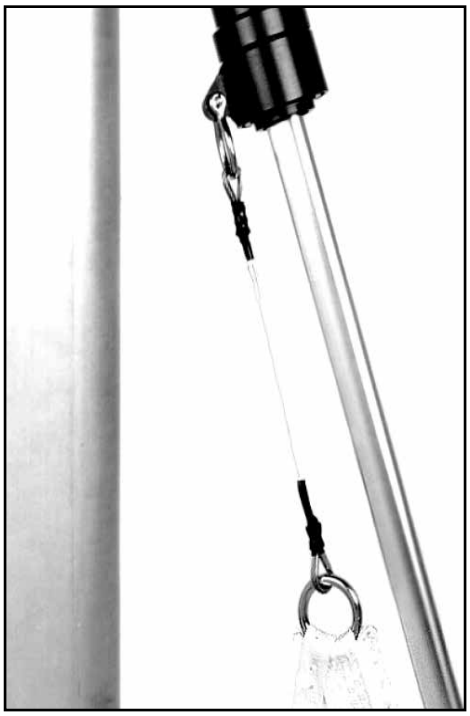
Pendants

If the sail luff is not long enough to position halyard swivel properly, a pendant is required. Pendants should be made of plastic-coated wire and be permanently attached so sail height will be correct. Adjustable-length pendants are not acceptable, as they might not adjust correctly during a sail change.

1. Raise sail, but do not attach tack shackle.
2. Position halyard swivel correctly near top of headstay.
3. Secure halyard.
4. Tie a piece of rope to sail tack.
5. Lead line through tack shackle on lower unit.
6. Tension sail.
7. Measure distance from tack shackle to sail tack and permanently attach pendant of this length to head of sail.
8. Repeat procedure for every jib in your sail inventory.







To prevent wraps, jib halyard must pull slightly to rear. On most boats, halyard lead angle is acceptable if halyard swivel is raised to top of foil.

On some boats, halyard sheaves are located too close to headstay and a halyard restrainer must be used.

Halyard restrainers should be used only when required by masthead geometry. Restrainers tend to limit sail luff length and can cause problems if not installed properly.

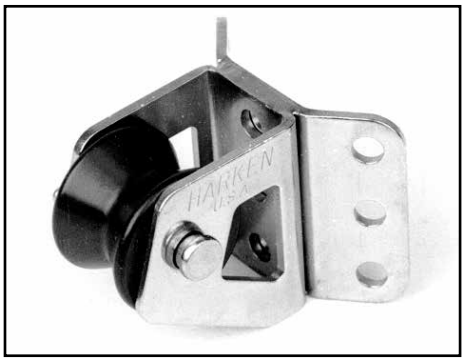
If your boat needs a halyard restrainer, use Harken part no. 945 or 1988.

Restrainer should be mounted as high as possible on face of mast. Position restrainer so that foils will not hit it when under load.

The restrainer should deflect halyard as little as possible or you may experience difficulty in tensioning sail luff as well as friction when furling, resulting in possible damage to foils. To decrease deflection angles, shorten sail luff.

Tip: Boats used in charter service should have a halyard restrainer, regardless of masthead geometry.





Halyard tension

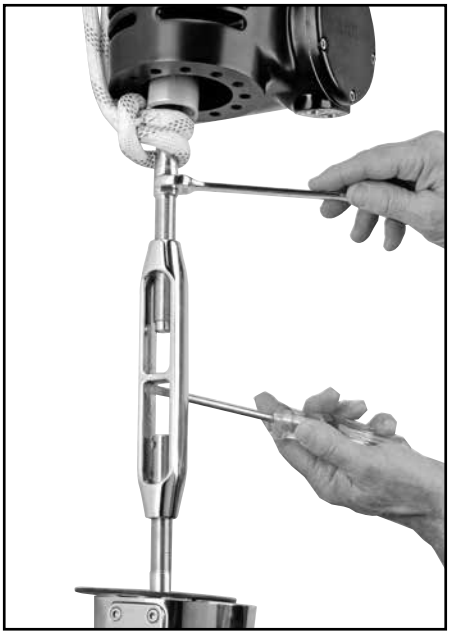
The jib halyard should be firm, but not too tight.

Tip: The luff foil system supports sail along its length so halyard tension is used only to shape sails, not support them. Use enough halyard tension to remove some wrinkles along luff of sail. Do not over-tension halyard causing vertical wrinkles in luff of sail. Tension to adjust position of draft in sail to suit sailing conditions. Halyard should be firm but not tight. If in doubt, release halyard tension. To protect sail, ease halyard when boat is not in use.









Spinnaker halyards

Spinnaker halyards occasionally cause problems with furling.

WARNING! In severe cases, spinnaker halyards can jam furler causing loss of control. Make sure all halyards are clear of furling unit action.

On many boats, it is not possible to attach the spinnaker halyard to bow pulpit because it may be "sucked" into the jib when furling.

On some boats the spinnaker halyard lays across headstay and will catch on halyard swivel, foils, or jib halyard. To prevent problems, it may be necessary to install a masthead bail to move spinnaker halyard block forward and to one side.

Boats with external halyards may find it necessary to flip both ends of spinnaker halyard behind spreaders to prevent fouling the furling system.

Headstay tension

A furling system will work best if headstay is tight.

A loose headstay is difficult to rotate and can cause unusual wear on foil joints.

To adjust headstay tension, remove sail and follow instructions on page 27.

Tip: Before adjusting headstay tension, slack mainsheet and vang.

Using hydraulic length adjuster

Use reference lines on guide rod to help repeat settings. Make sure mainsheet and vang are eased. Use adjuster to set length (especially when using two furlers) to make sure the desired furler is tensioned when the backstay is tensioned.

Backstay adjusters

Backstay adjusters allow headstay tension to be varied to change sail shape to match conditions. They permit a very tight headstay to be eased when boat is not in use. For best performance, consider adding a backstay adjuster; a mechanical adjuster like those offered by Harken, or a hydraulic adjuster.

Remember to keep headstay tight for best performance when furling or reefing.

If your boat is fitted with an adjuster be sure that it is tensioned **before** the halyard is tensioned. If not, backstay adjuster can increase halyard tension and could damage the sail or furling system.

Racing boats often slack the headstay completely when sailing downwind. Check to be sure that foil does not jam against upper headstay terminal when backstay is released. To prevent this, it may be necessary to shorten foil slightly.







Raise sails

1. Install prefeeder by securely tying end of line to a deck fitting or to toggle below furler so it is 610 mm (2') below feeder.
2. Shackle tack of sail to lower unit. Install shackle so screw pin head is on same side as sun cover.
3. Secure genoa sheets to clew of sail.
4. Attach genoa halyard to halyard swivel.
5. Pass luff tape through prefeeder and feeder into foil groove.
6. Attach head of sail or pendant at head of sail to halyard swivel.
7. Hoist sail.
8. Attach genoa tack to lower unit shackle.
8. Once sail is raised, determine the direction of furling so suncover will shield sail from UV rays when furled.
9. Suncover on port side of sail, furl clockwise. Suncover on starboard, furl counterclockwise.

Tip: Once you have determined the direction of furl to match suncover, mark remote furler switches, i.e. "furl/unfurl" or "in/out".

Tip: New sails are often stiff and can hang up on prefeeder while raising. Do not force sail when it hangs up—lower and remove twist. Sails break-in with use and will become easier to raise.

Storm sails

Most sailors onlly use one multi-purpose genoa when sailing, but it is not good seamanship to go offshore without storm sails.

Heavy-air working jibs and storm sails may be used with your unit. These sails need to have luff tape added so they can be raised in headstay foils.

Sails will generally require pendants to ensure that halyard swivel is properly positioned at top of headstay. See page 28.

Remember that heavy-air working jibs and storm jibs may be reefed and furled like any other sail.

Furl and reef







To furl or reef, ease jib sheets and press correct switch to furl sail.

In very light air, it may be necessary to place some tension on jib sheet to insure a tight furl.

To furl in a breeze, ease sheets gradually and furl sail in small increments until sail is furled or reefed.

When furling or reefing, make sure that nothing is jammed. Review swivel height, lead angle, halyard restrainer information. Make sure operator has a good view of sail and stops furling when sail is rolled and sheets have a wrap or two on the furled sail. Stop immediately if sheets jam or halyard wraps. If operator does not have a good view, station a crew member with good visibility. If motor is laboring, stop and check for reason. Consult the Troubleshooting Guide on page 35.

WARNING! A hydraulic furling system is very powerful and jammed parts can break suddenly at high load. Stop furling immediately and correct problem.

Before using the system, practice manual operation in case there is a power loss. Make sure that the emergency handle can rotate and not hit the bow pulpit.

A fully-charged cordless drill must be on hand at all times. Because a cordless drill may lose power, always have an emergency handle onboard in a secure, easy-to-find location.

WARNING! You must have a reliable manual drive procedure in place before using the system.





Furling or reefing with manual power

In the event of power failure, go forward and lower sail or furl by hand.

WARNING! You must observe all personal safety precautions. These include using a harness and secure tether and personal flotation device (PFD) when going forward.

1. Communicate to crewmembers that you are going to manually rotate the furler. Practice this emergency procedure in controlled conditions so you and your crew are prepared in the event of a power failure. Explain procedure for controlling the boat and have someone ease sheets as you rotate the handle.
2. Have an emergency handle available.
3. Use all personal safety precautions including PFD, harness, and tether, before going forward.
4. Position shift lever on right side as shown in photo.
5. Use the emergency handle or a cordless drill to turn the foil until the sail is reefed or furled.



Reefing tips

A sail may be partially furled before you resume sailing. This is known as reefing.

Many sailors find it helpful to place marks on foot of sail so they can reef to a variety of predetermined jib sizes. This allows marks to be placed on jib lead tracks or toe rail so that lead block position can be changed to correspond to reefed jib.

Sails are generally reefed to balance boat and to reduce heeling moment. Sails may also be reefed to improve visibility or to slow boat while sailing in congested areas, or entering or leaving harbors.

Secure sail

When furling prior to leaving your boat in slip or on mooring, be sure you get a tight furl. Continue furling system until sheets wrap around rolled sail two or three (3) times. Some people secure sail with shockcord or sail ties.



Race conversion

Race conversion allows use of both grooves for sail changes and tacking genoas on deck for use of maximum luff length genoas.

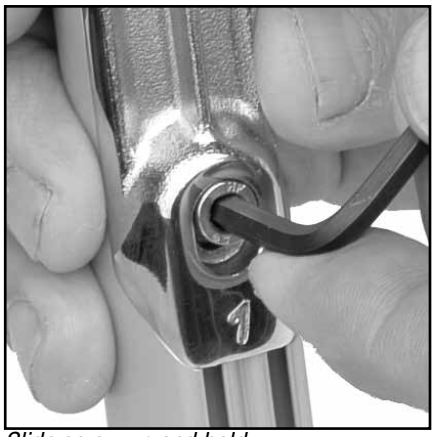
Halyard swivel below feeder

Use halyard to lift halyard swivel up, away from feeder. Loosen screw ***one revolution only.*** Slide screw up and hold. Remove feeder carefully—bottom end first. ***Don't lose the feeder overboard!*** Lower swivel onto lower unit. Replace feeder.

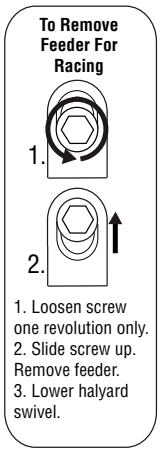
Remove feeder



*Loosen screw **one revolution only***



Slide screw up and hold





Carefully remove feeder–bottom end first
Don't drop the feeder overboard!



Clean and lubricate

Keep unit clean. When you wash boat, flush unit with soap and fresh water. Occasionally lower sail and flush halyard swivel with soap and fresh water.

Foils can be cleaned by washing with soap and water. A scrap of luff tape may be run up foil to scrub inside grooves. Sail luff tapes may be sprayed with McLube to reduce friction during sail changes.

Spray sails off boat so McLube® spray does not contact deck.

WARNING! Decks sprayed with McLube will be very slippery which can lead to slipping and falling overboard. Spray sails off boat so McLube spray does not contact deck.

WARNING! Worn, damaged or corroded parts may break suddenly. Periodically inspect items listed below and any others as necessary.





Inspect

Inspect unit for signs of chafe, wear or damage.

Inspect clevis and cotter pins below and inside lower unit for signs of loosening. Check headstay tension for signs of loosening. Inspect swage fitting and lower toggle for signs of stress corrosion.

Inspect Norseman or Sta-Lok® terminal or rod terminal for signs of loosening.

Inspect all screws on unit to be sure they have not loosened.

Inspect foil to make sure that it has not dropped into lower unit. Periodically inspect wire for signs of wear or unraveling.

Storage – mast down

In areas where it freezes, do not store system where water can accumulate in foils. Ice will rupture aluminum. Store foils under cover, with grooves facing down or on an angle so water will run out.

Storage/transporting

Do not store or transport system with lower unit extending beyond mast. Remove lower unit and halyard swivel for storage and transport.

After storage or transport

After storing or transporting unit, clean thoroughly including tack and halyard swivel ball bearings. See instructions above.

Loosen foil clamp before slacking backstay

In order to prevent foils from locking against upper stay terminal when backstay is released, loosen foil clamp screws and lower foil before loosening backstay.

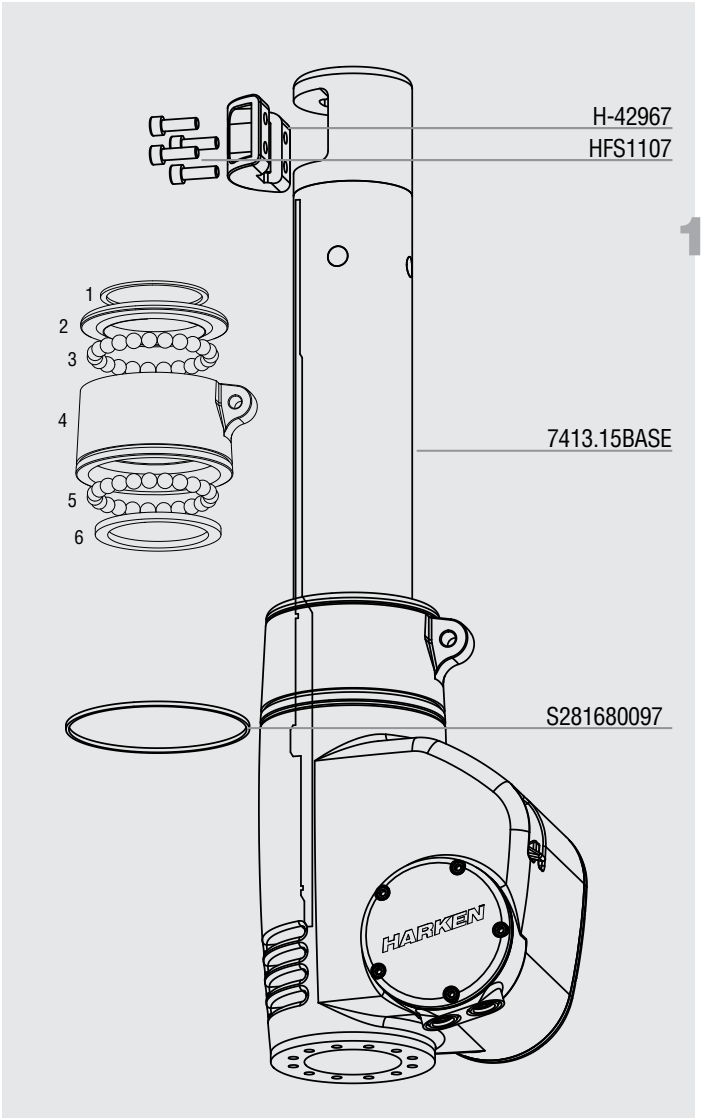
McLube is a registered trademark of McGee Industries, Inc.
Sta-Lok is a registered trademark of Sta-Lok Terminals, Ltd.

Troubleshoot

Problem	Probable cause	Solution
Sail will not furl or is difficult to furl	Jib halyard is wrapping around headstay because angle between mast and and halyard is too shallow	See installation instructions regarding optimal halyard angle. It may be necessary to mount a halyard restrainer on front of your mast to hold halyard to rear
	Jib halyard is wrapping around headstay because halyard swivel is too low	See installation instructions regarding optimal halyard swivel height. A wire pendant may be needed at head of sail to raise halyard swivel to proper height
	Jib halyard is too tight	Ease jib halyard
	Foils riding on turnbuckle	Raise foils. See adjusting turnbuckle on page 27
	Foils too high, binding on swage eye	Lower foils until clear. See adjusting turnbuckle on page 27
	Spare halyard is wrapping in sail as it furls	Secure spare halyards away from furling headstay by flipping them behind spreaders
	Salt or dirt in bearings	Flush bearings with fresh water and lubricate with dry spray lubricant such as McLube® lubricant
	Sail full of wind	Luff completely before furling or reefing
	Sail flogging too much	Release a short length of sheet, furl a small amount and repeat
	Foil out of clamp	Reinstall foil in lower unit and tighten clamp screws
	Halyard swivel installed upside down	Remount swivel correctly
Sail will not unfurl or will not unfurl completely	Jib halyard is wrapping around headstay because angle between mast and halyard is too shallow	See installation instructions regarding optimal halyard angle. It may be necessary to mount a halyard restrainer on front of your mast to hold halyard to rear
	Jib halyard is wrapping around the headstay because the halyard swivel is too low	See installation instructions regarding optimal halyard angle
	Foils riding on turnbuckle	Raise foils. See adjusting turnbuckle on page 27
	Foils too high, binding on swage eye	Lower foils. See adjusting turnbuckle on page 27
	Jib halyard is too tight	Ease jib halyard
	Spare halyard is wrapping in sail as it furls	Secure spare halyards away from furling headstay by flipping them behind spreaders
	Salt or dirt in bearings	Flush bearings with freshwater and lubricate with dry spray lubricant such as McLube
Sail will not furl completely	Spare halyard catching in sail as it furls	Move halyards away from furling headsail as above
Headstay rotates in jerks or elliptically	Insufficient tension on headstay	Tighten headstay and/or backstay to eliminate sag in headstay
Sail does not stay furled	Sail not furled tightly on stay	Keep some tension on sheets when furling in light air to get a tight, secure wrap
Sail will not go up	Luff tape will not go into groove	Check luff tape for fraying
		Check luff tape size
	Sail catching at prefeeder	Flake sail more loosely on deck
	Dirt in groove	Attach a halyard and downhaul to a small section of luff tape and clean groove by raising and lowering
Sail will not raise completely or luff will not tension	Halyard swivel is hitting end stop	Luff of sail is too long and must be recut
	Angle between halyard and mast is too sharp and halyard is pulling too much to the rear	Halyard must be routed from a point higher on mast. This may require that halyard turning block aloft be replaced or sail shortened
Sail will not come down	Halyard is wrapping on headstay	Angle between headstay and halyard is too shallow and must be optimized per installation instructions
	Halyard swivel off foil	Sail luff too long or foil is too short or low and must be lengthened or raised
Ultravoilet cover rolls up inside of sail	Wrong switch used to furl sail	Unroll sail and use other switch to furl. Alternatively, rewire switch. Once correct, label switch "furl" and the other "unfurl"

McLube is a registered trademark of McGee Industries, Inc.

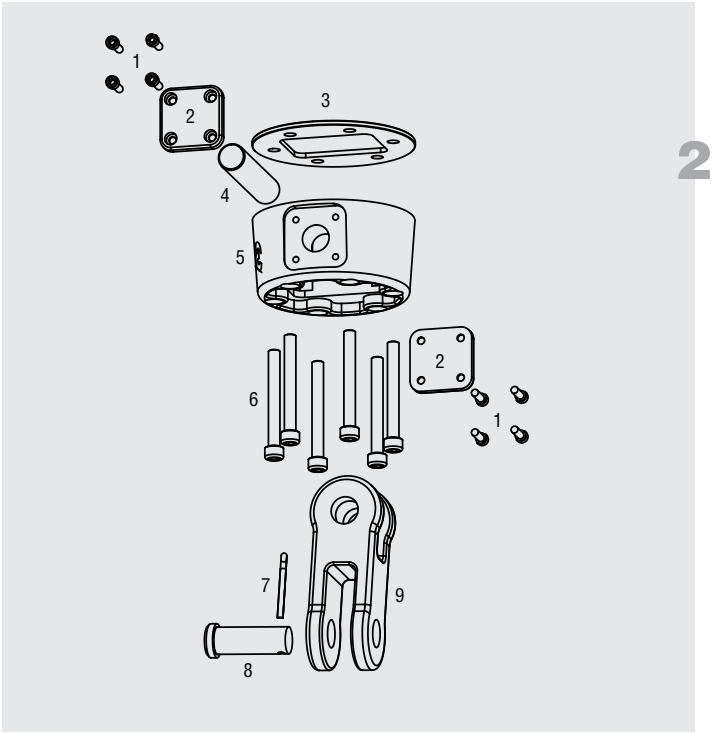
Warranty
www.harken.com/manuals
or call, write, email or fax Harken, Inc.,
Pewaukee, WI USA



1

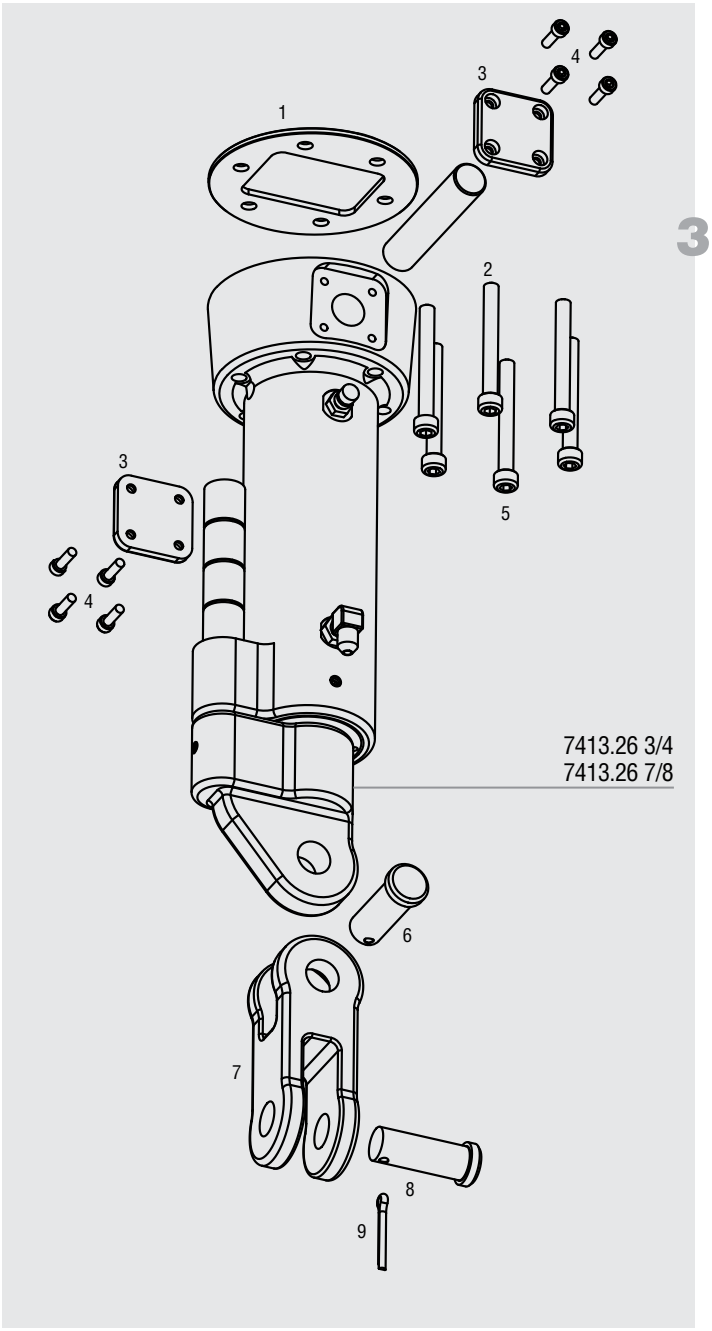
No.	Description	Order	Part no.
	Torque tube foil clamp	1	H-42967
	Torque tube screws M8 x 25 mm SHCS	4	HFS1107
	Red ring	1	S281680097
	Lower unit (reorder parts shown below)	**1**	**7413.15BASE**
1	Smalley ring	1	H-51494
2	Tack swivel top washer	1	H-51493
3	1/2" Torlon® ball bearings	23	MP-128
4	Tack swivel body	1	H-51491
5	1/2" Delrin® ball bearings	23	MP-116
6	Tack swivel lower washer	1	H-51492

Torlon is a registered trademark of Solvay Advanced Polymers L. L. C.
Delrin is a registered trademark of E. I. du Pont de Nemours and Company or its affiliates.

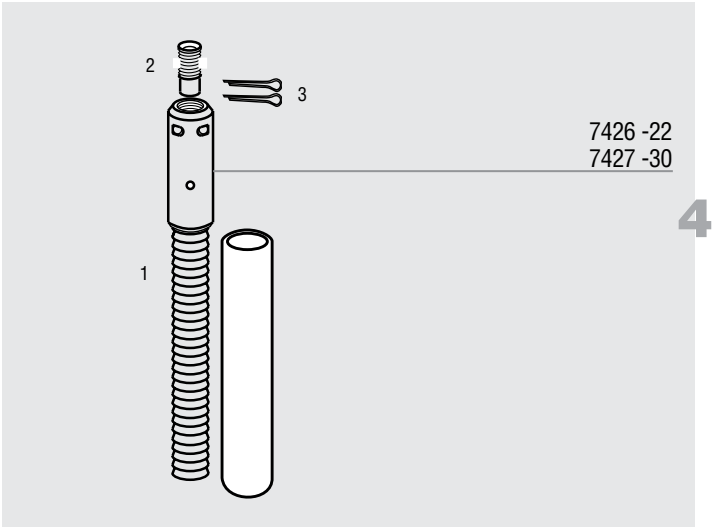


2

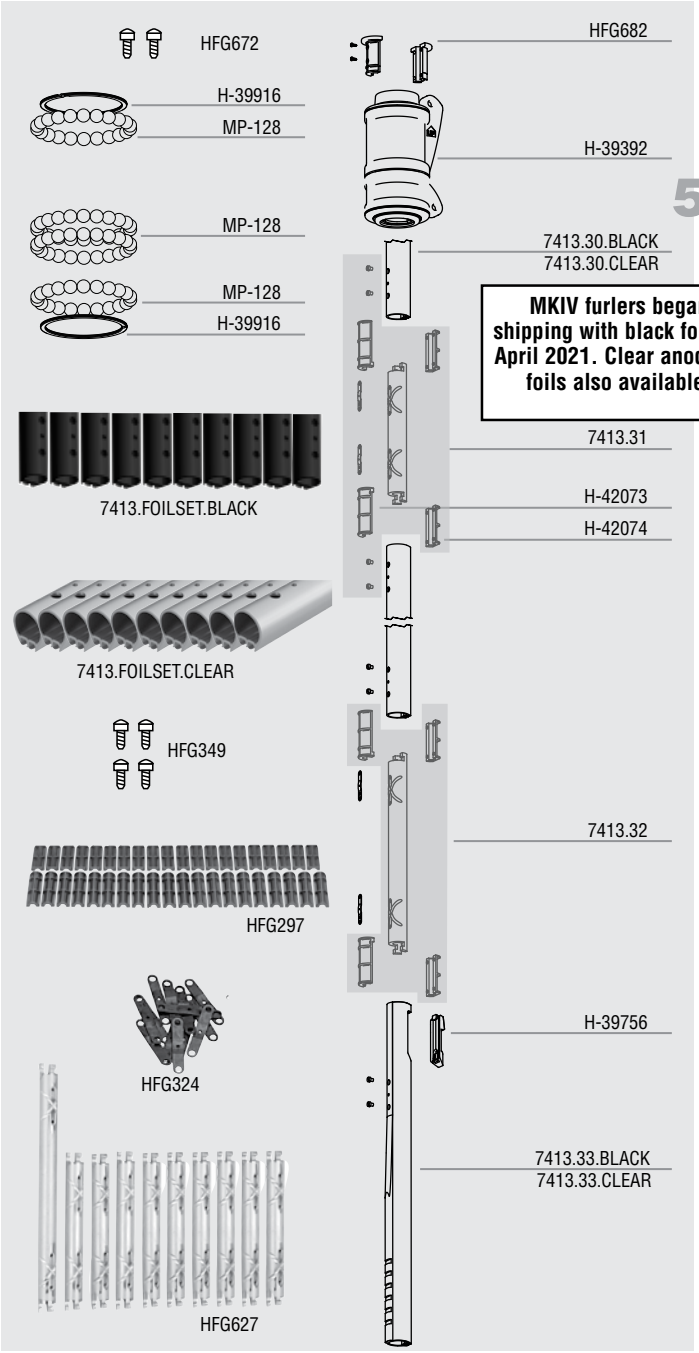
No.	Description	Order	Part no.
	Toggle assembly hydr 3/4"	**1**	**7413.25 3/4**
1	Toggle plate screws M5 x 16 mm SHCS	8	HFS982
2	Toggle plate	2	H-51477
3	Toggle housing insulator	1	H-51475
4	Cross pin 3/4"	1	H-52246
5	Toggle housing 3/4"	1	H-52245
6	Toggle housing screws M8 x 70 mm SHCS	6	HFS1064
7	Cotter pin 5/32" x 1.25"	1	HFS203
8	Clevis pin 3/4" x 1.76" grip length	1	H-42403
9	Jaw/jaw toggle 3/4"	1	H-41489
	Toggle assembly hydr 7/8"	**1**	**7413.25 7/8**
1	Toggle plate screws M5 x 16 mm SHCS	8	HFS982
2	Toggle plate	2	H-51477
3	Toggle housing insulator	1	H-51475
4	Cross pin 7/8"	1	H-51476
5	Toggle housing 7/8"	1	H-51474
6	Toggle housing screws M8 x 70 mm SHCS	6	HFS1064
7	Cotter pin 5/32" x 1.25"	1	HFS203
8	Clevis pin 7/8" x 1.96" grip length	1	H-42404
9	Jaw/jaw toggle 7/8"	1	H-42562



No.	Description	Order	Part no.
3	**Hydraulic cylinder—3/4" pin**	**1**	**7413.26 3/4**
1	Toggle housing insulator	1	H-51475
2	Cross pin 3/4"	1	H-52246
3	Toggle plate	2	H-51477
4	Toggle plate screws M5 X 16 mm SHCS	8	HFS982
5	Toggle housing screws M8 X 70 mm SHCS	6	HFS1064
6	Clevis pin 3/4" x 1.76" grip length	2	H-42403
7	Jaw/jaw toggle 3/4"	1	H-41489
8	Cotter pin 5/32" X 1.25"	1	HFS203
	Hydraulic cylinder—7/8" pin	**1**	**7413.26 7/8**
1	Toggle housing insulator	1	H-51475
2	Cross pin 7/8"	1	H-51476
3	Toggle plate	2	H-51477
4	Toggle plate screws M5 X 16 mm SHCS	8	HFS982
5	Toggle housing screws M8 X 70 mm SHCS	6	HFS1064
6	Clevis pin 7/8" x 1.96" grip length	2	H-42404
7	Jaw/jaw toggle 7/8"	1	H-41489
8	Cotter pin 5/32" X 1.25"	1	HFS203

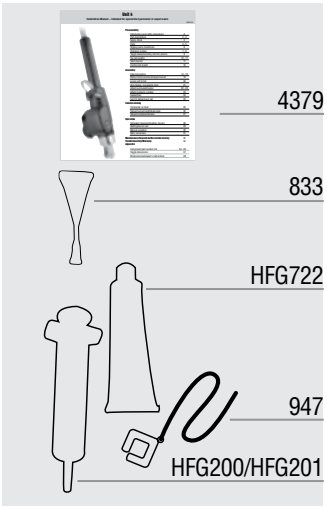


No.	Description	Order	Part no.
4	**Rod adapter stud w/nosepiece -22 rod**	**1**	**7426 -22**
1	Stud (main body)	1	H-41812
2	Nosepiece -22	1	H-41811
3	Cotter pin 3/32" x 1.750"	2	HFS1342
	Stud cap 7/8" ID	1	HFG303
	Rod adapter stud w/nosepiece -30 rod	**1**	**7427 -30**
1	Stud (main body)	1	H-41814
2	Nosepiece -30	1	H-41813
3	Cotter pin 3/32" x 1.750"	2	HFS1342
	Stud cap 7/8" ID	1	HFG303



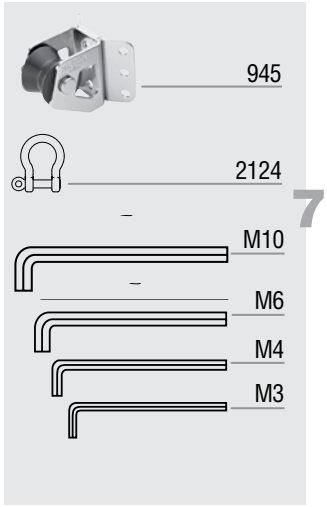
5

Description	Order	Part No.
Trim cap set w/o screws	**1**	**HFG682**
Trim cap screw set	**1**	**HFG672**
Trim cap screw	2	HFS1127
Halyard swivel	**1**	**H-39392**
Clip/smalley ring for balls	2	H-39916
Torlon® ball bearings	88	MP-128
Foil set, less bottom foil - Standard	**1**	**7413.FOILSET.BLACK**
Foil (7' / 2.13 m luff)	10	7413.30.BLACK
Foil (2' / 610 mm) bottom -Standard	**1**	**7413.33.BLACK**
Foil set, less bottom foil - (Special order)	**1**	**7413.FOILSET.CLEAR**
Foil (7' / 2.13 m luff)	10	7413.30.CLEAR
Foil (2' / 610 mm) bottom - (Special order)	**1**	**7413.33.CLEAR**
Foil screw set	**1**	**HFG349**
Foil screw	46	HFS1106
Connector kit	**1**	**7413.31**
Connector (247 mm / 9 3/4")	1	—
Connector bushing A	2	H-42073
Connector bushing B	2	H-42074
Foil screw	2	HFS1106
Plastic connector wedge	2	H-39487
Bottom connector kit	**1**	**7413.32**
Bottom connector (355 mm / 14")	1	—
Connector bushing A	2	H-42073
Connector bushing B	2	H-42074
Connector set (No bushings,wedges or screws included)	**1**	**HFG627**
Connector (247 mm / 9 3/4")	9	—
Bottom connector (355 mm / 14")	1	—
Connector bushing set	**1**	**HFG297**
Connector bushing A (curved/longer)	20	H-42073
Connector bushing B (flat/shorter)	20	H-42074
Plastic connector wedge set	**1**	**HFG324**
Plastic connector wedge	22	H-39487
Feeder with screw and tab	**1**	**H-39756**
Feeder tab	1	H-38372A
Screw	1	HFS1130



6

Description	Order	Part no.
Instruction manual	**1**	**4379**
Blue Loctite® adhesive	**1**	**833**
5200 adhesive set	**1**	**HFG725**
5200 marine adhesive sealant	1	HFG722
Injector	1	HFG200 HFG201
Prefeeder	**1**	**947**

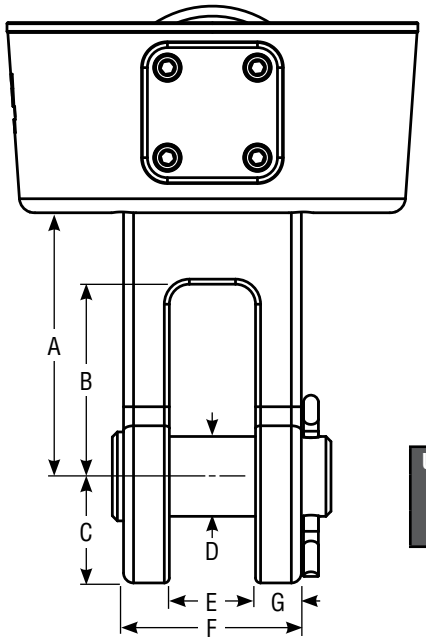


7

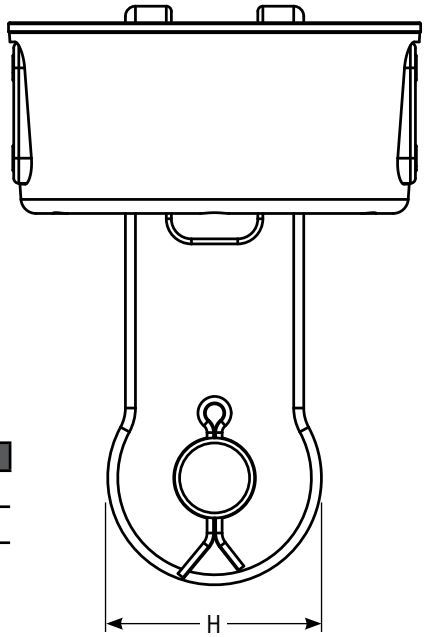
Description	Order	Part no.
Halyard restrainer (optional)	**1**	**945**
Sheave/ss inner race only	1	945ASSY
Clevis pin (.312" x 1.25")	1	SP-038
Bracket-large	1	HCP394
Cotter pin (3/32" x 3/4")	1	HFS181
Shackle	**3**	**2124**
Hex wrenches		
M10	1	HFG647
M6	1	HFG644
M4	1	HFG640
M3	1	HCP1089

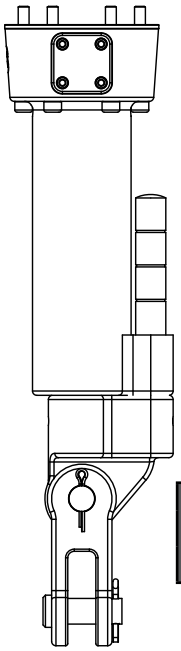
MKIV hydraulic unit 3

Loctite is a registered trademark of Henkel AG & Company KGaA.
Torlon is a registered trademark of Solvay Advanced Polymers L. L. C.



Unit	Part no.
3H	7413.25 3/4
	7413.25 7/8



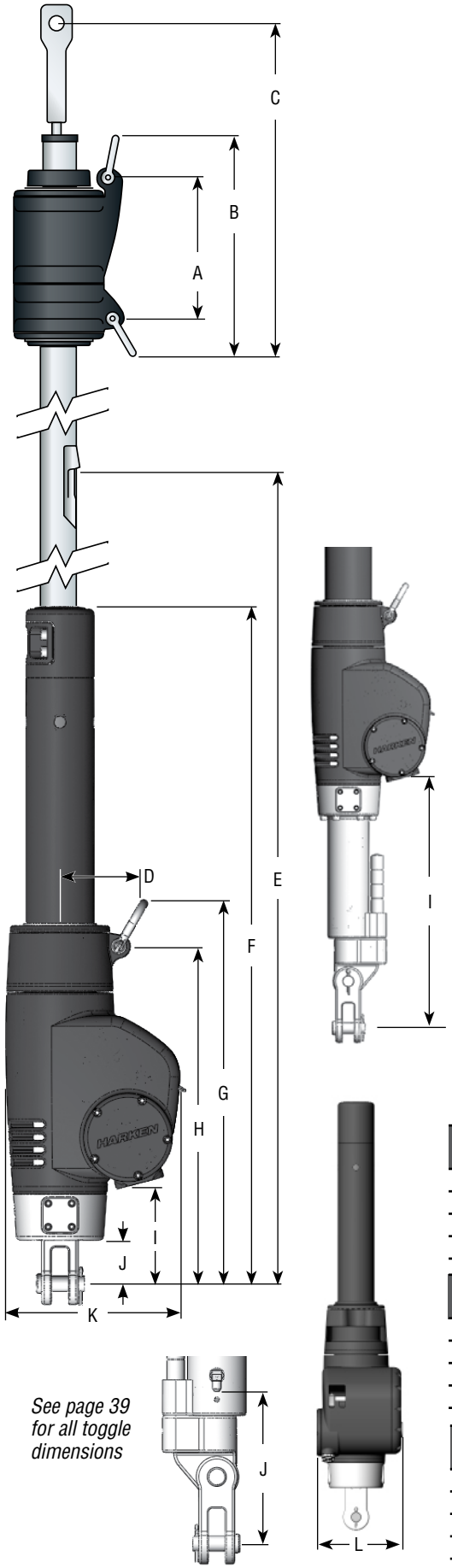


Unit	Part no.
3H	7413.26 3/4
	7413.26 7/8

Toggle dimensions*

A		B		C		D		E		F		G		H	
in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
7413.25 3/4, 7413.26 3/4*															
2.08	52.83	1.739	44.17	1.024	26.01	0.744	18.90	0.814	20.68	1.746	44.35	0.468	11.89	2	50.8
7413.25 7/8, 7413.26 7/8															
2.662	67.61	2	50.80	1.156	29.36	0.868	22.05	0.94	23.88	1.938	49.23	0.499	12.67	2.312	58.72

*Toggle dimensions apply to standard toggle and cylinder option. "A" does not apply to cylinder.



See page 39 for all toggle dimensions

Luff length

Note offsets above and below sail.

A shorter luff may be required if a halyard restrainer is used or an additional toggle assembly is used to raise unit.

If luff of sail is not long enough to put halyard swivel near top of headstay foil, a pendant must be added. See page 28.

Tack setback

Note setback for tack shackle and cut sail accordingly.

Luff tape size

Unit 3H requires #6 5 mm ($^{3}/_{16}$") luff tape.

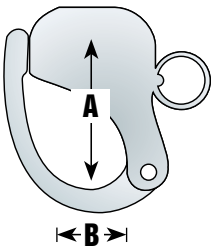
Luff tape length

Cut off top of luff tape so it is 450 to 600 mm (18 to 24") below head of sail. This allows head to lag behind rest of sail to help flatten sail. It will also help head to roll more smoothly.

Note feeder height and extend bottom of luff tape downward so it is below feeder. This will prevent luff tape from catching in feeder as sail is lowered.

Tack and head shackles

Make sure tack and head shackles fit sail rings. Minimum inside dimensions of standard head and tack shackles are:
(A) 48 mm ($1^{7}/_{8}$")
(B) 21 mm ($^{13}/_{16}$")



Sun cover

Sun covers may be installed on either side of sail. Be sure to match other sails in the customer's inventory.

Toggle assembly	A		B		C		D		E Max		E Min	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
7413.25 ¾ std	$7^{5}/_{16}$	186	$11^{5}/_{8}$	296	18	457	$3^{7}/_{8}$	98	47	1194	—	—
7413.25 7/8 std	$7^{5}/_{16}$	186	$11^{5}/_{8}$	296	18	457	$3^{7}/_{8}$	98	$47^{9}/_{16}$	1209	—	—
7413.26 ¾ cylinder	$7^{5}/_{16}$	186	$11^{5}/_{8}$	296	18	457	$3^{7}/_{8}$	98	$63^{5}/_{8}$	1616	$59^{5}/_{8}$	1515
7413.26 7/8 cylinder	$7^{5}/_{16}$	186	$11^{5}/_{8}$	296	18	457	$3^{7}/_{8}$	98	$64^{1}/_{4}$	1632	$60^{1}/_{4}$	1530

Toggle assembly	F Max		F Min		G Max		G Min		H Max		H Min	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
7413.25 ¾ std	$32^{5}/_{16}$	821	—	—	18	446	—	—	$16\ ^{1}/_{8}$	409	—	—
7413.25 7/8 std	$32^{7}/_{8}$	836	—	—	$18^{9}/_{16}$	472	—	—	$16^{11}/_{16}$	424	—	—
7413.26 ¾ cylinder	49	1245	45	1142	$34^{5}/_{8}$	879	$30^{5}/_{8}$	778	$32^{3}/_{4}$	832	$28^{3}/_{4}$	730
7413.26 7/8 cylinder	$49^{5}/_{8}$	1260	$45^{5}/_{8}$	1159	$35^{1}/_{4}$	895	$31^{1}/_{4}$	794	$33^{3}/_{8}$	848	$29^{3}/_{8}$	747

Toggle assembly	I Max*		I Min*		J Max		J Min		K		L	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
7413.25 ¾ std	$4^{5}/_{8}$	118	—	—	2	51	—	—	$8^{1}/_{4}$	209	$7^{11}/_{16}$	195
7413.25 7/8 std	$5^{3}/_{16}$	132	—	—	$2^{9}/_{16}$	65	—	—	$8^{1}/_{4}$	209	$7^{11}/_{16}$	195
7413.26 ¾ cylinder	$21^{1}/_{4}$	540	$17^{1}/_{4}$	438	$11^{7}/_{16}$	291	$7^{7}/_{16}$	189	$8^{1}/_{4}$	209	$7^{11}/_{16}$	195
7413.26 7/8 cylinder	$21^{7}/_{8}$	556	$17^{7}/_{8}$	455	$12^{1}/_{16}$	306	$8^{1}/_{16}$	205	$8^{1}/_{4}$	209	$7^{11}/_{16}$	195

*Height of threaded hydraulic ports

HARKEN®

Corporate Headquarters
N15W24983 Bluemound Rd, Pewaukee, WI 53072 USA
Telephone: (262) 691-3320 • Fax: (262) 701-5780
Web: www.harken.com • Email: harken@harken.com

Harken Australia Pty, Ltd.
1B Green Street, Brookvale, N.S.W. 2100, Australia
Telephone: (61) 2-8978-8666 • Fax: (61) 2-8978-8667
Web: harken.com.au • Email: info@harken.com.au

Harken France
ZA Port des Minimes, BP 3064, 17032 La Rochelle Cedex 1, France
Telephone: (33) 05.46.44.51.20 • Fax: (33) 05.46.44.25.70
Web: harken.fr • Email: info@harken.fr

Harken Italy S.p.A.
Via Marco Biagi, 14, 22070 Limido Comasco (CO) Italy
Telephone: (39) 031.3523511 • Fax: (39) 031.3520031
Web: harken.it • Email: info@harken.it

Harken New Zealand, Ltd.
158 Beaumont Street
Unit 11, Orams Marine Centre
Westhaven, Aukland, 1010, New Zealand
Telephone: (64) 9-303-3744 • Fax: (64) 9-307-7987
Web: harken.co.nz • Email: harken@harken.co.nz

Harken Polska Sp. z o.o.
ul. Przasnyska 6A, 01-756, Warszawa, Poland
Tel: +48 22 561 93 93 • Fax: +48 22 839 22 75
Web: harken.pl • Email: polska@harken.pl

Harken Sweden AB
Main Office and Harken Brandstore: Västmannagatan 81B
SE-113 26 Stockholm Sweden
Telephone: (46) 0303 61875 • Fax: (46) 0303 61876
Mailing address: Harken Sweden AB, Box 64, SE -440 30 Marstrand
Web: harken.se • Email: harken@harken.se

Harken UK, Ltd.
Bearing House, Ampress Lane, Lymington, Hampshire S041 8LW, England
Telephone: (44) 01590-689122 • Fax: (44) 01590-610274
Web: harken.co.uk • Email: enquiries@harken.co.uk

On Deck B.V.
Leimuiderdijk 478A, 2156 MX Weteringbrug, The Netherlands
Telephone: 31 71 331 3366 • Fax: 31 71 331 3387
Web: www.on-deck.nl • Email: allhands@on-deck.nl

Please visit: www.harken.com/dealer
to locate Harken dealers and distributors

Printed in USA 4379 v1 08/21