

HARKEN®

MKIV UNDERDECK JIB REEFING & FURLING

Unit 1, 2, 3

Installation Manual – Intended for specialized personnel or expert users

4656 v1 08/21

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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

Parts Description

Introduction

This manual gives technical information on installation and service. This 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 so wind has little effect on the sail. Use of this product for other than normal sailboat applications is not covered by the limited warranty.

Safety Precautions



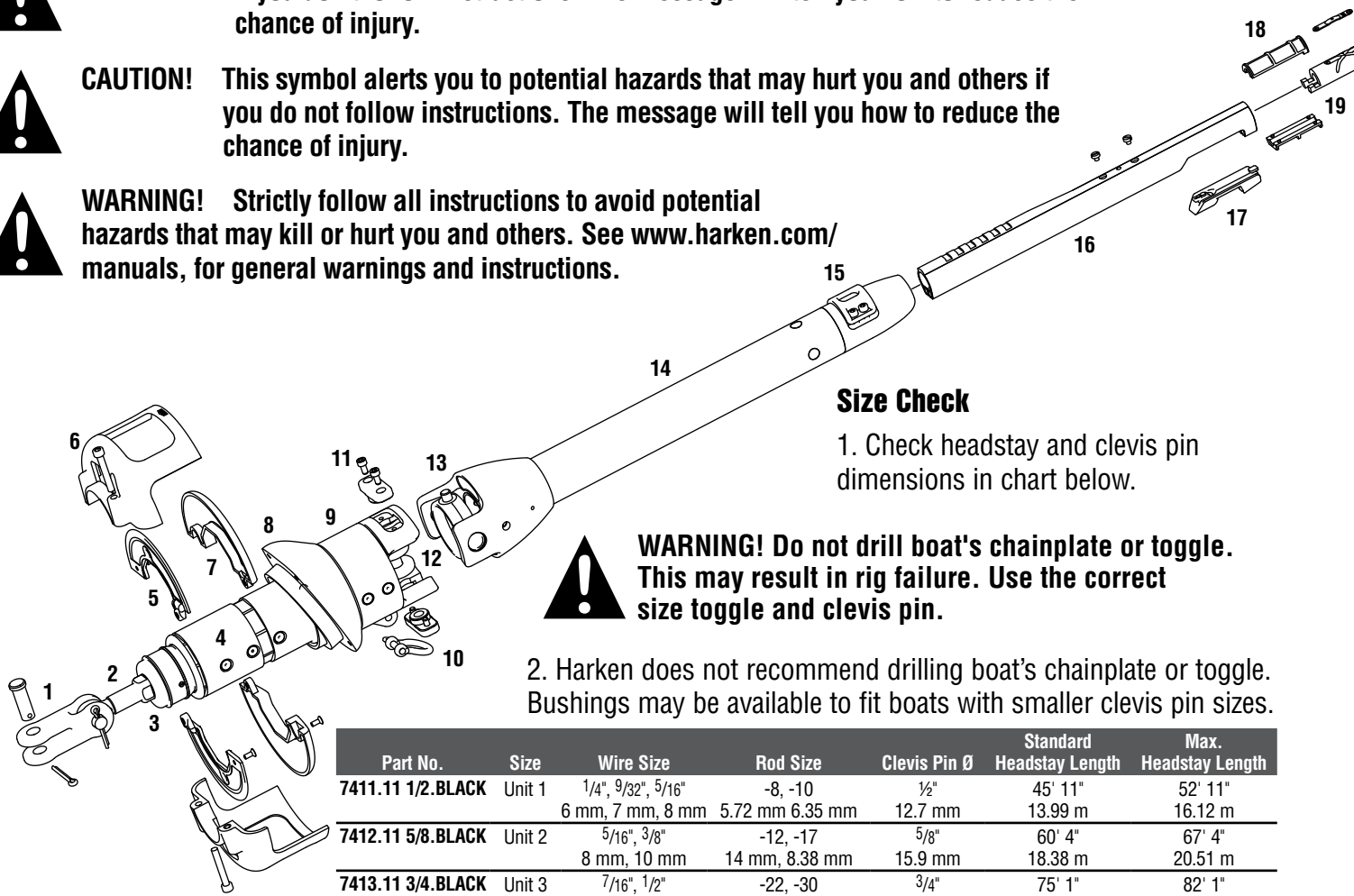
WARNING! This symbol alerts you to potential hazards that may kill or hurt you and others if you don't follow instructions. The message will tell you how to reduce the chance of injury.



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.



Size Check

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



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

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

Part No.	Size	Wire Size	Rod Size	Clevis Pin Ø	Standard Headstay Length	Max. Headstay Length
7411.11 1/2.BLACK	Unit 1	1/4", 9/32", 5/16"	-8, -10	1/2"	45' 11"	52' 11"
		6 mm, 7 mm, 8 mm	5.72 mm, 6.35 mm	12.7 mm	13.99 m	16.12 m
7412.11 5/8.BLACK	Unit 2	5/16", 3/8"	-12, -17	5/8"	60' 4"	67' 4"
		8 mm, 10 mm	14 mm, 8.38 mm	15.9 mm	18.38 m	20.51 m
7413.11 3/4.BLACK	Unit 3	7/16", 1/2"	-22, -30	3/4"	75' 1"	82' 1"
		11 mm, 12 mm	9.53 mm, 11.1 mm	19.1 mm	22.88 m	25.02 m
7413.11 7/8.BLACK	Unit 3	7/16", 1/2"	-22, -30	7/8"	75' 1"	82' 1"
		11 mm, 12 mm	9.53 mm, 11.1 mm	22.2 mm	22.88 m	25.02 m

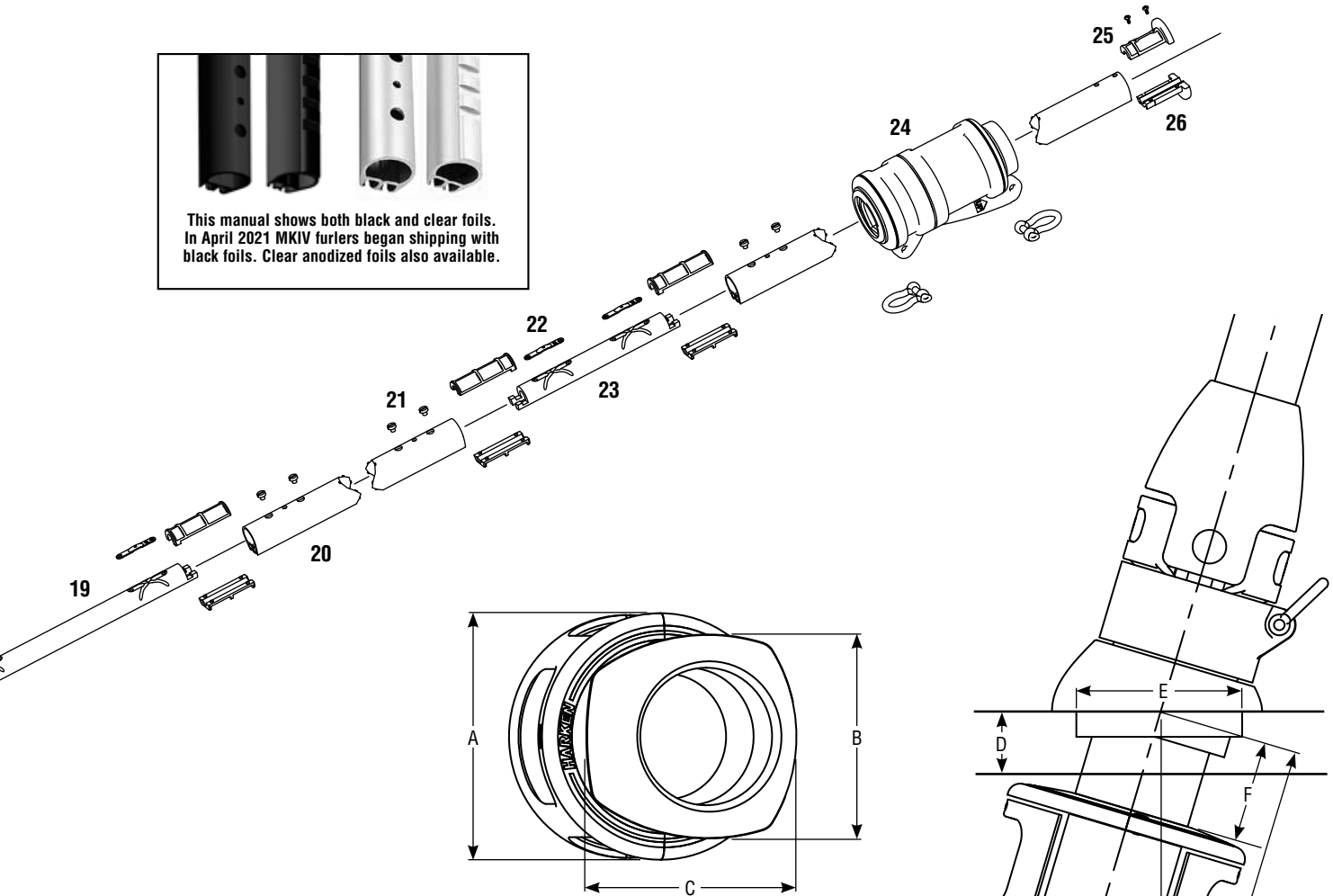
Parts Descriptions

- 1) Lower Jaw/Jaw Toggle
- 2) Threaded Stud
- 3) Length Adjuster Nut
- 4) Hub Assembly

- 5) Flange Assembly
- 6) Guard Assembly
- 7) Cover Assembly
- 8) Deck Flange

- 9) Tack Swivel
- 10) Tack Shackle
- 11) Bearing Caps
- 12) Upper Jaw/Jaw Toggle

- 13) Torque Tube Universal
- 14) Torque Tube Assembly
- 15) Foil Clamp
- 16) Bottom Foil

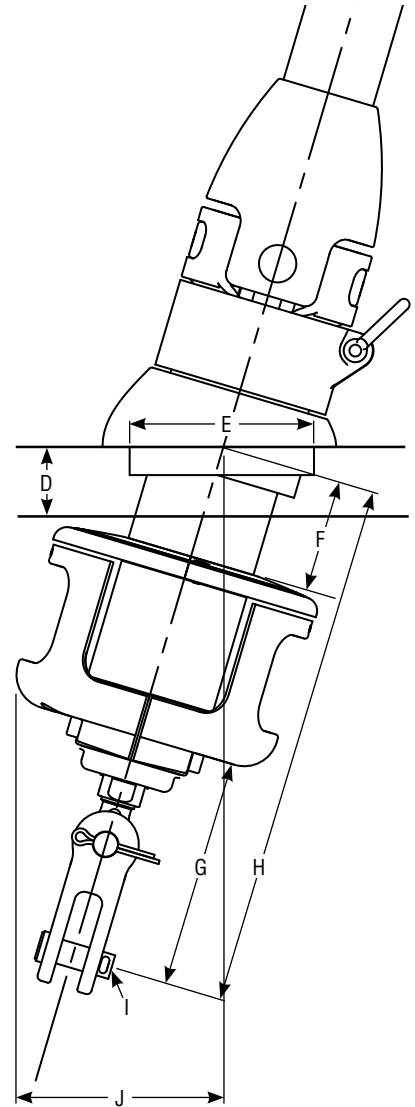


Will Drum Fit in Bow?

Note: If length of stud does not allow attachment to chainplate, link plates between chainplate and toggle must be fabricated.

Furler Requires Drained Compartment

Harken's Underdeck Furler is designed to keep much of the water from entering the bow compartment. Water will drip through the furler during rain or when sailing in heavy weather. Furling compartment must drain.



Unit	Part No.	A	B	C	D Max	E	F	G Min	G Max	H Min	H Max	I	J
1	7411.11 1/2.BLACK	5 1/2" 140 mm	4 9/16" 116 mm	4 11/16" 119 mm	1 1/2" 38 mm	3 11/16" 94 mm	2 5/16" 58 mm	4 5/8" 117 mm	9 5/8" 244 mm	10 5/8" 270 mm	15 5/8" 397 mm	1/2" 12.7 mm	4 1/8" 105 mm
2	7412.11 5/8 BLACK	6 5/8" 167 mm	5 1/16" 129 mm	5 1/4" 134 mm	1 13/16" 46 mm	4 3/16" 106.5 mm	2 3/4" 70 mm	5 3/8" 137 mm	11 5/16" 287 mm	12 11/16" 322 mm	18 9/16" 471 mm	5/8" 15.9 mm	5" 127 mm
3	7413.11 3/4 BLACK	8 3/16" 208 mm	6 1/2" 166 mm	6 3/4" 172 mm	2 1/2" 64 mm	5 7/16" 138.5 mm	3 5/8" 92 mm	6 7/8" 175 mm	14 3/8" 365 mm	16 1/8" 410 mm	23 5/8" 600 mm	3/4" 19.1 mm	6 5/16" 160 mm
3	7413.11 7/8.BLACK	8 3/16" 208 mm	6 1/2" 166 mm	6 3/4" 172 mm	2 1/2" 64 mm	5 7/16" 138.5 mm	3 5/8" 92 mm	7 5/16" 186 mm	15" 381 mm	16 9/16" 421 mm	24 1/4" 616 mm	7/8" 22.2 m	6 5/16" 160 mm

- 17) Feeder
- 18) Connector Bushing
- 19) Bottom Connector

- 20) 7' (2.13 m) Foil
- 21) Connector Screws
- 22) Connector Wedge

- 23) Connector
- 24) Halyard Swivel
- 25) Trim Cap Screws

- 26) Trim Cap



Line (Not included with Furler)

Note: Line is not included with furler. Drum of unit is smaller to allow it to fit into narrow bow sections. If overlapping sails are used, standard diameter line will fill up drum and jam furler. To prevent this, use small diameter, high strength line at forward end and have a rigger add a cover at aft end where line is handled.

Line Specifications

Unit	Forward Ø	Min Break Strength	Aft Ø
1	1/4" (6 mm)	2500 lb (1130 kg)	5/16" (8 mm)
2	5/16" (8 mm)	3740 lb (1700 kg)	3/8" (10 mm)
3	3/8" (10 mm)	5000 lb (2270 kg)	7/16" (12 mm)

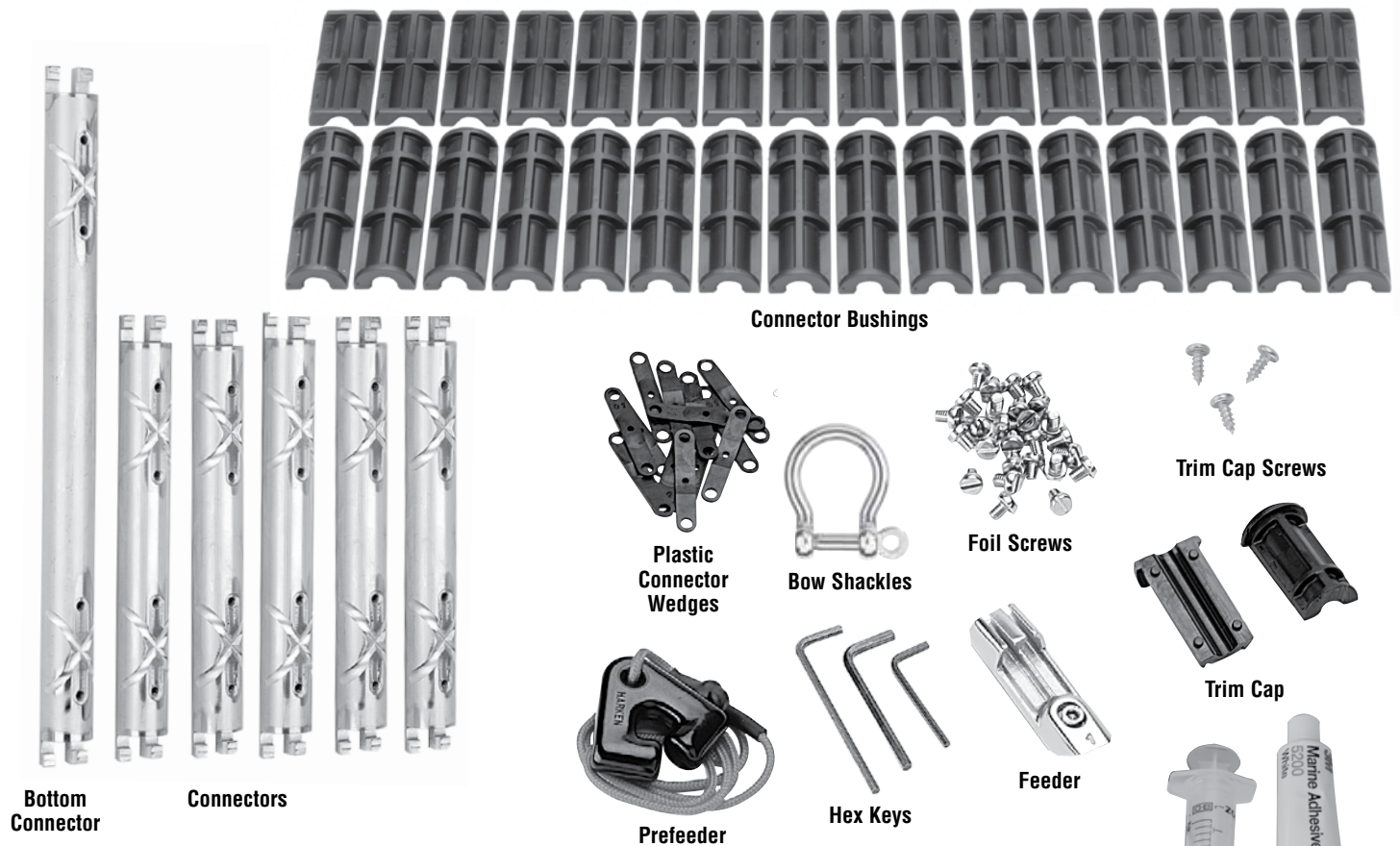
Foils (Standard Package)

Description	Unit	Part No.*	Qty
7' (2.13 m) Foil	1	7411.30.BLACK	6
2' (610 mm) Bottom foil		7411.33.BLACK	1
7' (2.13 m) Foil	2	7412.30.BLACK	8
2' (610 mm) Bottom foil		7412.33.BLACK	1
7' (2.13 m) Foil	3	7413.30.BLACK	10
2' (610 mm) Bottom foil		7413.33.BLACK	1

Main Components

Description	Part No.				Qty
	Unit 1	Unit 2	Unit 3-3/4	Unit 3-7/8	
Halyard swivel	H-39812	H-39794	H-39392	H-39392	1
Torque Tube Assembly	HFG927	HFG928	HFG929	HFG929	1
Hub Assembly	HFG923	HFG924	HFG925	HFG926	1
Cover Assembly	HFG683	HFG686	HFG689	HFG689	Pair
Flange Assembly	HFG684	HFG687	HFG690	HFG690	Pair
Guard Assembly	HFG685	HFG688	HFG691	HFG691	Pair

*Clear foils available. Replace "BLACK" with "CLEAR"



Bottom Connector

Connectors

Connector Bushings

Plastic Connector Wedges

Bow Shackles

Foil Screws

Trim Cap Screws

Trim Cap

Feeder

Hex Keys

Prefeeder

Hex Keys (Supplied)

Description	Unit	Qty
2.5, 4, 5 mm	1	1 Each
3, 4, 5, 6 mm	2	1 Each
3, 4, 6, 10 mm	3	1 Each

Blue Loctite®

Red Loctite®

Injector

5200 Adhesive

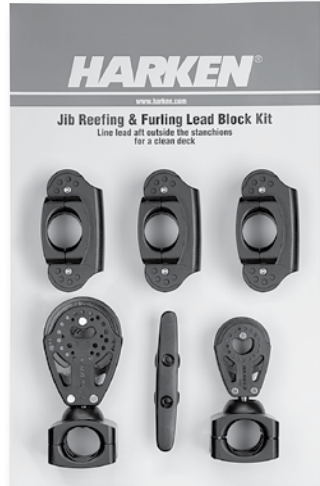
Other Components

Description	Unit 1			Unit 2			Unit 3 (3/4, 7/8)		
	Part No.	Qty	Size	Part No.	Qty	Size	Part No.	Qty	Size
Connector	7411.31	5	7" (177.8 mm)	7412.31	7	9" (229 mm)	7413.31	9	9.75" (248 mm)
Bottom connector	7411.32	1	10.75" (273 mm)	7412.32	1	13" (330 mm)	7413.32	1	14" (356 mm)
Bow shackle	2110	3	6 mm	2117	3	8 mm	2124	3	10 mm

Description	Unit 1		Unit 2		Unit 3 (3/4, 7/8)	
	Part No.	Qty	Part No.	Qty	Part No.	Qty
Connector bushing set	HFG295 (12-H-42062/12-H-42063)	1	HFG296 (16-H-42032/16-H-42033)	1	HFG297 (20-H-42073/20-H-42074)	1
Plastic connector wedge set	HFG299 (14-H-39625)	1	HFG300 (18-H-39487)	1	HFG324 (22-H-39487)	1
Foil screw set	HFG343 (28-HFS1105)	1	HFG348 (36-HFS1106)	1	HFG349 (44-HFS1106)	1
Trim cap set	HFG680 (H-37361/H-37362)	1	HFG681 (H-37403/H-37404)	1	HFG682 (H-39751/H-39752)	1
Trim cap screw set	HFG629 (3-HFS1126)	1	HFG672 (3-HFS1127)	1	HFG672 (3-HFS1127)	1
Prefeeder	947	1	947	1	947	1
Feeder with screw and tab	H-39683	1	H-39559	1	H-39756	1
Injector, 1 oz. 5200 Adhesive	HFG725	1	HFG725	1	HFG725	1
Loctite® Blue	833	1	833	1	833	1
Loctite® Red	HFG739	2	HFG739	2	HFG739	2

1. Stud/eye turnbuckle components are not included and must be purchased separately. See page 8.
2. Rod rigging requires Harken rod adapter stud.
3. Order Harken Lead Blocks and one additional 7403 if necessary. Fits 1" (25 mm) stanchions.

ROD RIGGING
Harken Rod Adapter
Stud Required
(Sold Separately)



Unit 1, 2
7404 Lead Block Kit
(Sold Separately)

349, 2652

Recommended Furling
Compartment Lead Blocks

Unit	Turning	Thru-Deck
1	349	131
2	2652	047
3	2600/137/071	HC7981

Rod Adapter Stud

Unit	Part No.	Thread Ø
1	7422 -8	1/2" - 20RH
	7423 -10	1/2" - 20RH
2	7424 -12	5/8" - 18RH
	7425 -17	5/8" - 18RH
3	7426 -22	3/4" - 16RH
	7427 -30	7/8" - 14RH

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 70F (22C) with 50% humidity. Do not apply at temperatures below 40F (5C) and above 100F (38C).

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 a couple days before sailing. If adhesive gets on sails remove using acetone. For faster-curing adhesive, purchase 4200 Fast Cure.

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

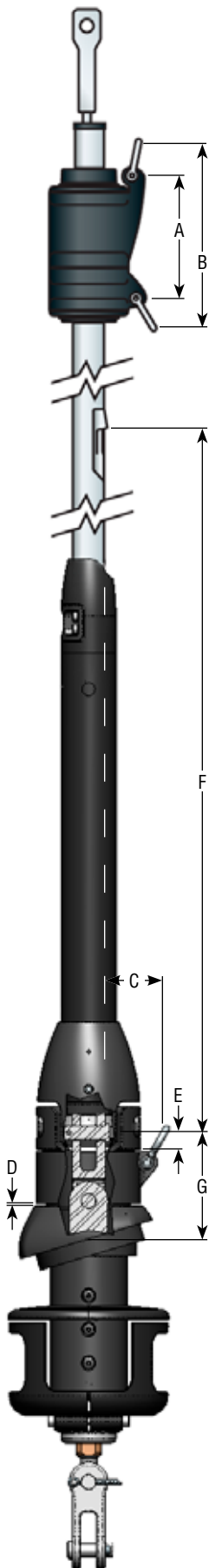
Tools You Will Need

Unit	Drill Ø
1	1/8" (3 mm), 1/4" (6.25 mm)
2	5/32" (4 mm), 1/4" (6.25 mm)
3 (3/4, 7/8)	5/32" (4 mm), 1/4" (6.25 mm)

Unit	Deck Flange Ø	Hole Saw Size
1	3.7" (94 mm)	3 3/4" (95 mm)
2	4.2" (106.5 mm)	4 1/4" (110 mm)
3	5.45" (138.5 mm)	5 1/2" (140 mm)

Unit	Wrench Size for Length Adjuster
1	7/8" (22 mm)
2	1" (25 mm)
3	1.25" (32 mm)

1. Long tape measure	6. Side cutters	11. Center punch	16. Hole saw
2. Short tape measure	7. Rat-tail file	12. Rigging or black tape	17. Deck sealant
3. Power drill	8. Hex Keys (provided)	13. Scissors	18. Box end wrench
4. Drill bits (see chart)	9. Slotted/phillips screwdrivers	14. Metal straight edge	19. 6 mm bolts, nuts and washers
5. Hacksaw	10. Needle-nose pliers	15. Hammer	



Luff Length

Note offsets above and below sail.

A shorter luff may be required if a halyard restrainer is necessary (page 37) or a toggle or long toggle assembly is used to raise drum. If luff of sail is not long enough to put halyard swivel near top of headstay foil, a pendant must be added. See page 36.

Tack Setback

Find setback "C" for tack shackle in chart below and modify sail accordingly. Setback is measured to luff tape of sail.

Luff Tape Size

All units require #6 (6/32" or 5 mm) luff tape.

Luff Tape Length

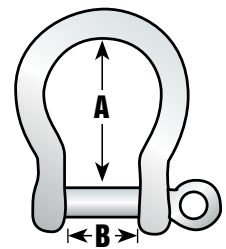
Cut off top of luff tape so it is 18 to 24" (450 to 600 mm) below head of sail. This allows head to lag behind rest of sail to help flatten sail. It will also help head to roll more smoothly.

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. The minimum inside dimensions of standard head and tack shackles are:

Unit	A	B
1	1 1/16" (27 mm)	1/2" (13 mm)
2	1 3/4" (44 mm)	1 1/16" (17 mm)
3	1 7/8" (48 mm)	1 3/16" (21 mm)



Suncover

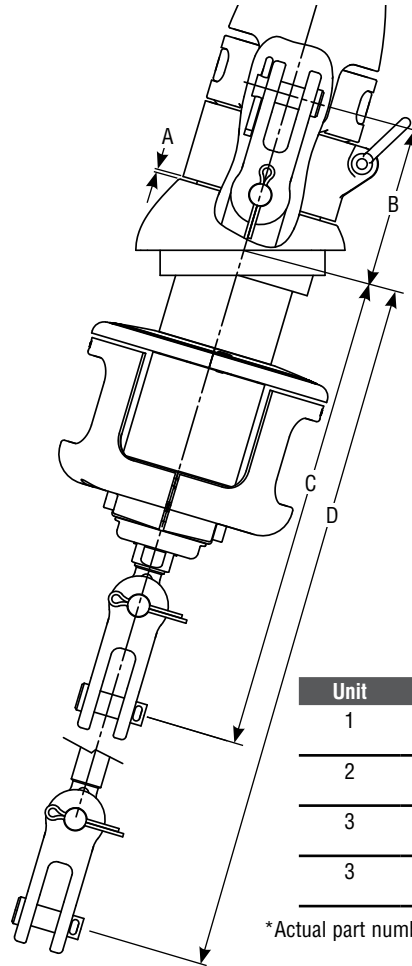
Suncover may be installed on either side of sail. Be sure to match other sails in the customer's inventory.

Unit	Part No.	A	B	C	D	E	F	G
1	7411.11 1/2*	4 3/4" 120 mm	7" 177 mm	1 15/16" 49 mm	1/16" 2 mm	—	37 13/16" 960 mm	3 5/8" 92 mm
2	7412.11 5/8*	5 5/8" 143 mm	9 1/8" 231 mm	2 5/16" 59 mm	1/16" 2 mm	9/16" 14mm	41 1/16" 1043 mm	4 1/16" 104 mm
3	7413.11 3/4*	7 5/16" 186 mm	11 5/8" 296 mm	3 3/16" 81 mm	1/16" 2 mm	7/16" 11mm	47 3/16" 1199 mm	5 3/8" 136 mm
3	7413.11 7/8*	7 5/16" 186 mm	11 5/8" 296 mm	3 3/16" 81 mm	1/16" 2 mm	—	46 1/16" 1170 mm	5 13/16" 148 mm

*Actual part numbers have ".BLACK" or ".CLEAR" at the end to designate foil color.

Use dimensions of Harken toggle below to build stay to correct length.

Tip: Turnbuckles should be 1/2 to 2/3rds open to allow shortening for new wire stretch and for fine-tuning mast rake.



Unit	Part No.	A	B	C	D
1	7411.11 1/2*	1/16" 2 mm	3 ⁵ / ₈ " 92 mm	10 ⁵ / ₈ " 270 mm	15 ⁵ / ₈ " 397 mm
2	7412.11 5/8*	1/16" 2 mm	4 ¹ / ₈ " 104 mm	12 ¹¹ / ₁₆ " 322 mm	18 ⁹ / ₁₆ " 471 mm
3	7413.11 3/4*	1/16" 2 mm	5 ³ / ₈ " 136 mm	16 ¹ / ₈ " 410 mm	23 ⁵ / ₈ " 600 mm
3	7413.11 7/8*	1/16" 2 mm	5 ¹³ / ₁₆ " 148 mm	16 ⁹ / ₁₆ " 421 mm	24 ¹ / ₄ " 616 mm

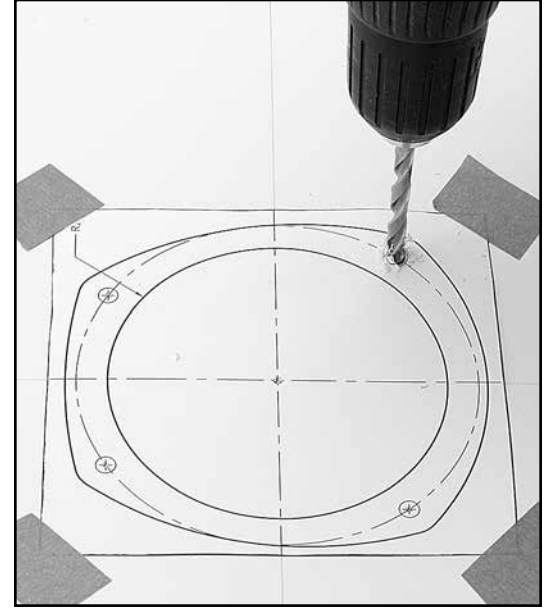
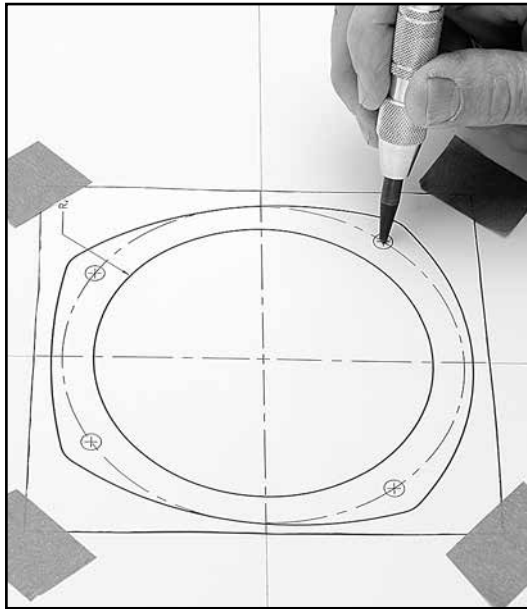
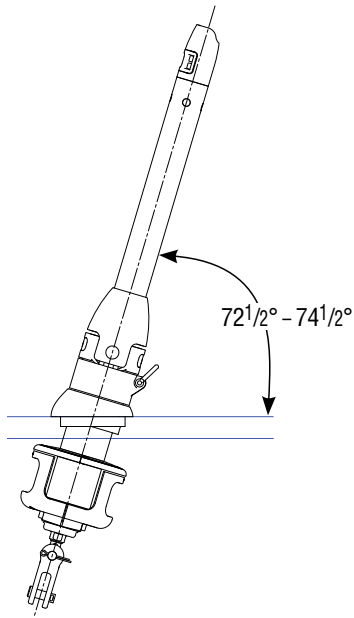
*Actual part numbers have ".BLACK" or ".CLEAR" at the end to designate foil color.

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 nosepiece for Harken rod adapter stud: Threaded nosepiece must have a positive lock as well as adhesive. Use Harken stud with cotter pins. See page 28.

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





Note: Deck flange angle matches a stay angle of $73\frac{1}{2}^\circ$ when compared to deck. Angles can vary between $72\frac{1}{2}^\circ$ and $74\frac{1}{2}^\circ$.

Carefully locate center point in deck to locate deck flange. Line from mast to under deck chainplate must intersect this center point. Mark center fore/aft and athwartships line. Use template to mark four outer holes and center pilot hole. Make sure closer pair of holes is forward.

If deck does not fall within these angles, shims must be made using structural adhesive to avoid excessive pressure on deck and deck bearings.

Once you are certain hole is located in line with chainplate and any required shimming is done, drill hole 90° to deck. Make sure hole is just large enough so deck flange bears against deck. It is better to make hole slightly smaller and file opening larger to fit. Use template to mark large hole and bolt holes. Use hole saw to drill deck.

Tip: After pilot drill bit clears deck, drill final hole from bottom using pilot hole to line up hole drilled from top. This will prevent glass from chipping.



Use 6 mm screws and compound to fasten deck flange.

Note: There must be a minimum of $\frac{3}{8}$ " (9 mm) thread engagement into deck flange.





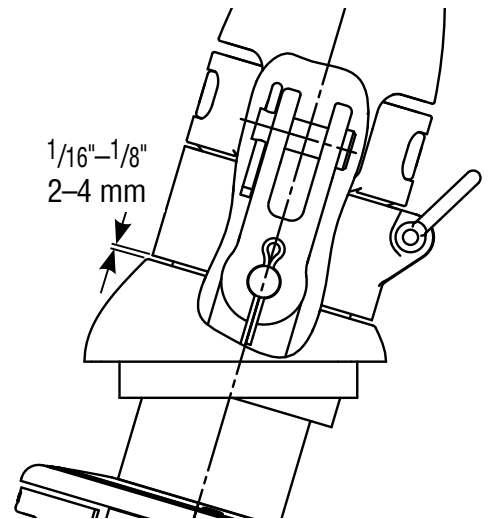
Slide hub assembly into deck flange. Turn adjusting nut to lengthen or shorten threaded stud as needed.



Adjust length so toggle is lined up with chainplate hole. Slide pin into chainplate and secure with cotter pin.



Stud Length	Turn Adjusting Nut
Shorten	Clockwise
Lengthen	Counter-Clockwise



Distance between bottom of tack swivel and deck flange must be 1/16"–1/8" (2–4 mm).

From on-deck, pull up on unit to check height between deck flange and tack swivel. Make sure tack swivel is free to rotate when there is upward pressure on unit. Check this again when stay is up and tensioned.



Place halves of plastic flange in lower groove on hub assembly so smooth side of flange is up.

Tip: Line up flats in flange with flats in groove.



Use blue Loctite® on flathead screws (provided).



Tighten screws using hex key (provided).



Place halves of plastic cover in grooves so flats in cover align with flats in groove.

Tip: Rotate each screw hole towards the stern.



Use blue Loctite® on flathead screws (provided).



Tighten screws using hex key (provided).

Assemble line guard so enclosed opening faces lead block. Do not use Loctite® on threads.

Tip: Loosely thread both screws turning guard so it can be rotated to its final position. Finish tightening final screw when enclosed opening faces lead block.



Assembly

Underdeck Lead Block

Mount lead block so that line exits furler at 90° to line of headstay as shown. Remember block will split angle and raise up slightly under load. Mount thru-deck block. You may want to angle it toward stanchion block.

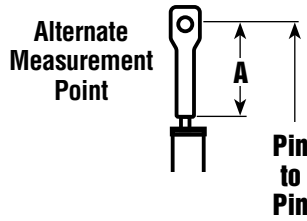


Mount thru-deck block. You may want to angle it toward stanchion lead block.



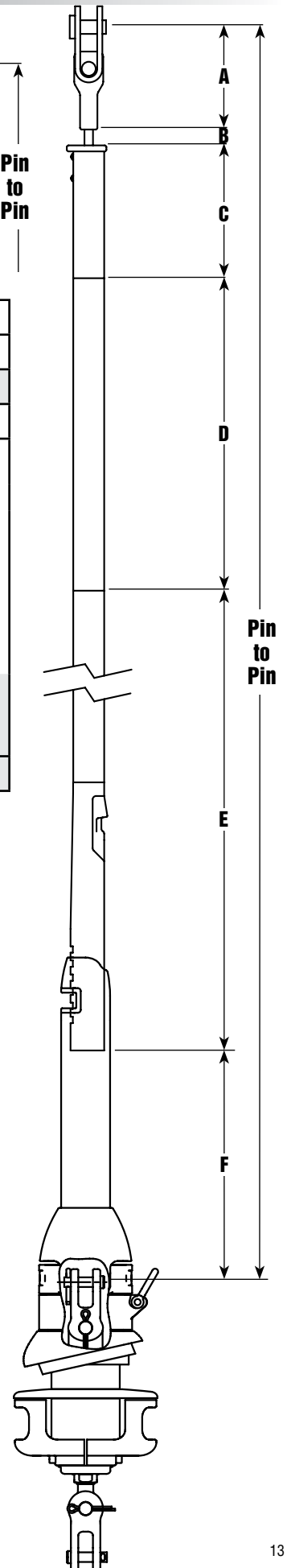
Measure A and add to this chart and length chart below		
	Inches	mm
A		
B	.50	13
E	24	610
F	15.25	387
Total A+B+E+F		

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



TOP FOIL LENGTH WORKSHEET

1	Pin-to-Pin Length	
2	Subtract ABEF	-
3	Result (Pin-to-Pin - ABEF)	
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
3 x 84 = 252	3 x 2133.6 = 6400.8	
4 x 84 = 336	4 x 2133.6 = 8534.4	
5 x 84 = 420	5 x 2133.6 = 10668	
6 x 84 = 504	6 x 2133.6 = 12801.6	
7 x 84 = 588	7 x 2133.6 = 14935.2	
8 x 84 = 672	8 x 2133.6 = 17068.8	
Example—If result from Step 3 is: 500 inches "D" = 420 inches 12,000 mm "D" = 10,668 mm		
5	Result (C) Top Foil Length	



UNIT 1

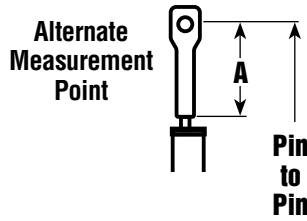
Length Check

After completing worksheet above fill in A, C and D below. Add "A" through "F" 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	.50	13
C Top Foil Length		
D Number of Foils _____ x 84" (2133.6 mm)		
E Bottom Foil	24	610
F Bottom of Foil to Jaw/Jaw Toggle	15.25	387
Pin-to-Pin Length		

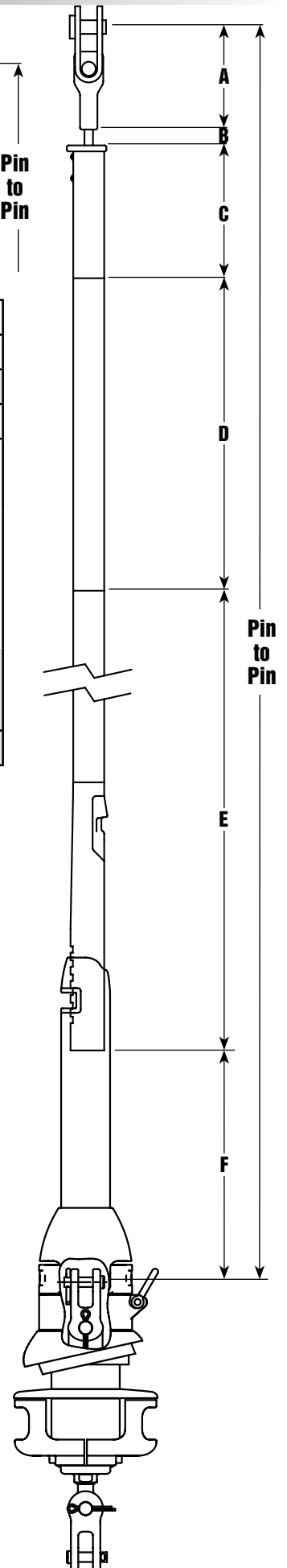
Measure A and add to this chart and length chart below		
	Inches	mm
A		
B	.63	16
E	24	610
F	18.45	469
Total A+B+E+F		

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



TOP FOIL LENGTH WORKSHEET

1	Pin-to-Pin Length	
2	Subtract ABEF	-
3	Result (Pin-to-Pin - ABEF)	
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To find "D" pick number from chart below that is closest to, but not greater than total from step 3.		
Inches		mm
5 x 84 = 420	5 x 2133.6 = 10668	
6 x 84 = 504	6 x 2133.6 = 12801.6	
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	
Example—If result from Step 3 is: 500 inches "D" = 420 inches 12,000 mm "D" = 10,668 mm		
5	Result (C) Top Foil Length	



UNIT 2

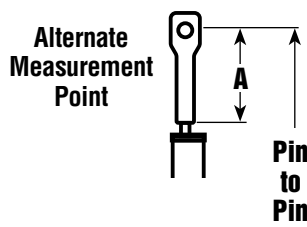
Length Check

After completing worksheet above fill in A, C and D below. Add "A" through "F" 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	.63	16
C Top Foil Length		
D Number of Foils _____ x 84" (2133.6 mm)		
E Bottom Foil	24	610
F Bottom of Foil to Jaw/Jaw Toggle	18.45	469
Pin-to-Pin Length		

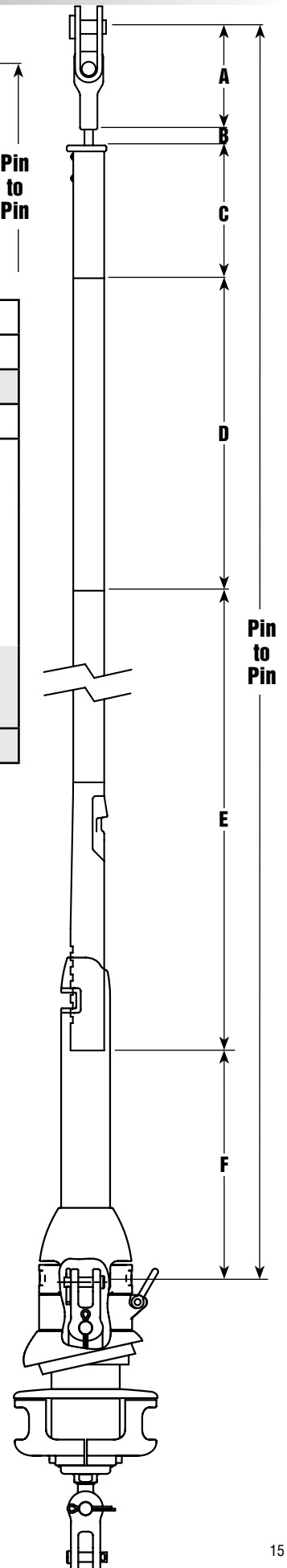
Measure A and add to this chart and length chart below		
	Inches	mm
A		
B	1	25
E	24	610
F	23.4	594
Total A+B+E+F		

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



TOP FOIL LENGTH WORKSHEET

1	Pin-to-Pin Length													
2	Subtract ABEF	-												
3	Result (Pin-to-Pin - ABEF)													
4	Subtract D	-												
To find "D" pick number from chart below that is closest to, but not greater than total from step 3. <table border="0"> <thead> <tr> <th>Inches</th> <th>mm</th> </tr> </thead> <tbody> <tr> <td>7 x 84 = 588</td> <td>7 x 2133.6 = 14935.2</td> </tr> <tr> <td>8 x 84 = 672</td> <td>8 x 2133.6 = 17068.8</td> </tr> <tr> <td>9 x 84 = 756</td> <td>9 x 2133.6 = 19202.4</td> </tr> <tr> <td>10 x 84 = 840</td> <td>10 x 2133.6 = 21336</td> </tr> <tr> <td>11 x 84 = 924</td> <td>11 x 2133.6 = 23470</td> </tr> </tbody> </table>			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
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 20,000 mm "D" = 19,202 mm														
5	Result (C) Top Foil Length													



UNIT 3 (3/4, 7/8)

Length Check

After completing worksheet above fill in A, C and D below. Add "A" through "F" 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	25
C Top Foil Length		
D Number of Foils _____ x 84" (2133.6 mm)		
E Bottom Foil	24	610
F Unit 3-3/4—Bottom of Foil to Jaw/Jaw Toggle	24	610
F Unit 3-7/8—Bottom of Foil to Jaw/Jaw Toggle	23.4	594
Pin-to-Pin Length		

If top foil is shorter than 7" (177.8 mm), use one of the following special techniques to ensure sufficient bearing surface for the foil in the area of the halyard swivel.



7" (178 mm) No special treatment required.



2 1/2"–1" (64–25 mm) Shorten top foil and adjoining full length foil so two screws are used to assemble joint instead of four. Do not use plastic bushings above top connector.



6"–5" (152–130 mm) Do not use plastic bushing above top connector.

Top Foil Length from Worksheet	1. Initial top foil cut length		2. Cut through middle hole in top foil.*		3. Shorten full length adjoining foil by cutting through middle hole.*	4. Shorten connector		5. Shorten trim cap	
			Resulting Top Foil Length			Length			
2 1/2" (64 mm)	5 7/8" (149 mm)	4 1/8" (105 mm)				3 1/2" (89 mm)		No	
2" (51 mm)	5 3/8" (137 mm)	3 5/8" (92 mm)				3 1/2" (89 mm)		No	
1 1/2" (38 mm)	4 7/8" (124 mm)	3 1/8" (79 mm)				3 1/2" (89 mm)		Yes	
1" (25 mm)	4 3/8" (111 mm)	2 5/8" (67 mm)				3 1/4" (83 mm)		Yes	



4 1/2"–4" (115–102 mm) Do not use plastic bushing above top connector. Shorten top of connector and if necessary shorten trim cap.



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



3 1/2"–3" (90–75 mm) Do not use plastic bushing above top connector. Cut connector right at cross formed by glue dispersion channels. Use single foil screw in top foil only.



Under 1" (25 mm) Eliminate top foil and run foil higher in torque tube.

If top foil is shorter than 8¹¹/₁₆" (221 mm), use one of the following special techniques to ensure sufficient bearing surface for the foil in the area of the halyard swivel.



8¹¹/₁₆" (221 mm) No special treatment required.



8⁵/₈" – 6³/₈" (219–162 mm) Do not use plastic bushing above top connector.



6"–5¹/₂" (152–140 mm) Do not use plastic bushing above top connector. Shorten top of connector and if necessary shorten trim cap.

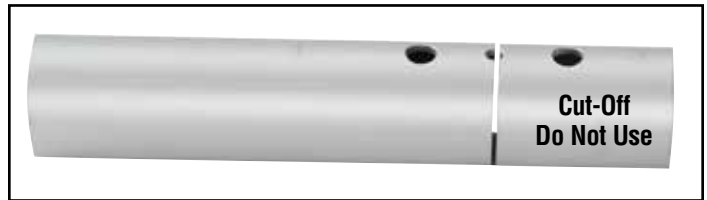


5¹/₄"–3⁵/₈" (133–92 mm) Do not use plastic bushing above top connector. Cut connector right at cross formed by glue dispersion channels. Use single foil screw in top foil only.



3"–1" (76–25 mm) Shorten top foil and adjoining full length foil so two screws are used to assemble joint instead of four. 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.*	3. Shorten full length adjoining foil by cutting through middle hole.*	4. Shorten connector	5. Shorten trim cap
		Resulting Top Foil Length		Length	
3" (76 mm)	7 ¹ / ₄ " (184 mm)	5 ¹ / ₈ " (130 mm)		4 ¹ / ₂ " (114 mm)	No
2 ¹ / ₂ " (64 mm)	6 ³ / ₄ " (172 mm)	4 ⁵ / ₈ " (117 mm)		4 ¹ / ₂ " (114 mm)	No
2" (51 mm)	6 ¹ / ₄ " (159 mm)	4 ¹ / ₈ " (105 mm)		4 ¹ / ₂ " (114 mm)	No
1 ¹ / ₂ " (38 mm)	5 ³ / ₄ " (146 mm)	3 ⁵ / ₈ " (92 mm)		3 ³ / ₄ " (95 mm)	Yes
1" (25 mm)	5 ¹ / ₄ " (133 mm)	3 ¹ / ₈ " (79 mm)		3 ³ / ₄ " (95 mm)	Yes



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



Under 1" (25 mm) Eliminate top foil and run foil higher in torque tube.

If top foil is shorter than 93/4" (248 mm), use one of the following special techniques to ensure sufficient bearing surface for the foil in the area of the halyard swivel.



93/4" (248 mm) No special treatment required.



95/8"-71/8" (244-181 mm) Do not use plastic bushing above top connector.



7"-51/2" (178-140 mm) Do not use plastic bushing above top connector. Shorten top of connector and if necessary shorten trim cap.

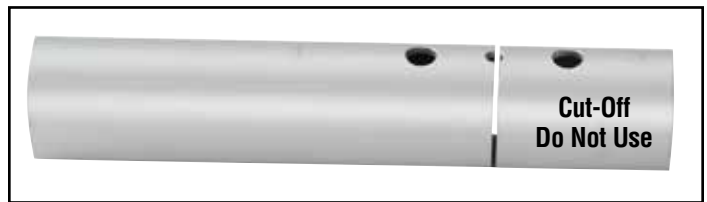


53/8"-4" (137-102 mm) Do not use plastic bushing above top connector. Cut connector right at cross formed by glue dispersion channels. Use single foil screw in top foil only.



31/2"-11/2" (89-38 mm) Shorten top foil and adjoining full length foil so two screws are used to assemble joint instead of four. 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.*	3. Shorten full length adjoining foil by cutting through middle hole.*	4. Shorten connector	5. Shorten trim cap
		Resulting Top Foil Length		Length	
31/2" (89 mm)	69/16" (167 mm)	5" (127 mm)		47/8" (124 mm)	No
3" (76 mm)	61/16" (154 mm)	41/2" (114 mm)		47/8" (124 mm)	No
21/2" (64 mm)	69/16" (167 mm)	4" (102 mm)		47/8" (124 mm)	No
2" (51 mm)	51/16" (129 mm)	31/2" (89 mm)		43/8" (111 mm)	Yes
11/2" (38 mm)	49/16" (116 mm)	3" (76 mm)		33/4" (95 mm)	Yes



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

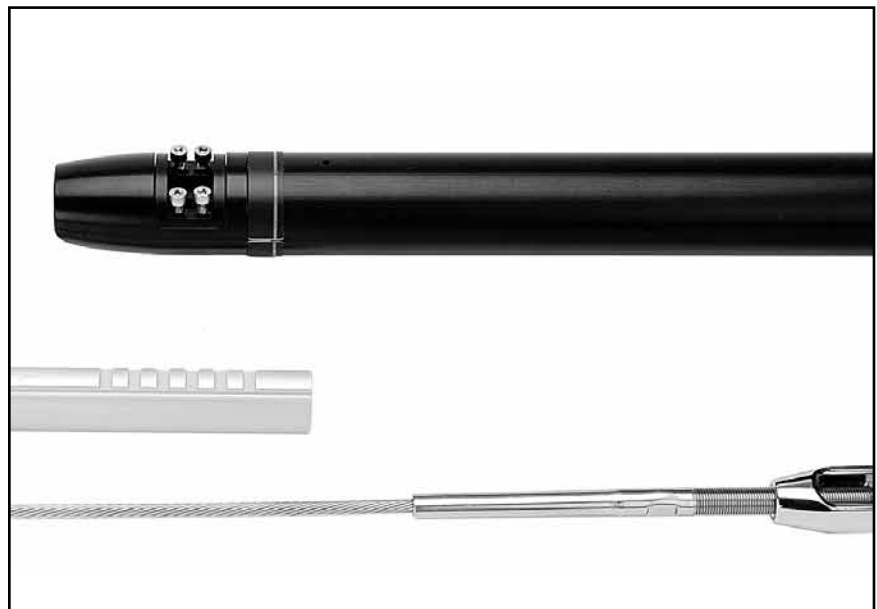


Under 11/2" (38 mm) Eliminate top foil and run foil higher in torque tube.

Confirm foil length by laying foils alongside stay with turnbuckle components and torque tube assembly. Pull stay out straight. Line up turnbuckle eye with a point just above bottom of torque tube assembly. This point will line up with Jaw/Jaw toggle pin. See chart above right.

Unit	Pin	Jaw/Jaw Toggle Pin to Bottom of Torque Tube Assembly
1	1/2" (12.7 mm)	7/16" (11 mm)
2	5/8" (15.9 mm)	1/4" (6 mm)
3	3/4" (19.1 mm)	5/8" (16 mm)
3	7/8" (22.2 mm)	1" (25 mm)

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



Note: Position top foil so that with top cap the foil will ride 5/8" (16 mm) 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.



Cut foil to length using hacksaw.



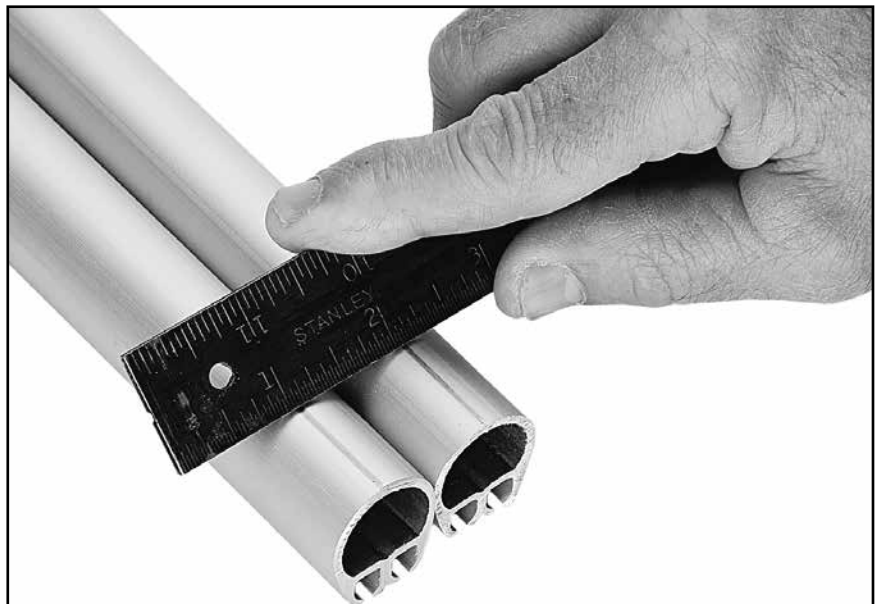
Deburr inside edge using rat-tail file.



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 cutoff piece and use a flat metal object (i.e. metal ruler) to scribe top line of foil.

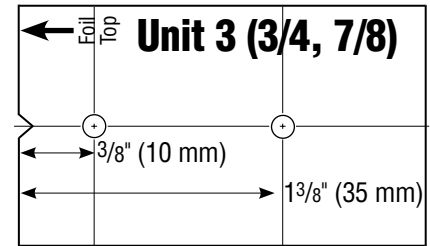
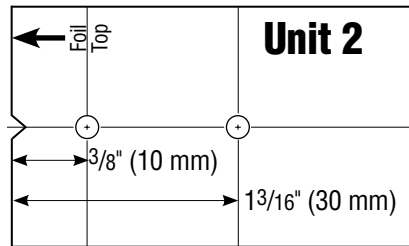
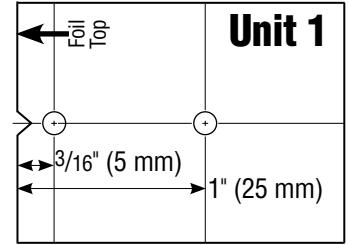


Assembly

Top Foil

Cut out template at right. Line template up with top of foil and scribed line. Tape in place. Use a center punch to mark holes. Check center punch marks to confirm they from top of foil (see chart below).

Unit	Center Punch Marks	
1	3/16" (5 mm)	1" (25 mm)
2	3/8" (10 mm)	1 3/16" (30 mm)
3 (3/4, 7/8)	3/8" (10 mm)	1 3/8" (35 mm)



Drill two (2) holes for trim cap. See chart below for correct drill size

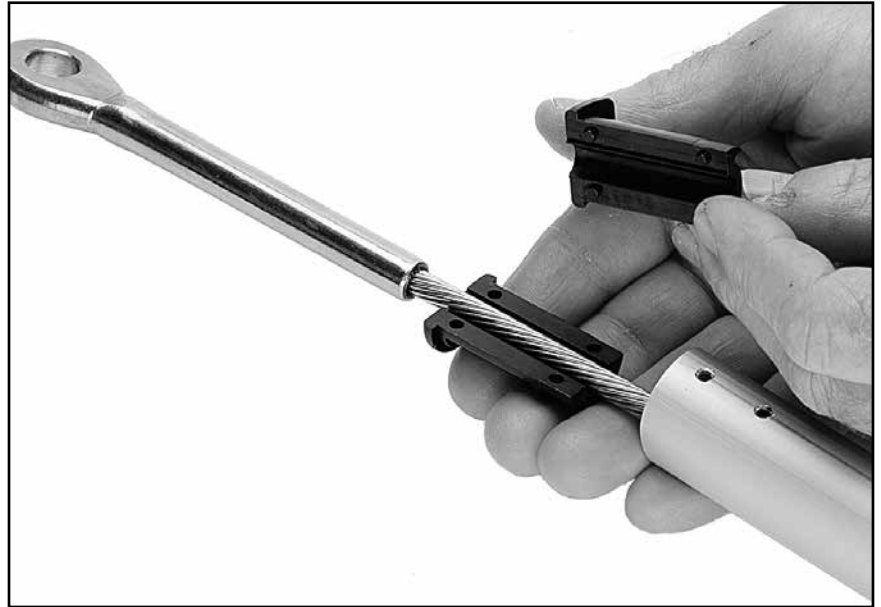
Unit	Drill Ø
1	1/8" (3 mm)
2	5/32" (4 mm)
3 (3/4, 7/8)	5/32" (4 mm)



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 as 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® into screw holes.



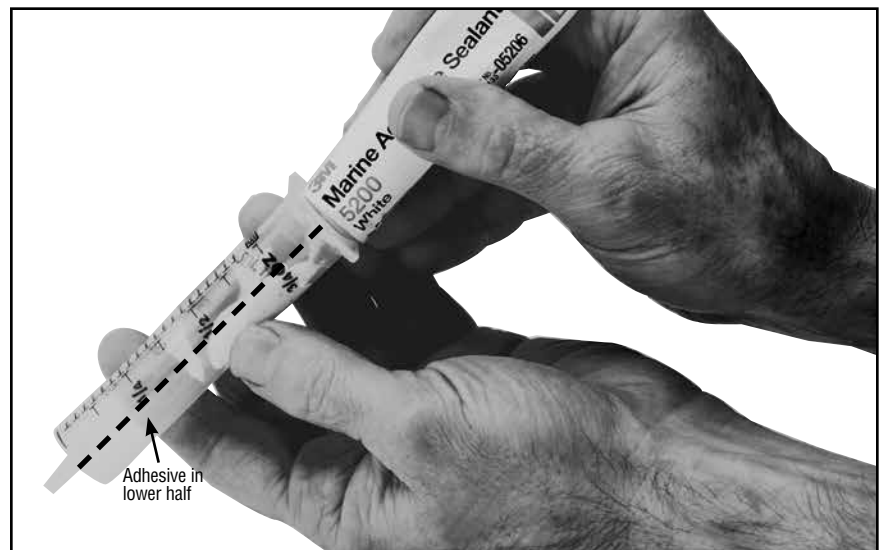
Hold plastic wedge in place with thumb as you insert into foil. Line foil holes with connector screw holes.



Loading Injector with Adhesive

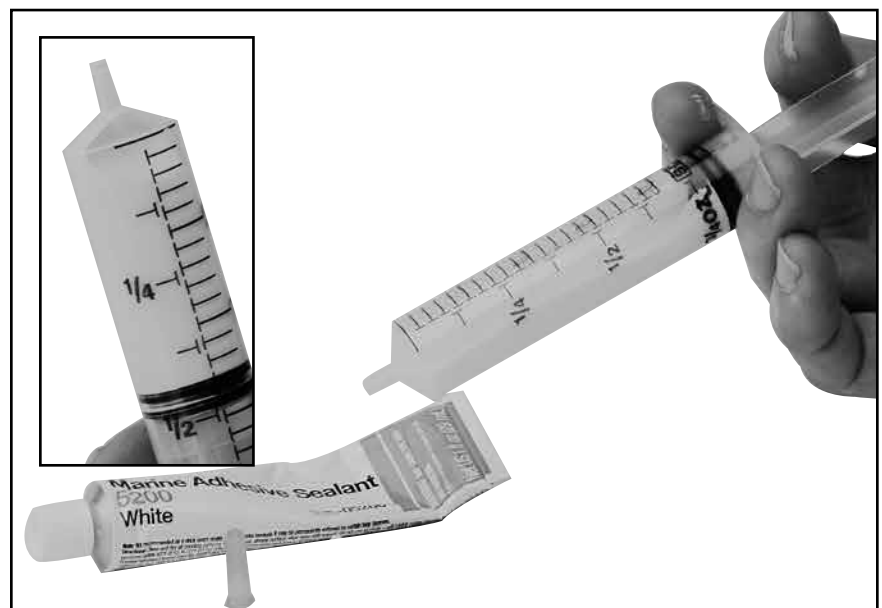
Tip: In cooler weather, keep sealed adhesive in pocket to keep warm. Use instructions below to fill injector less than half way; you will only use a small amount of adhesive. Refill if needed but do not keep open sealant for long periods. Use adhesive within 3 hours.

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 as shown. 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.

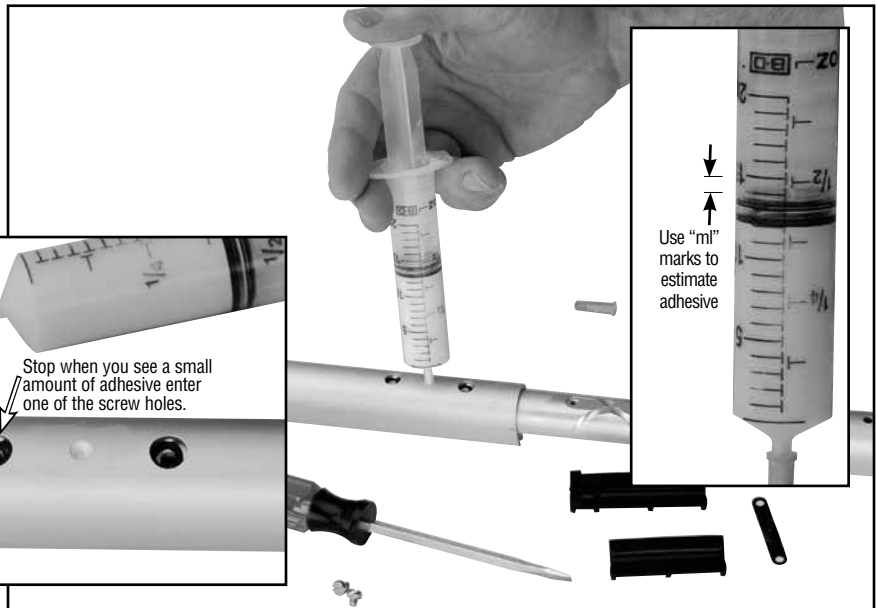
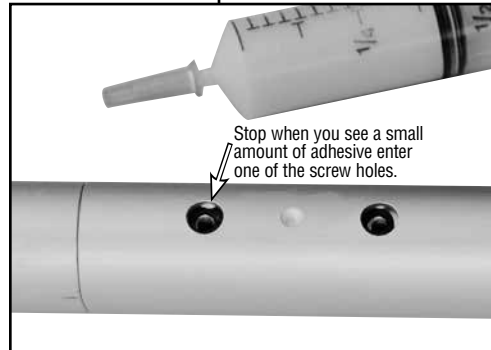
As sealant runs down towards plunger an air pocket will form near tip. Push plunger to evacuate air. You are now ready to begin injecting adhesive.



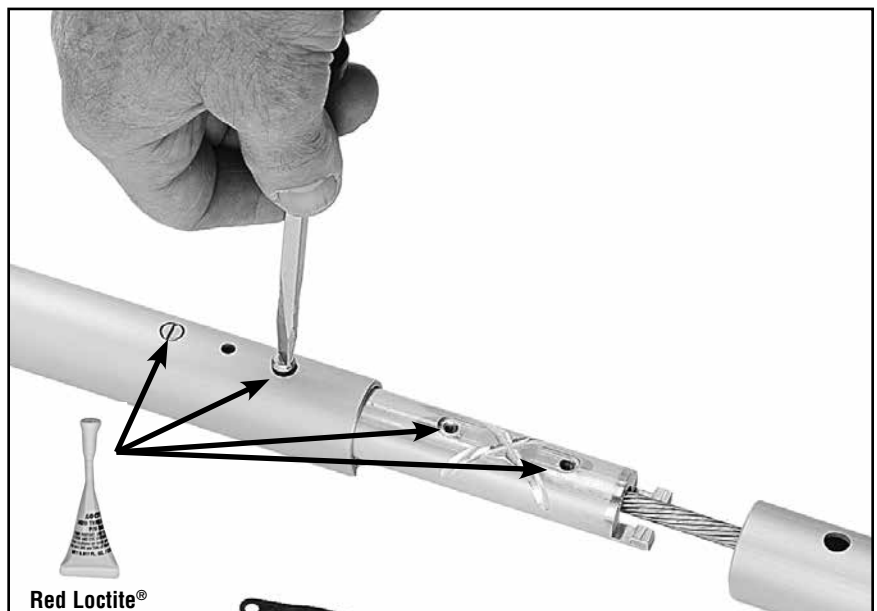
Inject only a small amount of adhesive into middle hole. See chart below for amount.

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

Unit	Adhesive (ml)
1	1/3 – 1/2
2	3/4 – 1
3 (3/4, 7/8)	1 – 1 1/4



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

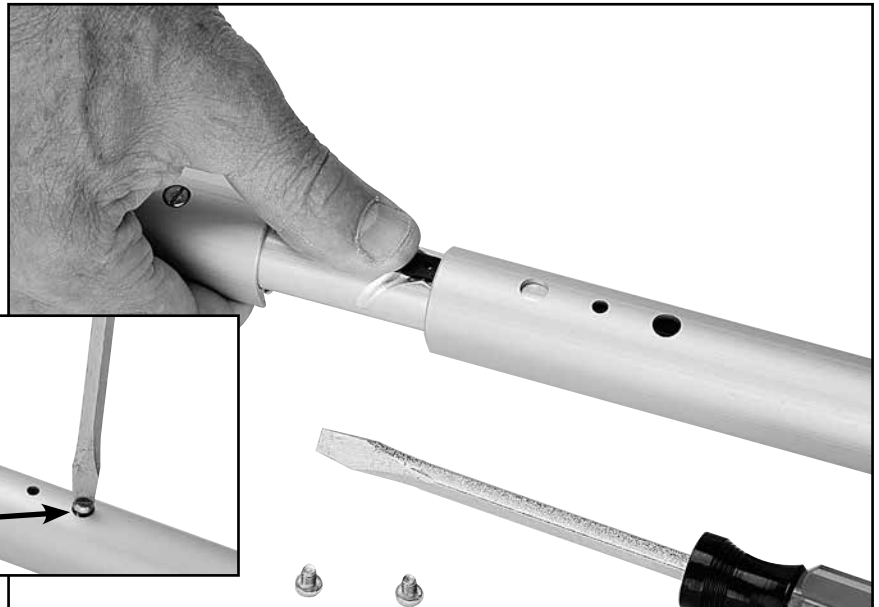
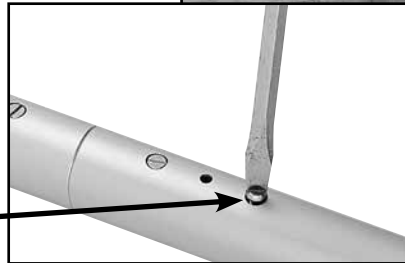


Use bushings, connector, wedge and adhesive in other screw hole and insert into other foil. Use adhesive (see chart below for amount).

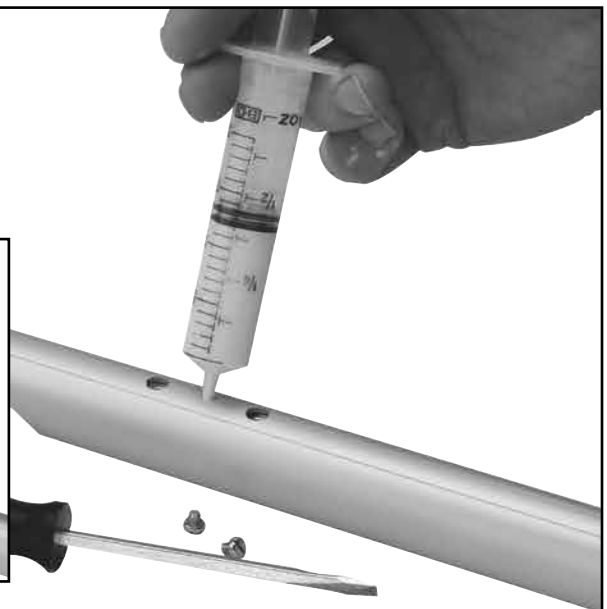
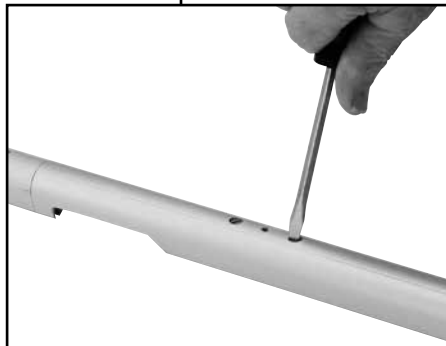
Unit	Adhesive (ml)
1	1/3 – 1/2
2	3/4 – 1
3 (3/4, 7/8)	1 – 1 1/4



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



Continue assembly. Use bottom connector to assemble bottom foil.



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



Loosen foil clamp screws at top of drum assembly.



Slide drum assembly onto foils.

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



Temporarily clamp torque tube assembly to top of bottom foil, leaving feeder gap partially exposed as shown at right. Gap will be used to rig a foil system lifting line.



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Apply a few drops of red Loctite® 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.

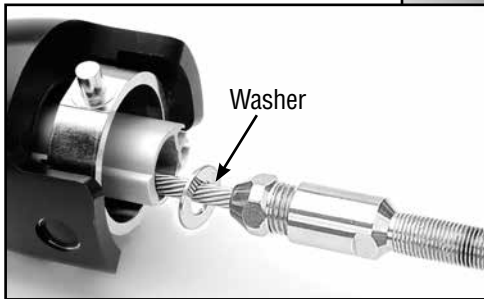
Flats will be close and may only require a small half turn to align with cotter pin holes.

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



Thread turnbuckle and threaded eye to stud protruding from foil. Assemble turnbuckle.

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



Taking care not to lose parts, remove bearing caps from drum assembly.

Tip: Rig a large round plastic wash basin below furler to catch any parts that may be lost overboard.

Assembly

Attach Turnbuckle/Foil System to Boat

Carefully Raise foil and stay up onto boat. Raise foils using line attached to feeder gap as shown.

Attach eye to jaw/jaw toggle deck level using clevis pin. Adjust turnbuckle. Secure with cotter pin.



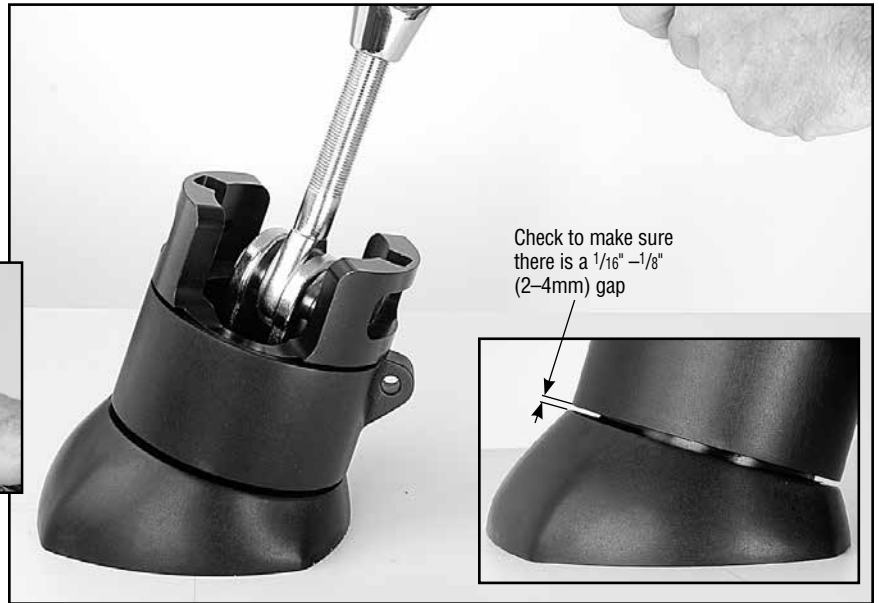
Secure with cotter pin.



Adjust turnbuckle.

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

Check to make sure there is a $\frac{1}{16}$ "– $\frac{1}{8}$ " (2–4 mm) gap between the deck flange and tack swivel. If necessary loosen adjusting nut below and take up on turnbuckle to increase gap between deck flange and tack swivel when turnbuckle is tightened.



Loosen foil clamp while holding torque tube assembly and carefully lower into place.

Note: Do not remove screws, just loosen them. Capture posts on universal posts with caps and secure with screws. **Do not use Loctite® on screws.**

Tip: If it is hard to capture posts in cap, push against stay to help align universal. If necessary loosen backstay.



Check foil height at top, set and secure using hex key. See tip on next page.





Tip: Do not remove foil clamp screws to adjust foil. Loosen screws, hold foils and bring clamp away from foils. Adjust and reclamp.



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 due to vibration.

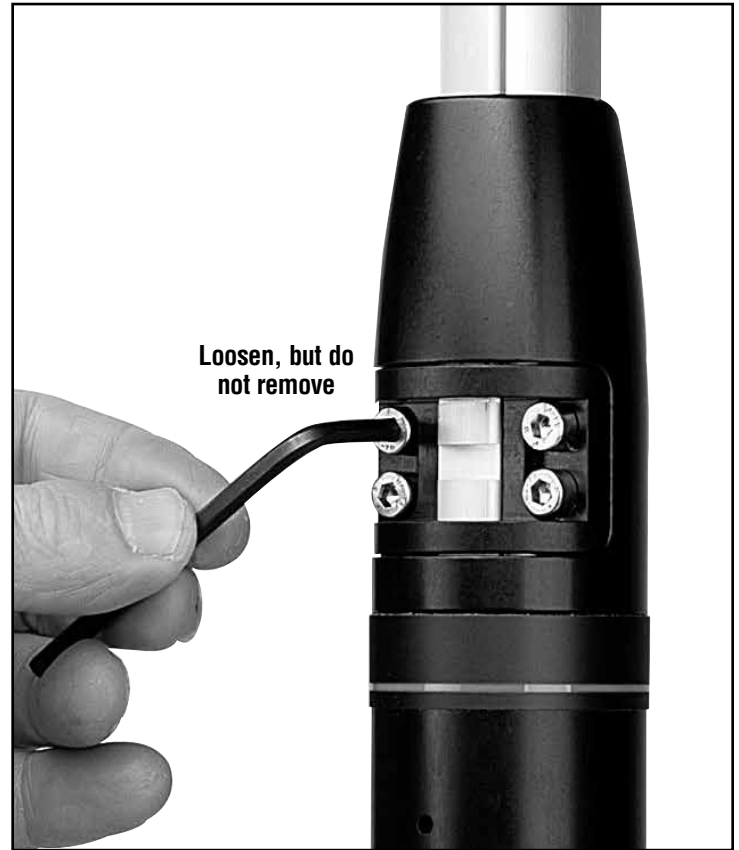
Important! When removing feeder, loosen screw no more than one full turn. Slide screw up and remove feeder.

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

Hold foils and loosen torque tube screws until you can pull clamp part way out in order to lower foils.

Lower foils.

Rig a screw catcher. Remove screws holding bearing caps and remove taking care to not lose parts.





Slide torque tube assembly onto foil and clamp just below top of feeder gap as shown. Use halyard to lift foil assembly.



Adjust turnbuckle



CAUTION! Foils can drop suddenly causing injury to hands. Make sure drum assembly and foils are securely lifted using a halyard before adjusting turnbuckle.

Check to make sure there is a 1/16"–1/8" (2–4 mm) gap between deck flange and tack swivel. If necessary loosen adjusting nut below and take up on turnbuckle to increase gap between deck flange and tack swivel when the turnbuckle is tightened.

Reassemble Torque Tube Assembly to Hub Assembly.

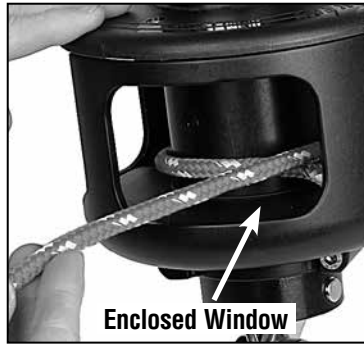
Do not use Loctite® on screws.

Tip: If it is hard to capture posts in cap, push against stay to help align universal. If necessary loosen backstay.

Lift foils so top is 1/2"–3/8" (12 mm–16 mm) below upper terminal.

Slide foil clamp into foil notches and tighten screws to secure.





Run line through enclosed window in guard and into hole in bottom plate of spool. Tie a small overhand knot and pull it up under drum assembly.



WARNING! Lead line through enclosed window. If line is led through opening between two enclosed windows it can ride above lineguard and jam furler which can cause loss of control of boat.

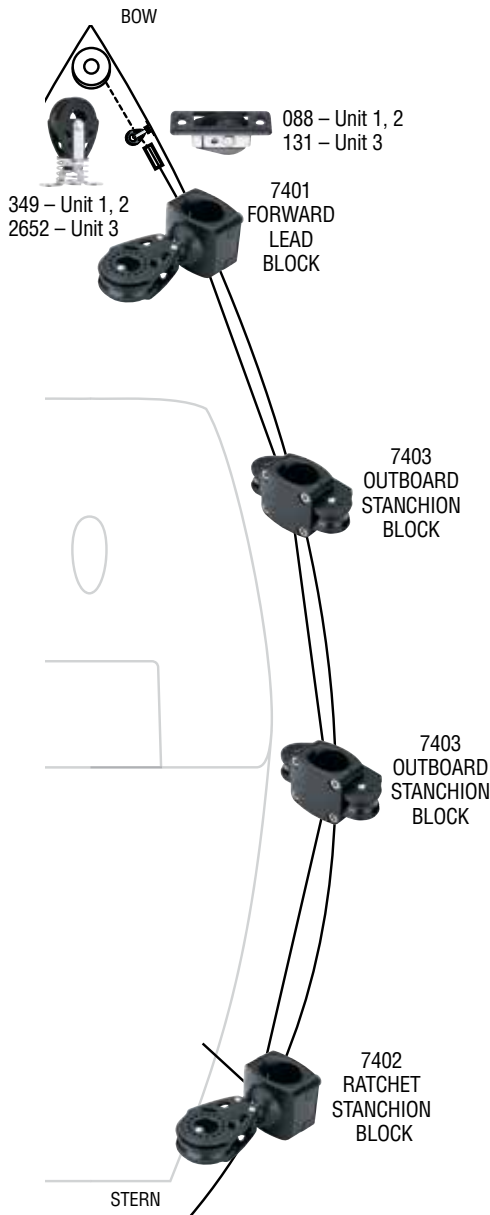
Note location of sun cover. Charge system by rotating furler to wrap line on drum.

Tip: Sun cover to starboard—turn clockwise to charge. Sun cover to port—turn counter-clockwise. Tension line while charging.

Mount Lead Blocks

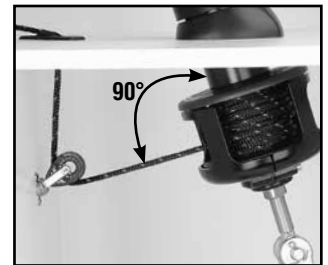
Furling line can be led down either side of boat. If boat is in slip, consider mounting opposite dock. Remove four screws on stanchion blocks. Clamp blocks to stanchions. See instructions below.

Tip: Start all four screws before tightening.



7401 Forward Lead Block

Position Forward Lead Block so line enters drum at right angles to headstay and centers vertically in opening. Install so line is inside stanchion. **Correct block position is critical to even line spooling and ease of furling.**



7403 Outboard Stanchion Blocks

Install 7403 Outboard Stanchion Blocks so line is outside stanchions. Number and placement of leads depends on boat length and number/configuration of stanchions.



7402 Ratchet Stanchion Block

Mount 7402 Ratchet Stanchion Block as furthest-aft lead to prevent line overrides in drum when unfurling. Position ratchet block so line turns at least 90°. Install so line is inside stanchion.



Lead line through block so ratchet makes clicking sound when pulling line to furl sail.

Tip: Make sure ratchet switch is in "ON" position. If there is no clicking sound, lead line through block in opposite direction.

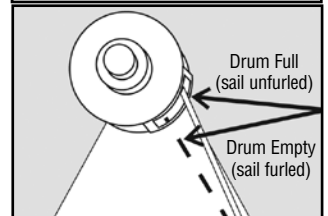
Lead line to Furling Line Cleat in cockpit.

HCP168 Furling Line Cleat

Install so line is angled as shown. Use #10 (5 mm) fasteners.



Note: As furling line lead changes, make sure line doesn't chafe against line guard. Rotate line guard if necessary.



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 may 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.

If Halyard Wraps

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 a professional going aloft and freeing halyard.

If sail will not furl or unfurl, try to remove jib sheets and manually wrap sail around headstay.



WARNING! Do not go aloft on boat's halyards if there has been a halyard wrap. Do not use boat. Damage to halyard, headstay, stay terminals, or connections as a result of a halyard wrap may cause these parts to break suddenly causing mast to fall down while person is aloft. Sailing or motoring with boat after a wrap can result in the headstay breaking and mast falling down. Before using boat, have a professional rigger inspect and replace parts as necessary using following methods.

A professional rigger must carefully inspect the masthead area using a secure hoisting method. Inform rigger that there has been a halyard wrap so they can avoid an accident by relying on standing rigging or halyards. Inspection must be done while rigger is suspended from a separate crane or mast must be lowered to perform inspection. Some professionals may rig a new line through internal masthead sheaves to serve as a temporary headstay to hold mast in place. Wire, rod rigging, terminals, toggles, clevis pins, or cotter pins must be inspected and replaced if they show any signs of damage.

Prevent Halyard Wrap

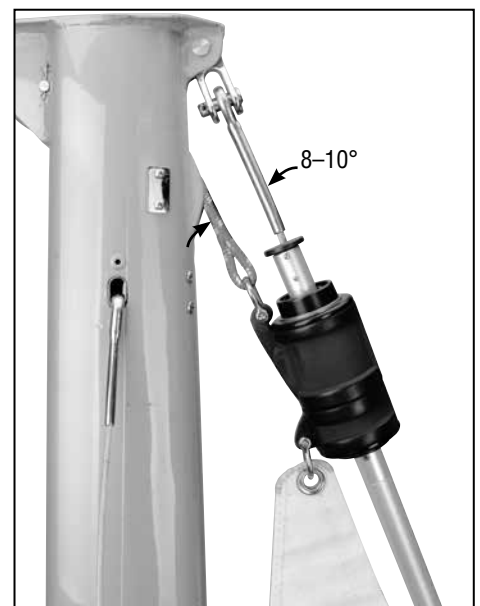
To prevent wraps, the halyard must exert a slight pull to the rear. This allows the foils to turn while halyard remains stationary.



WARNING! Sail must be fitted to foil length before using to prevent halyard wraps and possible headstay loss.

1. Halyard swivel should be within top 4–6" (100–152 mm) 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.

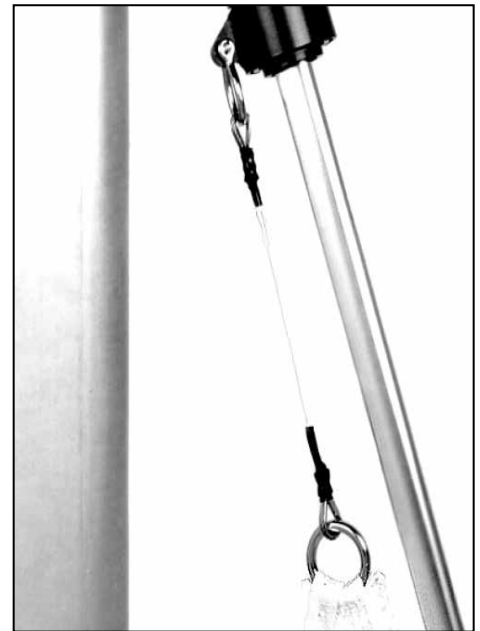
Test furler at dock, but if water is smooth an incorrect lead angle may not be apparent. Halyard wraps usually occur in wave action when lead angle is not correct. The 8–10° angle shown at right is critical.



Pendants

If the your sail luff is not long enough to position halyard swivel high enough to create an 8–10° angle as shown, you must add a pendant. 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 be adjusted 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 furling drum.
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.



Halyard Deflector/Halyard Restrainer

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 Deflector or Halyard Restrainer must be used.

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

If your boat needs a Halyard Deflector, use Part No. 7302 or a Halyard Restrainer, use Harken Part No. 944.

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, friction when furling, and 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.

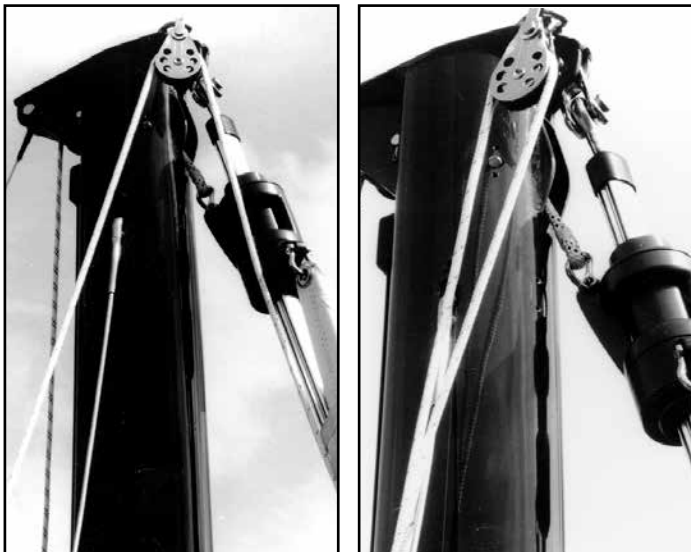
Tip: The luff foil system supports sail along its length so halyard tension is used only to shape sails, not to support them. Use enough halyard tension to remove some wrinkles along luff of sail. Do not tension halyard enough to cause vertical wrinkles in luff of sail. Tension to adjust position of 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.



Halyard Deflector



Halyard Restrainer



Spinnaker Halyards

Spinnaker halyards occasionally cause problems with furling.



WARNING! In severe cases, spinnaker halyards can jam furler causing loss of control of boat which can cause an accident, damage to your vessel, personal injury or death. See www.harken.com/manuals for additional safety information.

On many boats it will not be possible to attach spinnaker halyard to bow pulpit or it may be "sucked" into 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 with 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 furling line from unit and follow instructions on page 30.

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

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; either a block and tackle, 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 may 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 2' (610 mm) below feeder.
- 2) Shackle tack of sail to tack shackle. 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.

Tip: *New sails are often stiff and may hang up on prefeeder during 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 people will use one multipurpose genoa for all their 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 to allow them to be raised in headstay foils.

These sails will generally require pendants to ensure that halyard swivel is properly positioned at top of headstay. See page 36.

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 the jib sheets and pull furling line.

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

In a breeze, you must **completely** luff sail by **totally** slacking jib sheets before furling.

The furling line should pull readily. The amount of force required is related to amount of wind, but Unit should never require use of a winch to furl. If the sail will not furl, or if furling

requires a great deal of effort, there is a problem with system. Consult the Troubleshooting Guide on page 43. Do not use a winch to force a system to turn. If you are certain that the system is operating properly, you may use a winch to make furling easier.



Reef

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 that 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 the sail completely, make sure sheets and furling line are secured. Check amount of line on the spool compared to the furled sail before using the system.

A furled sail must have:

- a. Two to three wraps of jib sheet wrapped around sail.
- b. Two wraps minimum of line wound on spool.
- c. Furling line securely cleated.
- d. Jib sheets securely wrapped on winch and held in self-tailing jaws.

Furl at dock with tension on sheets to duplicate furling in high wind.

Remember sails furled in light wind and left loosely secured can be a problem if wind increases.

IMPORTANT! Remove sail from furler if extreme winds are predicted, especially if boat is left unattended.

IMPORTANT! Check all points above—a, b, c, and d—when leaving boat to avoid damage to furler or boat.

A loosely rolled sail can catch wind in a storm. Sheets or furling lines can loosen as winds increase and allow furler to unroll. If no wraps of line are on spool, the line deadend can break the drum when the boat motors through waves.

Be sure mooring lines are not placed across furling line where they may cause chafe.



If you want to:

Add more wraps of jibsheet on furled sail.	Untie jib sheets and keep sail completely rolled. Secure with sail tie.	Turn spool to unroll a couple of wraps of line.	Retie sheets.
Add more wraps of line on spool.		Turn spool to add a couple of wraps of line.	

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 torque tube. Replace feeder.

Halyard Swivel Off Furler

Serious racers may want to remove the halyard swivel.

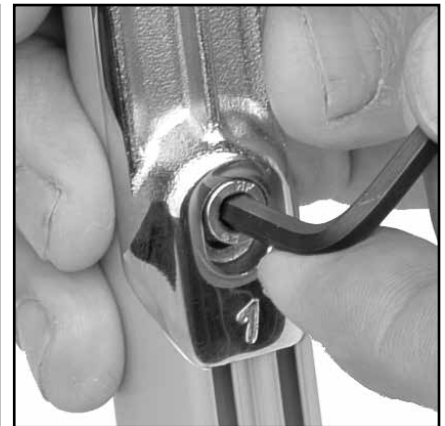
- 1) Remove drum assembly.
- 2) Rig a secure, temporary headstay.
- 3) Loosen backstay, mainsheet and vang so that headstay goes slack.
- 4) See procedure on pages 29 - 31.

Note: It is not possible to remove halyard swivel on a unit with a Norseman/Sta-Lok® or rod adapter stud unless you disassemble terminal stud. Make sure you use a new Norseman/Sta-Lok® wedge to reassemble Norseman/Sta-Lok® fitting.

Remove Feeder



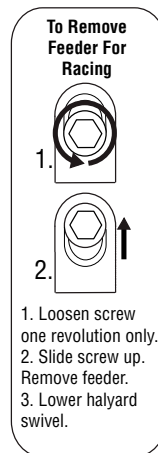
Loosen screw **one revolution only**.



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.

At least twice a year unit should be cleaned more thoroughly by removing line (first note direction of spool) and flushing bearings with soap and fresh water. After unit has dried, apply a dry spray lubricant such as McLube®.

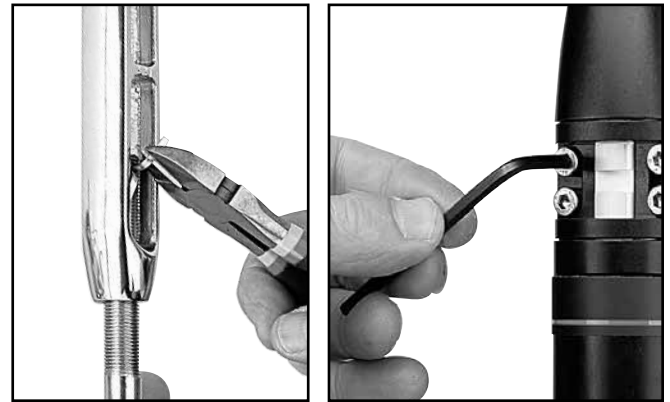
Foils may be cleaned by washing with soap and water. A scrap of luff tape may be run up foil to scrub inside grooves. If lubrication is required, spray a thin coat of McLube® SailKote on sail luff tapes away from boat deck.

! WARNING! Periodically inspect items listed below and any others as necessary. Failure to inspect can cause an accident.

! WARNING! Do not spray foil on boat. McLube® will cause slippery decks which may result in loss of footing, falling overboard.

Inspect

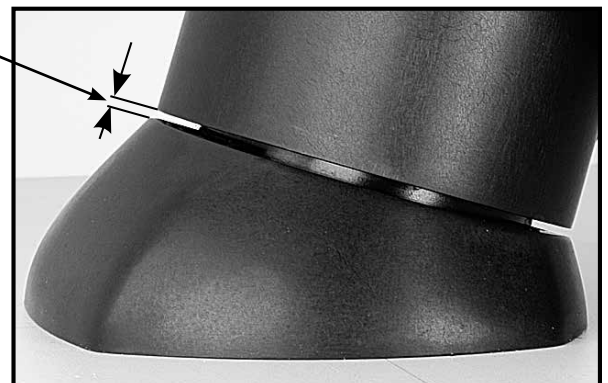
- Inspect unit for signs of chafe, wear, or damage.
- Inspect locking devices below drum and inside torque tube for signs of loosening. Check headstay tension for signs of loosening.
- Inspect swage fitting and lower toggle for signs of stress corrosion.
- Inspect Norseman or Sta-Lok® terminal or rod 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 torque tube. Periodically inspect wire for signs of wear or unraveling.



Confirm Gap Between Deck Flange and Tack Swivel

Check to make sure there is a 1/16"–1/8" (2–4 mm) gap between the deck flange and tack swivel. If necessary loosen adjusting nut below and take up on turnbuckle to increase gap between deck flange and tack swivel when turnbuckle is tightened.

Check to make sure there is a 1/16"–1/8" (2 - 4mm) gap



Storage – Mast Down

In areas where it freezes, do not store system where water can accumulate in foils. When water freezes it 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 drum assembly extending beyond mast. Remove masthead clevis pin and shift furler up so drum assembly can be strapped securely to mast. Some people remove drum assembly and halyard swivel for storage and transport.

After Storage or Transport

After storing or transporting unit, clean thoroughly including ball bearings. See instructions above.

Remove Furler From Boat

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

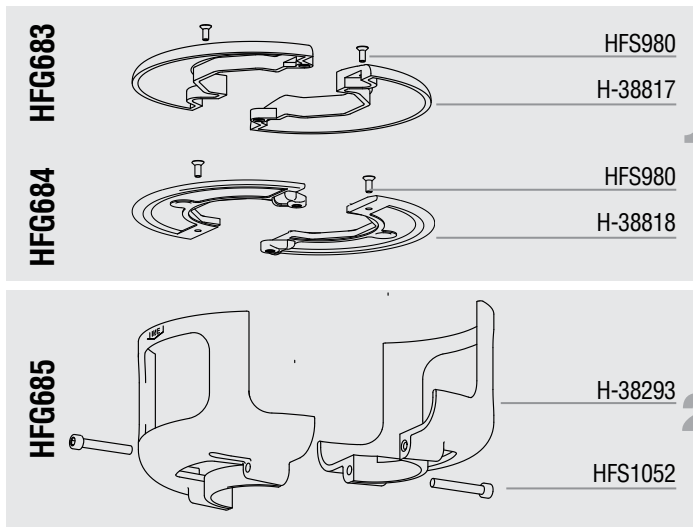
Troubleshoot

Problem	Probable Cause	Solution	
Sail will not furl or is difficult to furl.	Jib halyard is wrapping around headstay because angle between mast and 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 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 34.	
	Foils too high, binding on swage eye.	Lower foils until clear. See adjusting turnbuckle on page 34.	
	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 frequently with fresh water and a detergent solution.	
	Furling line tangled in drum.	Overrides are best prevented by using a 7402 ratchet block as the last furling line lead to maintain proper drag on line while unfurling.	
	Stop knot catching.	Make sure knot is a single overhand and is pushed up inside drum.	
	Sail full of wind.	Luff completely before furling or reefing.	
	Sail flogging too much.	Release a short length of sheet, pull some furling line and repeat.	
	Jib sheets are not free.	Free jib sheets.	
	Foil out of torque tube.	Reinstall foil in torque tube and tighten clamp screws.	
	No wraps of furling line on drum.	Remove sheets. Rotate stay wrapping as much furling line on drum as possible.	
	Lineguard assembly has slipped down.	Tighten line guard assembly screws securely.	
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 34.	
	Foils too high, binding on swage eye.	Lower foils. See adjusting turnbuckle on page 34.	
	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®	
	Furling line is not free.	Free furling line.	
	Sail will not furl completely.	Insufficient furling line on drum.	Remove sheets. Rotate stay, wrapping as much furling line on drum as possible.
		Too much line on drum.	Adjust amount of line on drum or change position of forward lead block to allow line to roll evenly on drum.
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.	Maintain drag on sheets while furling.	
	Furling line not secure.	Secure furling line.	
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.	Clean groove.	
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 any halyard turning blocks 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.	
Ultraviolet cover rolls up inside of sail.	Furling line is wrapped on drum in wrong direction.	Remove sheets. Pull line to remove all furling line from drum. Turn stay to rewind line on drum in opposite direction. Line guard and cowl alignment may need to be adjusted.	
Line jams between guard and plastic spool plate.	Line is not led through windows.	Pull line through enclosed window.	

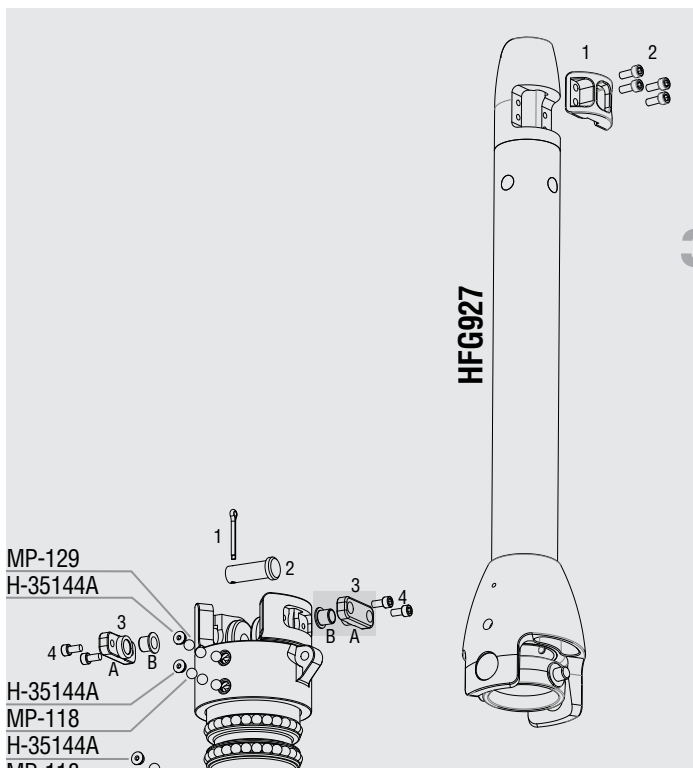
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**Warranty: www.harken.com/manuals
 or call, write, email, or fax Harken, Inc.,
 Pewaukee, WI USA**

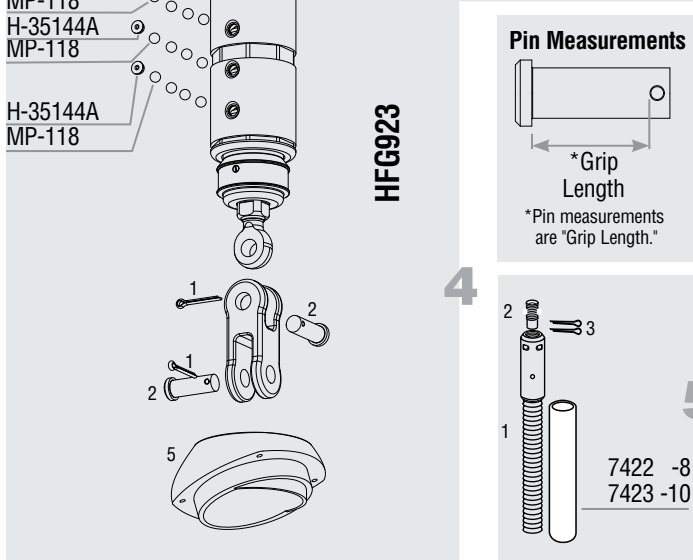


No.	Description	Order	Part No.
1	Top Cover Assembly w/Screws	1	HFG683
	Top Cover	2	H-38817
	Top Cover Screw (M4 x .7 x 10MM)	2	HFS980
2	Bottom Flange Assembly w/Screws	1	HFG684
	Flange	2	H-38818
	Bottom Flange Screw (M4 x .7 x 10MM)	2	HFS980
3	Guard Assembly	1	HFG685
	Guard Set	2	H-38293
	Guard Screw (M6 x 1 x 40MM SHCS)	2	HFS1052

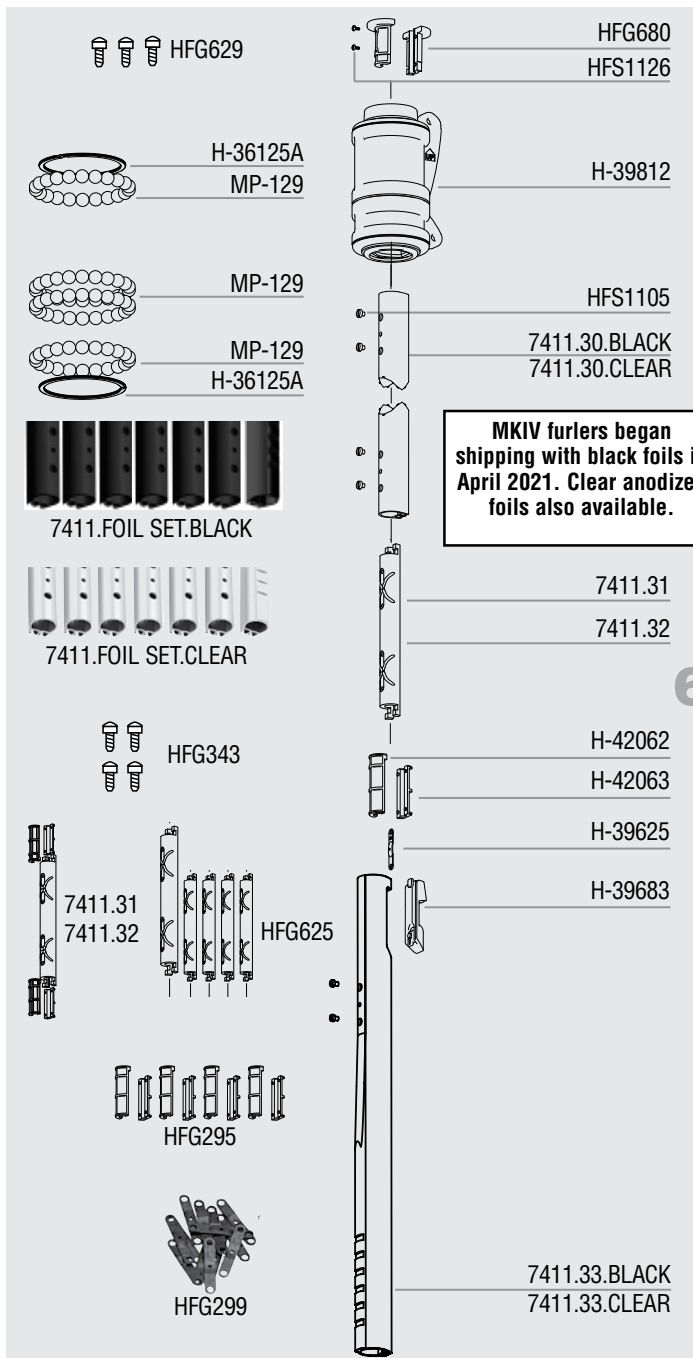


No.	Description	Order	Part No.
3	Torque Tube Assembly	1	HFG927
	1 Clamp	1	H-42954
	2 Clamp Screw (M5 x .08 x 12MM SHCS)	4	HFS827
4	Hub Assembly	1	HFG923
	1 Cotter Pin (5/32" x 1.250")	4	HFS203
	2 Clevis Pin (1/2" x 1.146")	4	H-42395
	3 Bearing Cap w/Insert	2	HFG931
	A Bearing Cap	1	AL-8101
	B IGUS® Bushing	1	H-43838
	4 Socket Head Cap Screws (M5 x .8 x 10MM)	4	HFS334
	Ball Plug	5	H-35144A
	Torlon® Ball Bearing (5/16")	28	MP-129
	Delrin® Ball Bearing (5/16")	134	MP-118
5 Deck Flange	1	H-42461	

UNIT 1



No.	Description	Order	Part No.
5	Rod Adapter Stud (-8) w/Nosepiece	1	7422 -8
	1 Stud (Main Body)	1	H-41536
	2 Nosepiece (-8)	1	H-41534
	3 Cotter Pin (3/32" x 1")	2	HFG193
5	Rod Adapter Stud (-10) w/Nosepiece	1	7423 -10
	1 Stud (Main Body)	1	H-41536
	2 Nosepiece (-10)	1	H-41535
	3 Cotter Pin (3/32" x 1")	2	HFG193



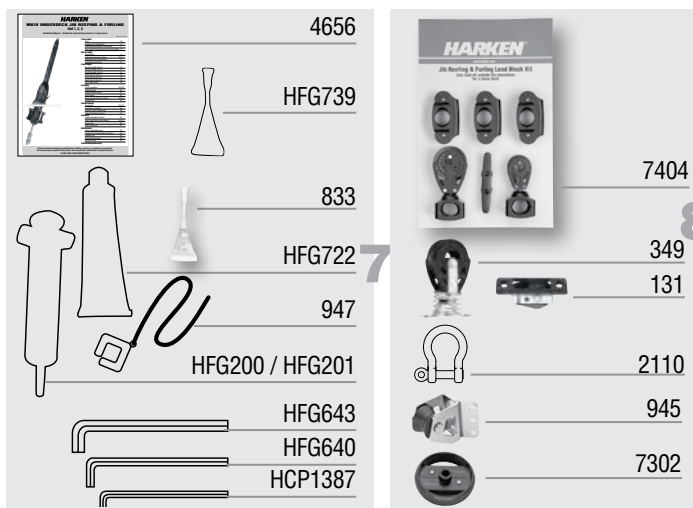
MKIV furlers began shipping with black foils in April 2021. Clear anodized foils also available.

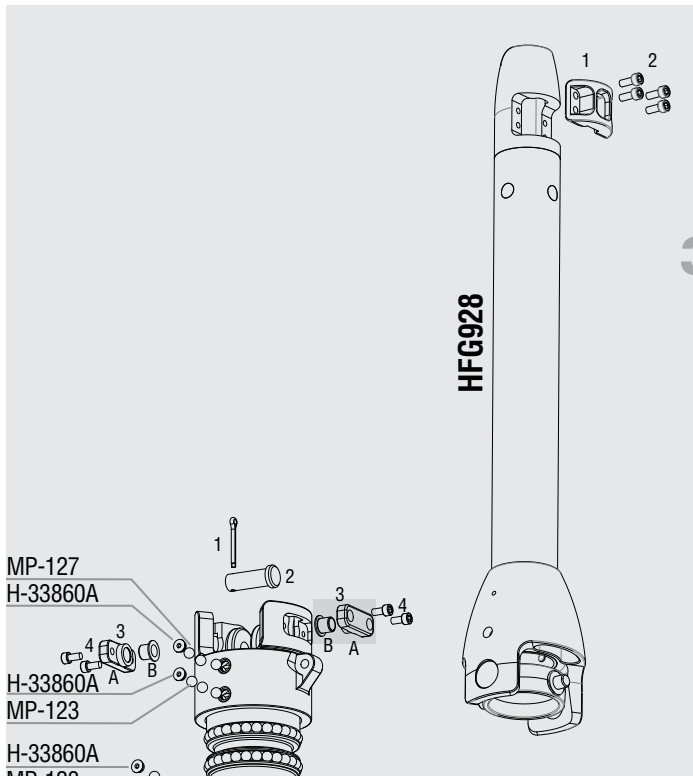
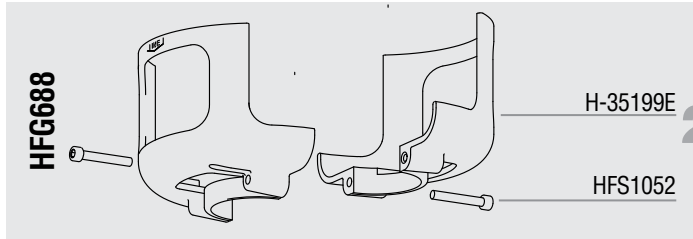
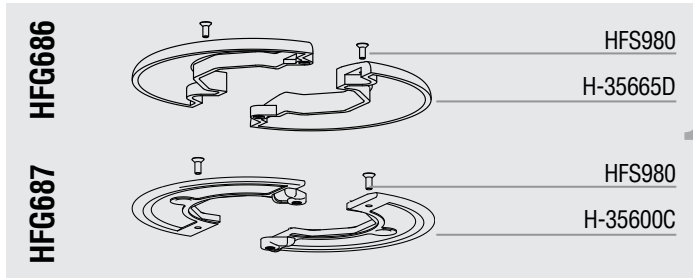
UNIT 1

Description	Order	Part No.
Trim Cap Set w/o Screws	1	HFG680
Trim Cap Screw Set	1	HFG629
Trim Cap Screw	3	HFS1126
Halyard Swivel w/o Shackles	1	H-39812
Torlon® Ball Bearings	96	MP-129
Clip/Smalley Ring	2	H-36125A
Foil Set, Black	7411.FOILSET.BLACK	
Foil (7' / 2.13 m) Luff, Black Anodized	6	7411.30.BLACK
Foil (2' / 610 mm) Bottom, Black Anodized	1	7411.33.BLACK
Foil Set, Clear - (Special Order)	7411.FOILSET.CLEAR	
Foil (7' / 2.13 m) Luff, Clear Anodized	6	7411.30.CLEAR
Foil (2' / 610 mm) Bottom, Clear Anodized	1	7411.33.CLEAR
Foil Screw Set	1	HFG343
Foil Screw	30	HFS1105
Connector Set w/o Bushings	1	HFG625
Connector (7" / 178 mm)	5	—
Connector Bottom (10.75" / 273 mm)	1	—
Connector Bushing Set	1	HFG295
Connector Bushing (Curved / Longer)	12	H-42062
Connector Bushing (Flat / Shorter)	12	H-42063
Connector w/Bushings, Foil Screws, and Wedges	1	7411.31
Connector (7" / 178 mm)	1	—
Connector Bushing (Curved / Longer)	2	—
Connector Bushing (Flat / Shorter)	2	—
Foil Screw	4	—
Connector Wedge	2	—
Connector w/Bushings Bottom	1	7411.32
Connector Bottom (10.75" / 273 mm)	1	—
Connector Bushing (Curved / Longer)	2	—
Connector Bushing (Flat / Shorter)	2	—
Connector Wedge Set	1	HFG299
Connector Wedge	14	H-39625
Feeder Set	1	H-39683
Feeder	1	H-35623B
Feeder Screw	1	HFS1129
Tab	1	H-35666A

Description	Order	Part No.
Instruction Manual	1	4656
Prefeeder	1	947
Loctite® Blue	1	833
Loctite® Red	2	HFG739
5200 Adhesive Set	1	HFG725
5200 Marine Adhesive Sealant	1	HFG722
Injector	1	HFG200 HFG201
Hex Keys		
5 mm	1	HFG643
4 mm	1	HFG640
2.5 mm	1	HCP1387

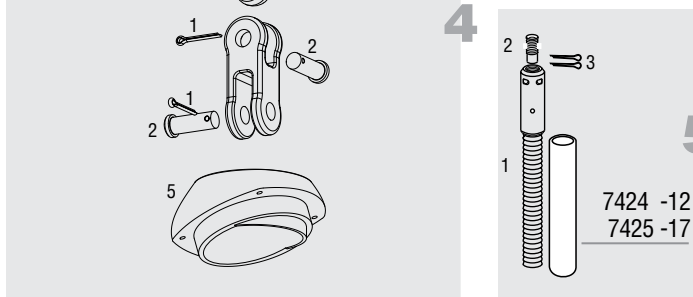
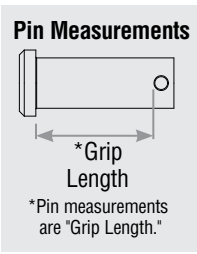
Description	Order	Part No.
Lead Block Kit	1	7404
29 mm Outboard Lead Assembly	3	7403
57 mm Carbo Ratchet Assembly	1	7402
40 mm Carbo Assembly	1	7401
Horn Cleat	1	HCP168
Additional Lead Blocks		
29 mm Carbo Stand-Up Fixed	1	349
Big Bullet Thru-Deck	1	131
Shackle (6 mm)	3	2110
Halyard Restrainer	1	945
Sheave/SS Inner Race Only	1	945ASSY
Clevis Pin (5/16" x 1/4")	1	SP-038
Bracket-Large	1	HCP394
Cotter Pin (3/32" x 3/4")	1	HFS181
Halyard Deflector	1	7302





HFG928

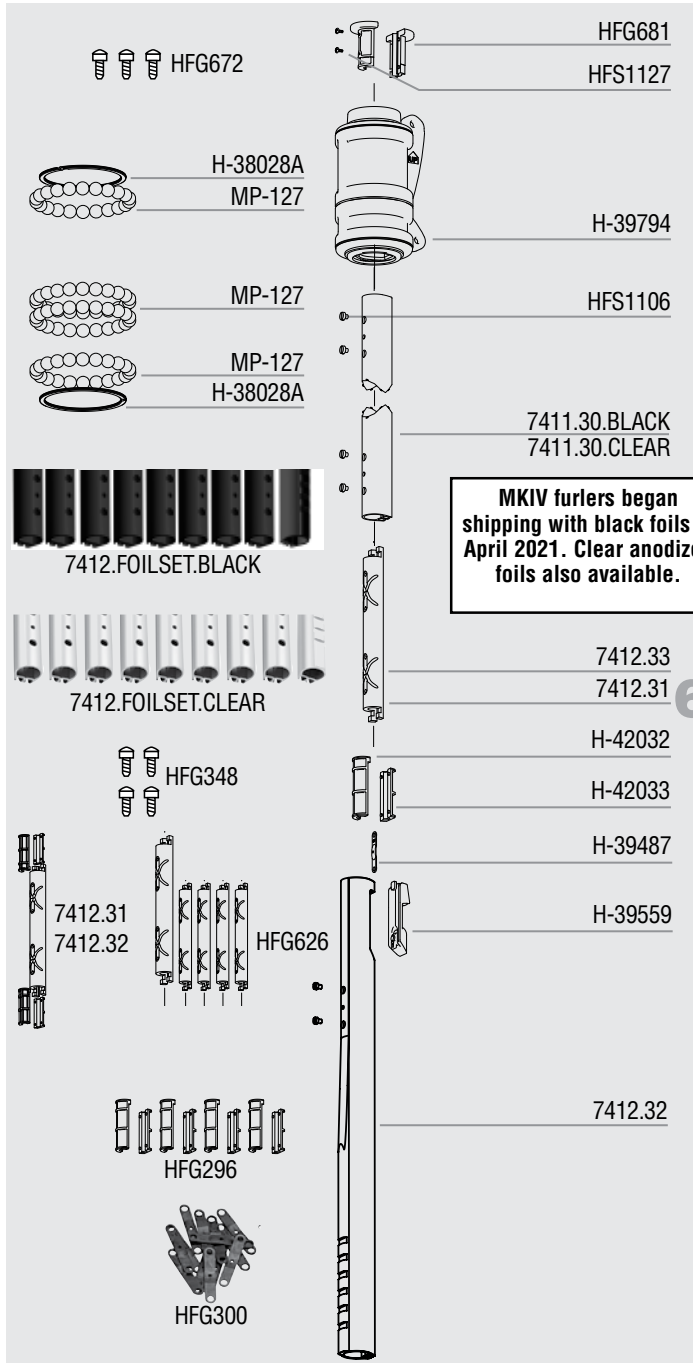
HFG924



	Description	Order	Part No.
1	Top Cover Assembly w/Screws	1	HFG686
	Top Cover	2	H-35665D
	Top Cover Screw (M4 x .7 x 10MM)	2	HFS980
2	Bottom Flange Assembly w/Screws	1	HFG687
	Flange	2	H-35600C
	Bottom Flange Screw (M4 x .7 x 10MM)	2	HFS980
3	Guard Assembly	1	HFG688
	Guard Set	2	H-35199E
	Guard Screw (M6 x 1 x 40MM SHCS)	2	HFS1052
4	Torque Tube Assembly	1	HFG928
	1 Clamp	1	H-42346
	1 Clamp Screw (M6 x 1 x 16MM SHCS)	4	HFS747
5	Hub Assembly	1	HFG924
	1 Cotter Pin (5/32" x 1.250")	4	HFS203
	2 Clevis Pin (5/8" x 1.460")	4	H-42397
	3 Bearing Cap w/Insert	2	HFG933
	A Bearing Cap	1	H-43231
	B IGUS® Bushing	1	HCP1707
	4 Socket Head Cap Screws (M6 x 1 x 12MM)	4	HFS876
	Ball Plug	5	H-33860A
	Torlon® Ball Bearing (3/8")	28	MP-127
	Delrin® Ball Bearing (3/8")	134	MP-123
5 Deck Flange	1	H-43100	

UNIT 2

No.	Description	Order	Part No.
5	Rod Adapter Stud (-12) w/Nosepiece	1	7424 -12
	1 Stud (Main Body)	1	H-41531
	2 Nosepiece (-12)	1	H-41527
5	Rod Adapter Stud (-17) w/Nosepiece	1	7425 -17
	1 Stud (Main Body)	1	H-41531
	2 Nosepiece (-17)	1	H-41526
5	3 Cotter Pin (3/32" x 1")	2	HFG193



MKIV furlers began shipping with black foils in April 2021. Clear anodized foils also available.

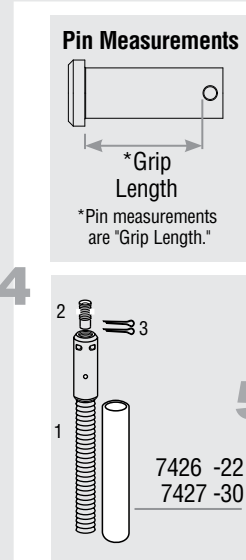
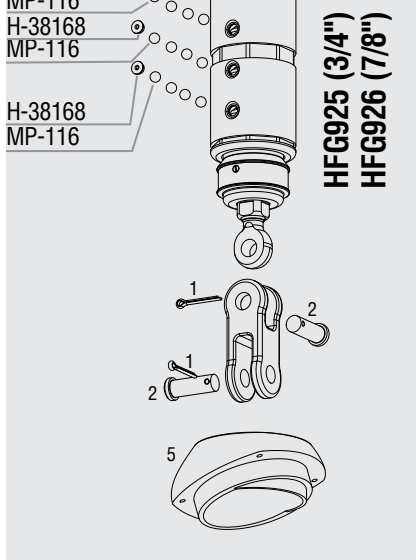
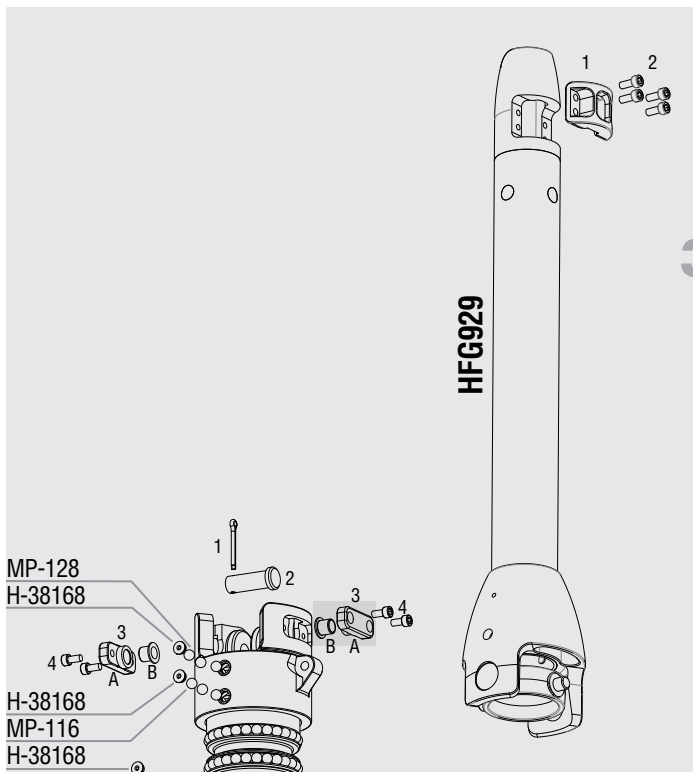
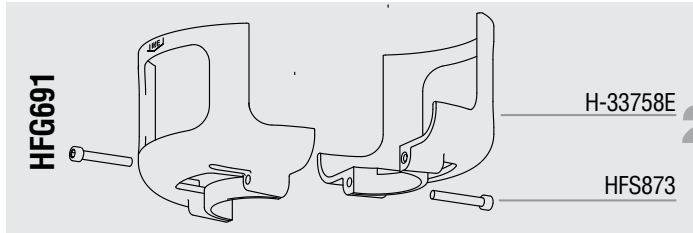
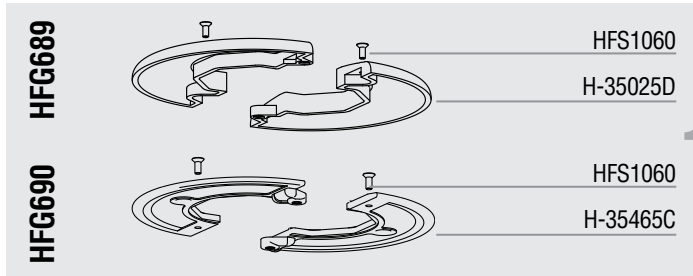


6
UNIT 2
6
7
8
8

Description	Order	Part No.
Trim Cap Set w/o Screws	1	HFG681
Trim Cap Screw Set	1	HFG672
Trim Cap Screw	3	HFS1127
Halyard Swivel w/o Shackles	1	H-39794
Torton® Ball Bearings	92	MP-127
Clip/Smalley Ring	2	H-38028A
Foil Set - Standard	1	7412.FOILSET.BLACK
Foil (7' / 2.13 m) Luff	8	7412.30.BLACK
Foil (2' / 610 mm) Bottom	1	7412.33.BLACK
Foil Set - (Special Order)	1	7412.FOILSET.CLEAR
Foil (7' / 2.13 m) Luff	8	7412.30.CLEAR
Foil (2' / 610 mm) Bottom	1	7412.33.CLEAR
Foil Screw Set	1	HFG348
Foil Screw	38	HFS1106
Connector Set w/o Bushings	1	HFG626
Connector (9' / 229 mm)	7	—
Connector Bottom (13" / 330 mm)	1	—
Connector Bushing Set	1	HFG296
Connector Bushing (Curved / Longer)	16	H-42032
Connector Bushing (Flat / Shorter)	16	H-42033
Connector w/Bushings, Foil Screws, and Wedges	1	7412.31
Connector (9' / 229 mm)	1	—
Connector Bushing (Curved / Longer)	2	—
Connector Bushing (Flat / Shorter)	2	—
Foil Screw	4	—
Connector Wedge	2	—
Connector w/Bushings Bottom	1	7412.32
Connector Bottom (13" / 330 mm)	1	—
Connector Bushing (Curved / Longer)	2	—
Connector Bushing (Flat / Shorter)	2	—
Connector Wedge Set	1	HFG300
Connector Wedge	18	H-39487
Feeder Set	1	H-39559
Feeder	1	H-33931B
Feeder Screw	1	HFS1129
Tab	1	H-35671A

Description	Order	Part No.
Instruction Manual	1	4656
Preefeeder	1	947
Loctite® Blue	1	833
Loctite® Red	2	HFG739
5200 Adhesive Set	1	HFG725
5200 Marine Adhesive Sealant	1	HFG722
Injector	1	HFG200 HFG201
Hex Keys		
6 mm	1	HFG644
5 mm	1	HFG643
4 mm	1	HFG640
3 mm	1	HCP1089

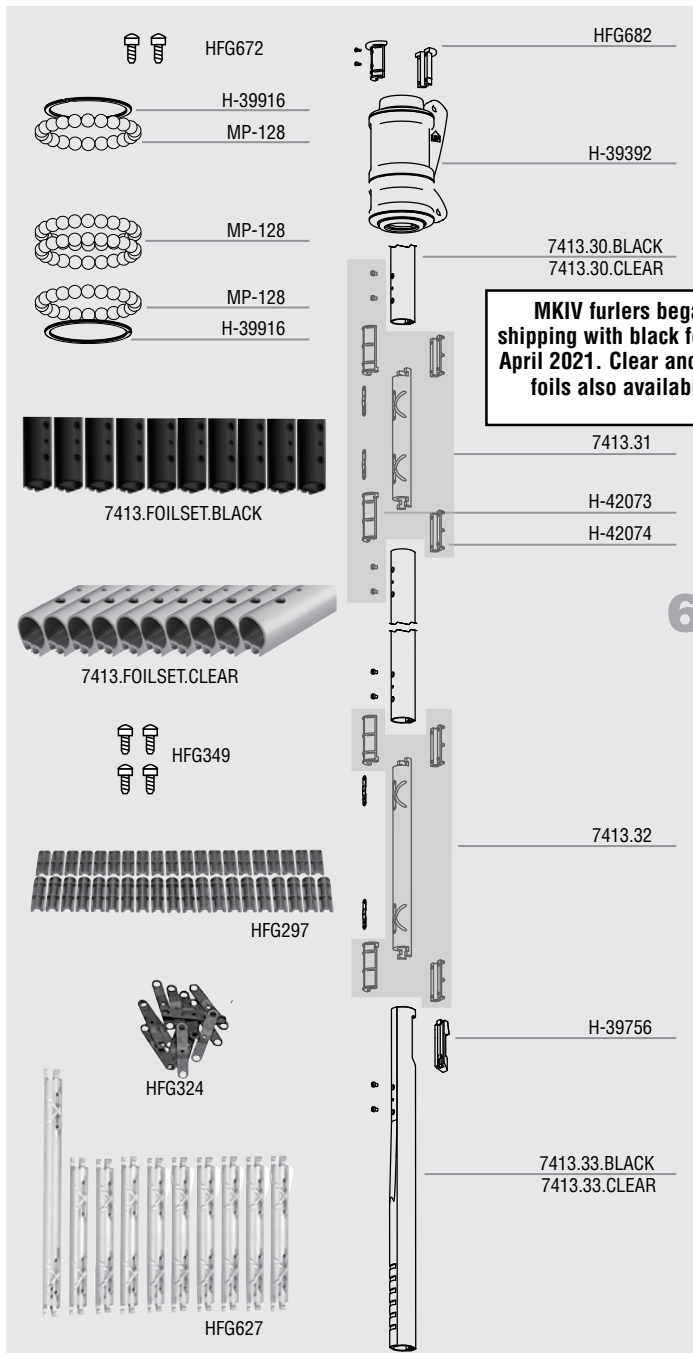
Description	Order	Part No.
Lead Block Kit	1	7404
29 mm Outboard Lead Assembly	3	7403
57 mm Carbo Ratchet Assembly	1	7402
40 mm Carbo Assembly	1	7401
Horn Cleat	1	HCP168
Additional Lead Blocks		
40 mm Carbo Stand-Up Fixed	1	2652
2.25" Thru-Deck	1	047
Shackle (8 mm)	3	2117
Halyard Restrainer	1	944
Sheave/SS Inner Race Only	1	944ASSY
Clevis Pin (1/4" x .9")	1	HFG467
Bracket-Small	1	HCP393
Cotter Pin (1/16" x 1/2")	1	HFS118
Halyard Deflector	1	7303



No.	Description	Order	Part No.	
1	Top Cover Assembly w/Screws	1	HFG689	
	Top Cover	2	H-35025D	
	Top Cover Screw (M5 x .8 x 12MM)	2	HFS1060	
2	Bottom Flange Assembly w/Screws	1	HFG690	
	Flange	2	H-35465C	
	Bottom Flange Screw (M5 x .8 x 12MM)	2	HFS1060	
3	Guard Assembly	1	HFG691	
	Guard Set	2	H-33758E	
	Guard Screw (M8 x 1.25 x 50MM SHCS)	2	HFS873	
4	Torque Tube Assembly	1	HFG929	
	1 Clamp	1	H-42967	
	2 Clamp Screw (M8 x 1.25 x 25MM SHCS)	4	HFS1107	
	Hub Assembly (3/4")		1	HFG925
	1 Cotter Pin (5/32" x 1.250")	4	HFS203	
2 Clevis Pin (3/4" x 1.766")	4	H-42403		
3 Bearing Cap w/Insert	2	HFG935		
A Bearing Cap	1	H-44674		
B IGUS® Bushing	1	HCP1684		
4 Socket Head Cap Screws (M6 x 1 x 12MM)	4	HFS876		
Ball Plug	5	H-38168		
Torlon® Ball Bearing (1/2")	27	MP-128		
Delrin® Ball Bearing (1/2")	128	MP-116		
5 Deck Flange	1	H-44680		
4	Hub Assembly (7/8")		1	HFG926
	1 Cotter Pin (5/32" x 1.250")	4	HFS203	
	2 Clevis Pin (7/8" x 1.958")	4	H-42404	
	3 Bearing Cap w/Insert	2	HFG935	
	A Bearing Cap	1	H-44674	
B IGUS® Bushing	1	HCP1684		
4 Socket Head Cap Screws (M6 x 1 x 12MM)	4	HFS876		
Ball Plug	5	H-38168		
Torlon® Ball Bearing (1/2")	27	MP-128		
Delrin® Ball Bearing (1/2")	128	MP-116		
5 Deck Flange	1	H-44680		

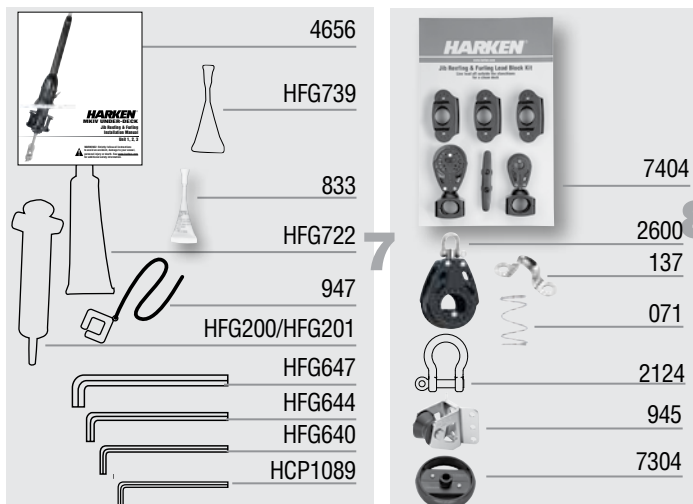
UNIT 3

No.	Description	Order	Part No.
5	Rod Adapter Stud (-22) w/Nosepiece	1	7426 -22
	1 Stud (Main Body)	1	H-41812
	2 Nosepiece (-22)	1	H-41811
	3 Cotter Pin (5/32" x 1 3/4")	2	HFG319
4 Stud Cap (7/8" ID (not shown))	1	HFG303	
5	Rod Adapter Stud (-30) w/Nosepiece	1	7427 -30
	1 Stud (Main Body) (not shown)	1	H-41814
	2 Nosepiece (-30)	1	H-41813
	3 Cotter Pin (5/32" x 1 3/4")	2	HFG319
4 Stud Cap (7/8" ID (not shown))	1	HFG303	



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UNIT 3



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/smalliey 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

Description	Order	Part No. (3/4, 7/8)
Instruction Manual	1	4656
Prefeeder	1	947
Loctite® Blue	1	833
Loctite® Red	2	HFG739
5200 Adhesive Set	1	HFG725
5200 Marine Adhesive Sealant	1	HFG722
Injector	1	HFG200 HFG201

Hex Keys		
10 mm	1	HFG647
6 mm	1	HFG644
4 mm	1	HFG640
3 mm	1	HCP1089

Description	Order	Part No.
Lead Block Kit	1	7404
29 mm Outboard Lead Assembly	3	7403
57 mm Carbo Ratchet Assembly	1	7402
40 mm Carbo Assembly	1	7401
Horn Cleat	1	HCP168

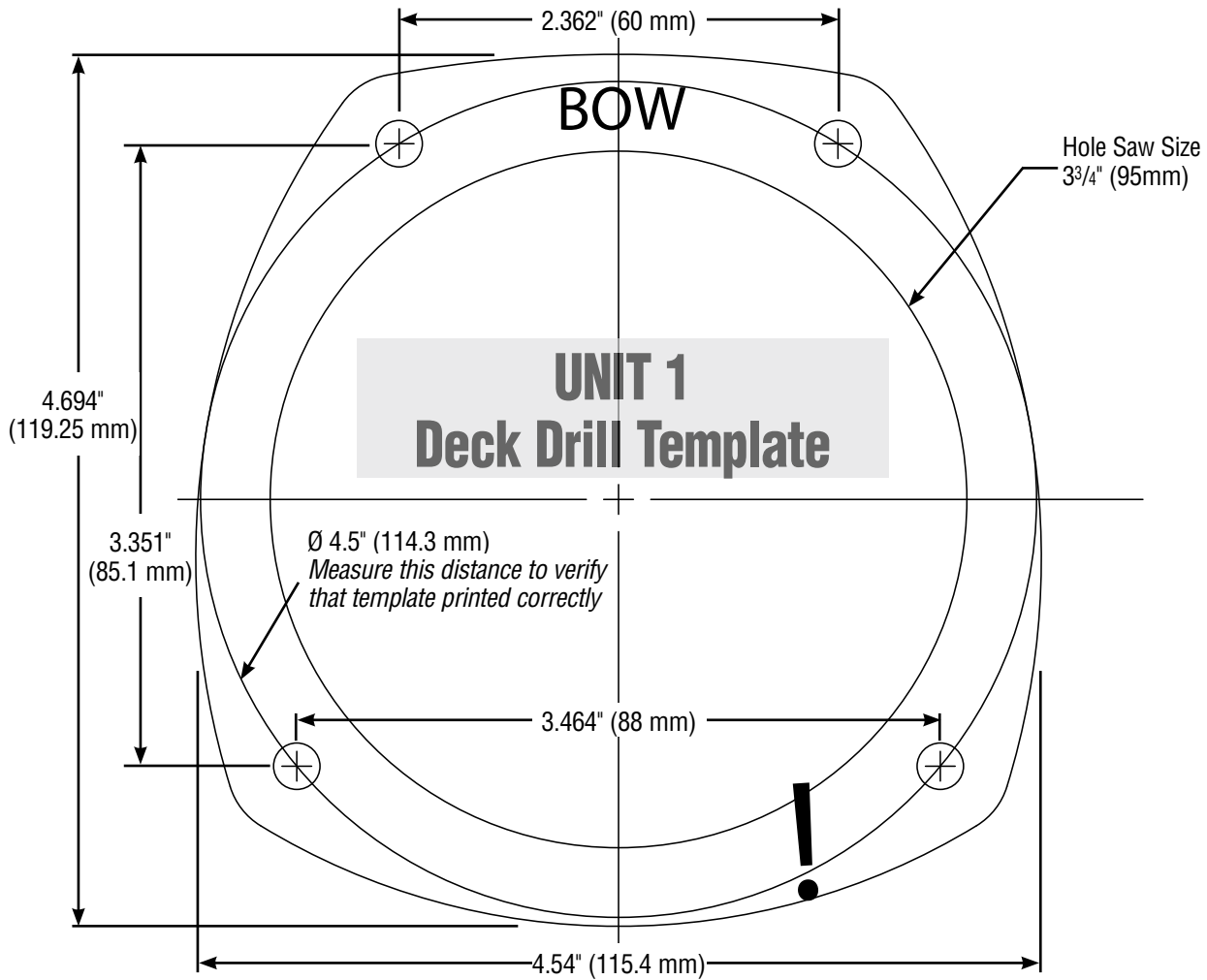
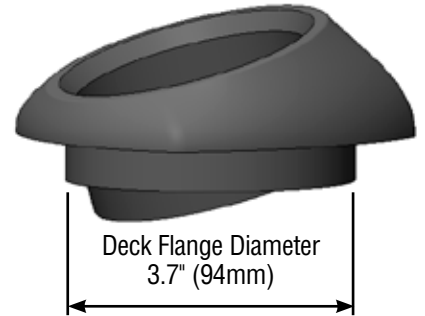
Additional Lead Blocks		
57 mm Carbo Single Swivel	1	2600
Stainless Steel Eyestraps	1	137
Stand-Up Spring	1	071
Thru-Deck (2.25") (not shown)	1	HC7981

Shackle (10 mm)	3	2124
Halyard Restrainer	1	945
Sheave/SS Inner Race Only	1	945ASSY
Clevis Pin (5/16" x 1 ¹ / ₄ ")	1	SP-038
Bracket-Large	1	HCP394
Cotter Pin (3/32" x 3/4")	1	HFS181
Halyard Deflector	1	7304

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UNIT 1 — Deck Drill Template

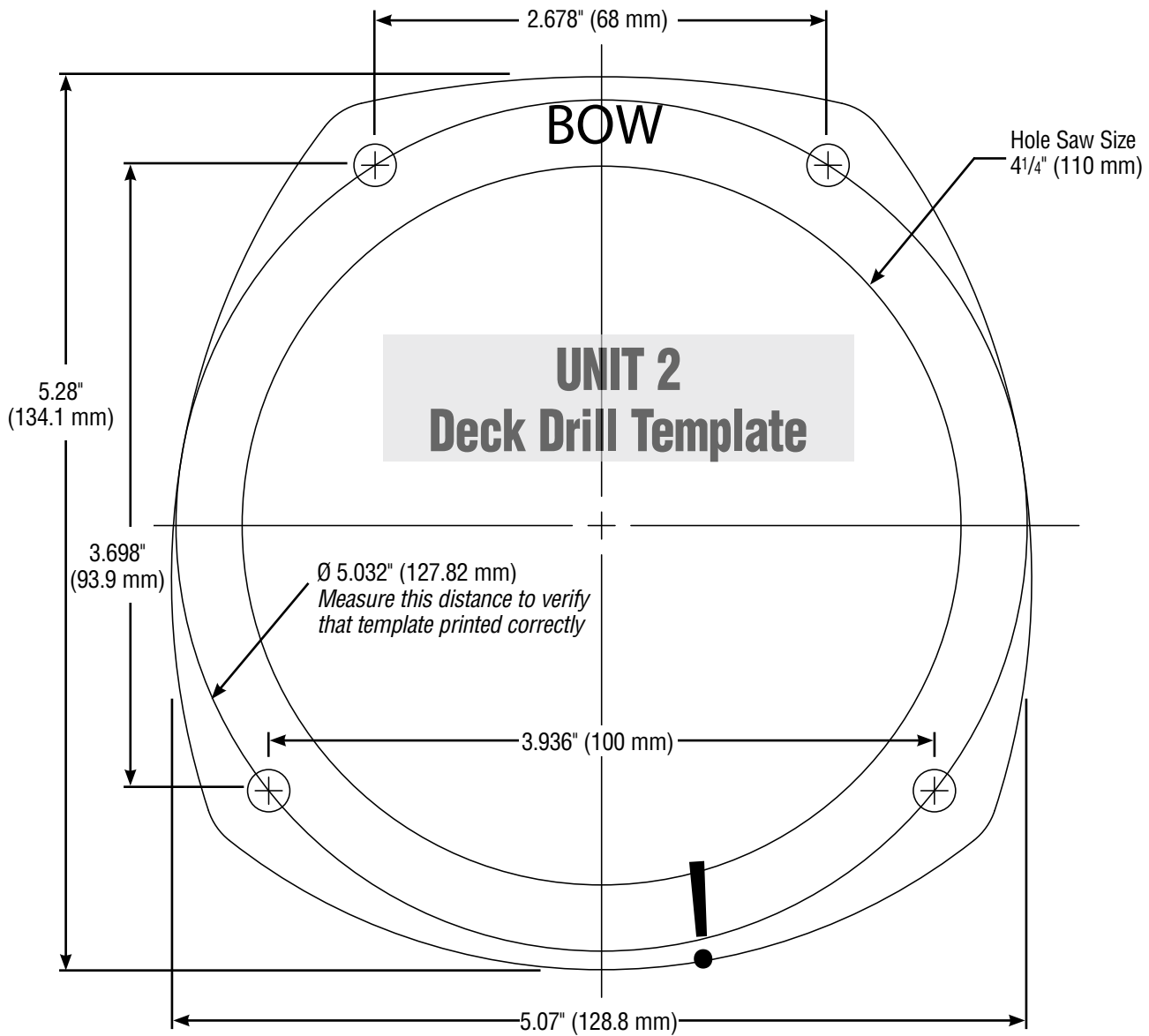
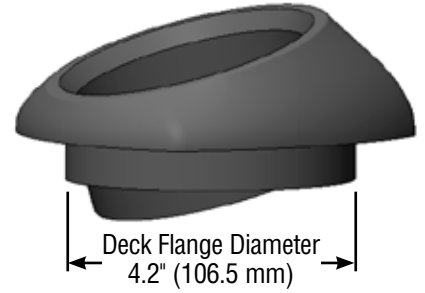
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UNIT 2 — Deck Drill Template

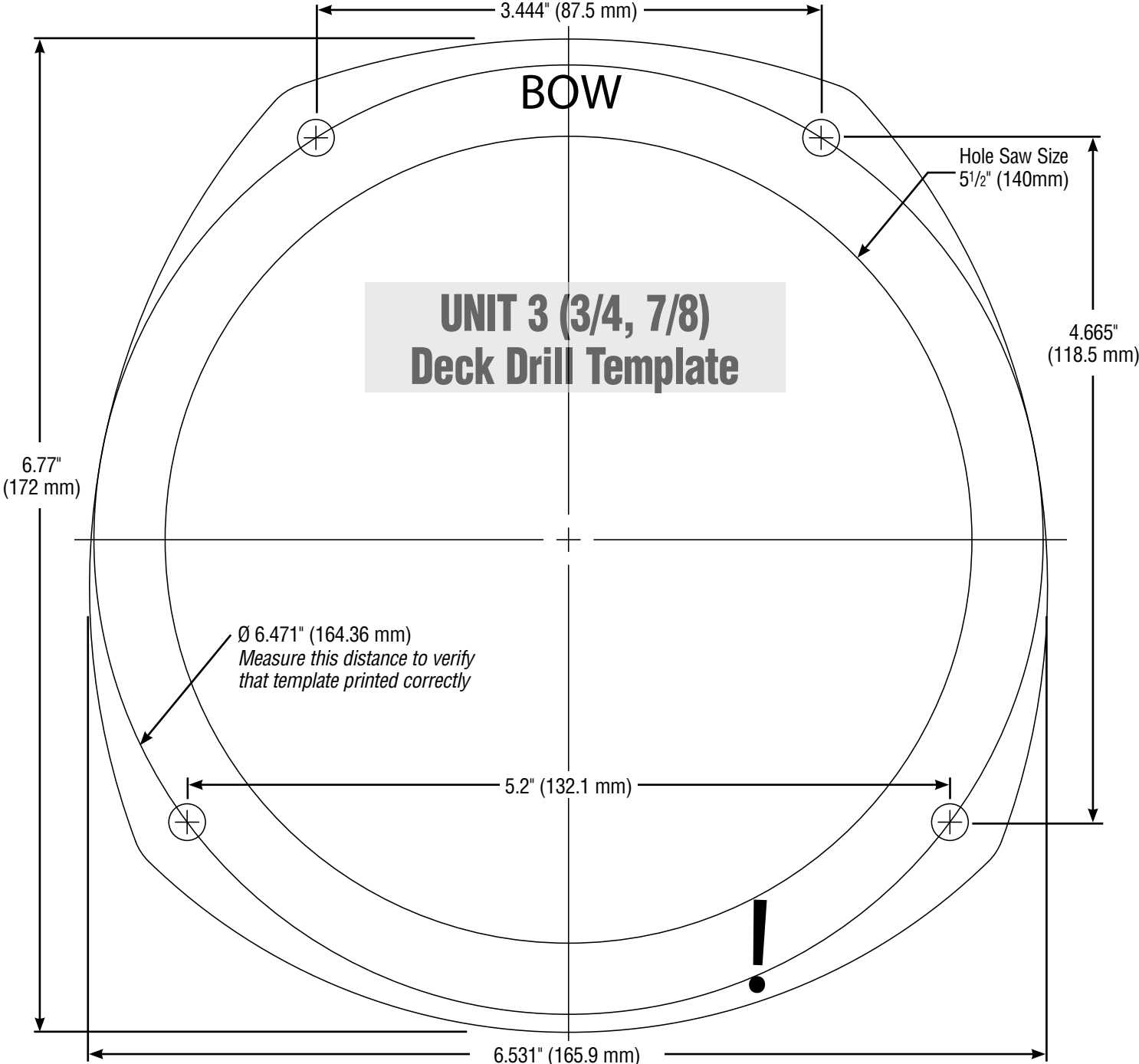
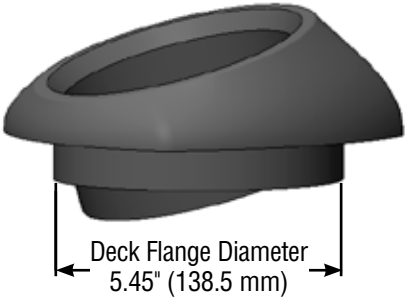
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UNIT 3 (3/4, 7/8) — Deck Drill Template

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