

HARKEN®

BATTCAR INSTALLATION MANUAL

System AA

Installation manual – Intended for specialized personnel or expert users

4247 10/14



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Troubleshooting – installation/operation

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. 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 Battcars are designed to reduce the size of or completely drop the mainsail on a sailboat 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.



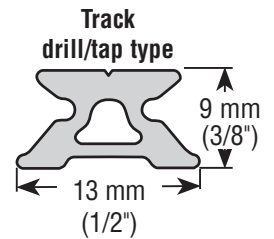
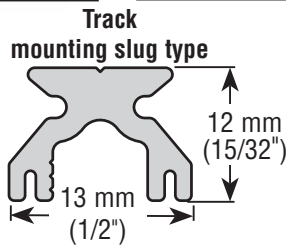
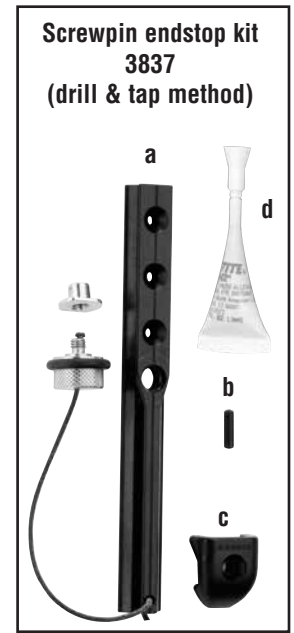
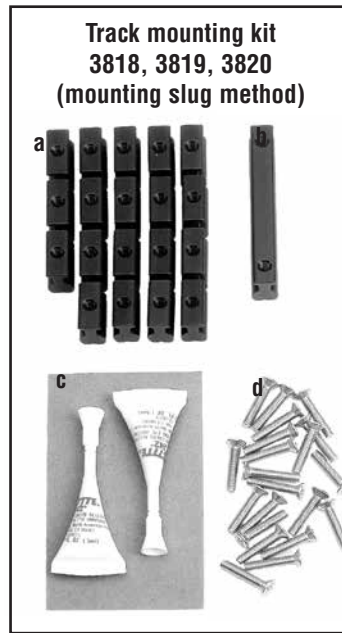
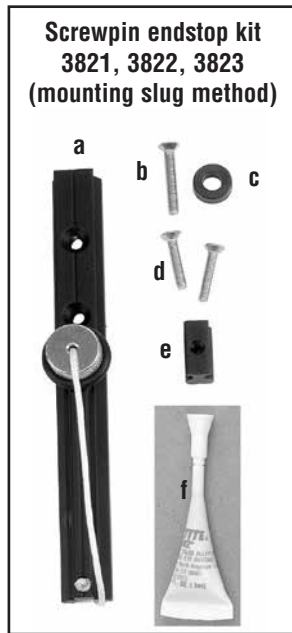
CAUTION! This symbol alerts you to potential hazards that may hurt you and others if you do not follow instructions. The message will tell you how to reduce the chance of injury.



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.



Batten cars without receptacle



Cars

Part No.	Description	Comments
3813	Headboard car	
3814	Slider intermediate car	If battens are close enough intermediate cars are not needed.
3815	CB intermediate car	If battens are close enough intermediate cars are not needed.
3816	Batten car	10 mm Threaded stud. Purchase batten receptacle separately.

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Track and Accessories

Part No.	Description	Includes
Mounting slug method		
3818, 3819 3820	Track Mounting Kit	(a) 19 x mounting slugs 19 mm (3/4"); (b) 1 x connector slug 67 mm (2 5/8"); (c) 2 x tubes blue Loctite® (d) 21 x HFS1009 flathead screws 4 x 20 mm.
3821, 3822 3823	Screwpin Endstop Kit	(a) 1 x 152 mm (6") end track with screwpin stop; (b) 1 x flathead screw HFS948 4 x 25 mm; (c) 1 x topstop; (d) 2 x HFS1009 flathead screws 4 x 20 mm; (e) 1 x mounting slug 19 mm (3/4"); (f) 1 x tube blue Loctite®.
3817	Track	Section length: 2.05 m (6'8 7/8"). Number track sections vary according to luff length of mainsail.
Drill & tap method		
3837	Screwpin Endstop Kit	(a) 1 x 152 mm (6") end track with screwpin stop; (b) 1 x 2711 splice link; (c) 1 x H-28411C endstop (d) 1 x tube blue Loctite®
2707	Track (Micro CB)	Use for masts without grooves or when slugs will not fit. Purchase stainless steel 4 mm (#8) screws separately. Do not use 3817 open-backed track. It requires mounting slugs. See page 11 for drill/tap sizes and mounting instructions.

Tools you will need

1. Tape measure	10. Putty knife
2. Tape	11. Hex wrench (4 mm)
3. Power drill (screwdriver)	12. Nut driver (8 mm) or open wrench
4. Drill bit 3/16" (4.5 mm)	Drill & tap (additional)
5. Phillips screwdriver	13. Spring clamp
6. Hammer	14. Spring-loaded centerpunch (not shown)
7. Hacksaw	15. Drill bit 1/8" (3 mm) (not shown)
8. Center punch	16. Tap 8-32 (M4) (not shown)
9. File	17. Transfer punch



Mast-up installation: Stepladder secured to the boat.
Work height: 7' (2.13 m) above boom

Sizing

Make sure that you have the correct size battcar system for your boat.

Maximum Sail Area		Part No.	Part No.	Part No.		
Monohull	Multihull	Headboard	Battcars	Intermediate Car		
300 ft ²	28 m ²	250 ft ²	23 m ²	3813	3816	3814, 3815

Sail Modifications

See page 12 - 13.

1. Mainsail Headboard
 - A. Drill new halyard location
 - B. Drill Attachment to accept clevis pin for 3813 headboard car coupler.
2. Batten receptacle on sail to accept 10 mm threaded stud.
Note: Harken does not supply receptacle.
3. Becket spacer on sail for 3815 intermediate car, or install 3814 slider on sail.

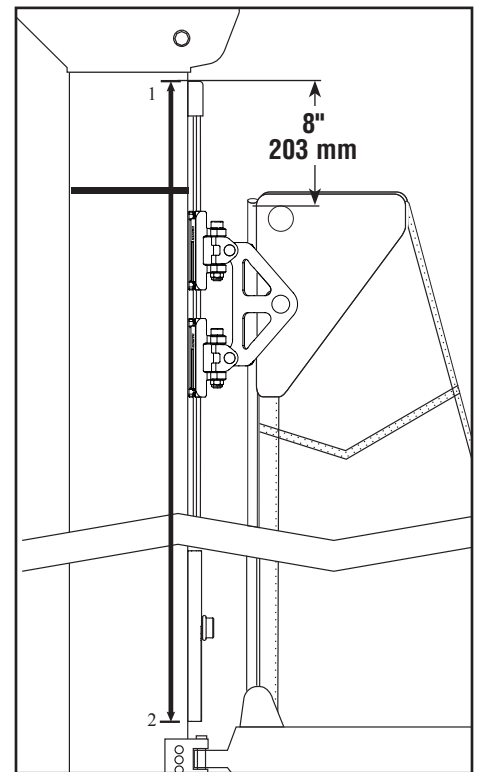
Determine Track Length

Note: Track length is longer than sail luff length.

1. **Upper End:** Extend track 8" (203 mm) above headboard halyard attachment point to allow for sail stretch as sail ages. Track *must not* block mast halyard exit.
2. **Lower End:** Place 6" (152 mm) Screwpin Endstop track on mast. Make sure car clears gooseneck fittings and adjust height as necessary. Measure to lower end of track.

Number of 3817 Track Sections (Slug Mount)

Variable length top track included	
Track length	Number of 2.05 m (6'8 7/8") track sections
6.350 m to 8.382 m 20'10" to 27'6"	
8.407 m to 10.439 m 27'7" to 34'3"	5
10.465 m to 12.471 m 34'4" to 40'11"	6
12.497 m to 14.529 m 41'0" to 47'8"	7

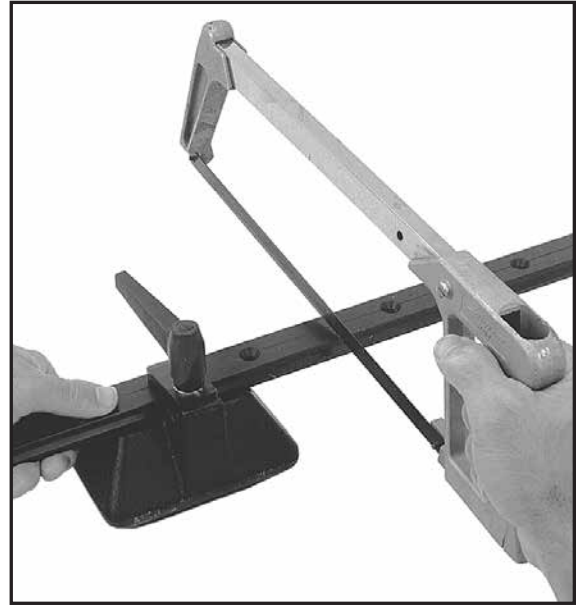


Round track length to nearest 1" (25 mm).

Note: Chart is based on using 3817 track-length 2.05m (6'8 7/8") and 3821, 3822, or 3823 Endstop Kits-length 152.4 mm (6").

Total track length (as defined on page 3)								Top track length	
20' 10"	6.350 m	27' 7"	8.407 m			41' 0"	12.497 m	1 ³ / ₁₆ "	30 mm
20' 11"	6.375 m	27' 8"	8.433 m	34' 4"	10.465 m	41' 1"	12.522 m	2"	51 mm
21' 0"	6.401 m	27' 9"	8.458 m	34' 5"	10.490 m	41' 2"	12.548 m	3"	76 mm
21' 2"	6.452 m	27' 11"	8.509 m	34' 7"	10.541 m	41' 4"	12.598 m	5"	127 mm
21' 4"	6.502 m	28' 1"	8.560 m	34' 9"	10.592 m	41' 6"	12.649 m	7"	178 mm
21' 6"	6.553 m	28' 3"	8.611 m	34' 11"	10.643 m	41' 8"	12.700 m	9"	229 mm
21' 8"	6.604 m	28' 5"	8.661 m	35' 1"	10.693 m	41' 10"	12.751 m	11"	279 mm
21' 10"	6.655 m	28' 7"	8.712 m	35' 3"	10.744 m	42' 0"	12.802 m	1' 1"	330 mm
22' 0"	6.706 m	28' 9"	8.763 m	35' 5"	10.795 m	42' 2"	12.852 m	1' 3"	381 mm
22' 2"	6.756 m	28' 11"	8.814 m	35' 7"	10.846 m	42' 4"	12.903 m	1' 5"	432 mm
22' 4"	6.807 m	29' 1"	8.865 m	35' 9"	10.897 m	42' 6"	12.954 m	1' 7"	483 mm
22' 6"	6.858 m	29' 3"	8.915 m	35' 11"	10.947 m	42' 8"	13.005 m	1' 9"	533 mm
22' 8"	6.909 m	29' 5"	8.966 m	36' 1"	10.998 m	42' 10"	13.056 m	1' 11"	584 mm
22' 10"	6.960 m	29' 7"	9.017 m	36' 3"	11.049 m	43' 0"	13.106 m	2' 1"	635 mm
23' 0"	7.010 m	29' 9"	9.068 m	36' 5"	11.100 m	43' 2"	13.157 m	2' 3"	686 mm
23' 2"	7.061 m	29' 11"	9.119 m	36' 7"	11.151 m	43' 4"	13.208 m	2' 5"	737 mm
23' 4"	7.112 m	30' 1"	9.169 m	36' 9"	11.201 m	43' 6"	13.259 m	2' 7"	787 mm
23' 6"	7.163 m	30' 3"	9.220 m	36' 11"	11.252 m	43' 8"	13.310 m	2' 9"	838 mm
23' 8"	7.214 m	30' 5"	9.271 m	37' 1"	11.303 m	43' 10"	13.360 m	2' 11"	889 mm
23' 10"	7.264 m	30' 7"	9.322 m	37' 3"	11.354 m	44' 0"	13.411 m	3' 1"	940 mm
24' 0"	7.315 m	30' 9"	9.373 m	37' 5"	11.405 m	44' 2"	13.462 m	3' 3"	991 mm
24' 2"	7.366 m	30' 11"	9.423 m	37' 7"	11.455 m	44' 4"	13.513 m	3' 5"	1.041 m
24' 4"	7.417 m	31' 1"	9.474 m	37' 9"	11.506 m	44' 6"	13.564 m	3' 7"	1.092 m
24' 6"	7.468 m	31' 3"	9.525 m	37' 11"	11.557 m	44' 8"	13.614 m	3' 9"	1.143 m
24' 8"	7.518 m	31' 5"	9.576 m	38' 1"	11.608 m	44' 10"	13.665 m	3' 11"	1.194 m
24' 10"	7.569 m	31' 7"	9.627 m	38' 3"	11.659 m	45' 0"	13.716 m	4' 1"	1.245 m
25' 0"	7.620 m	31' 9"	9.677 m	38' 5"	11.709 m	45' 2"	13.767 m	4' 3"	1.295 m
25' 2"	7.671 m	31' 11"	9.728 m	38' 7"	11.760 m	45' 4"	13.818 m	4' 5"	1.346 m
25' 4"	7.722 m	32' 1"	9.779 m	38' 9"	11.811 m	45' 6"	13.868 m	4' 7"	1.397 m
25' 6"	7.772 m	32' 3"	9.830 m	38' 11"	11.862 m	45' 8"	13.919 m	4' 9"	1.448 m
25' 8"	7.823 m	32' 5"	9.881 m	39' 1"	11.913 m	45' 10"	13.970 m	4' 11"	1.499 m
25' 10"	7.874 m	32' 7"	9.931 m	39' 3"	11.963 m	46' 0"	14.021 m	5' 1"	1.549 m
26' 0"	7.925 m	32' 9"	9.982 m	39' 5"	12.014 m	46' 2"	14.072 m	5' 3"	1.600 m
26' 2"	7.976 m	32' 11"	10.033 m	39' 7"	12.065 m	46' 4"	14.122 m	5' 5"	1.651 m
26' 4"	8.026 m	33' 1"	10.084 m	39' 9"	12.116 m	46' 6"	14.173 m	5' 7"	1.702 m
26' 6"	8.077 m	33' 3"	10.135 m	39' 11"	12.167 m	46' 8"	14.224 m	5' 9"	1.753 m
26' 8"	8.128 m	33' 5"	10.185 m	40' 1"	12.217 m	46' 10"	14.275 m	5' 11"	1.803 m
26' 10"	8.179 m	33' 7"	10.236 m	40' 3"	12.268 m	47' 0"	14.326 m	6' 1"	1.854 m
27' 0"	8.230 m	33' 9"	10.287 m	40' 5"	12.319 m	47' 2"	14.376 m	6' 3"	1.905 m
27' 2"	8.280 m	33' 11"	10.338 m	40' 7"	12.370 m	47' 4"	14.427 m	6' 5"	1.956 m
27' 4"	8.331 m	34' 1"	10.389 m	40' 9"	12.421 m	47' 6"	14.478 m	6' 7"	2.007 m
27' 6"	8.382 m	34' 3"	10.439 m	40' 11"	12.471 m	47' 8"	14.529 m	6' 8 7/8"	2.054 m

1. Cut special length top track from 2.05 m (6'8 3/4") track.



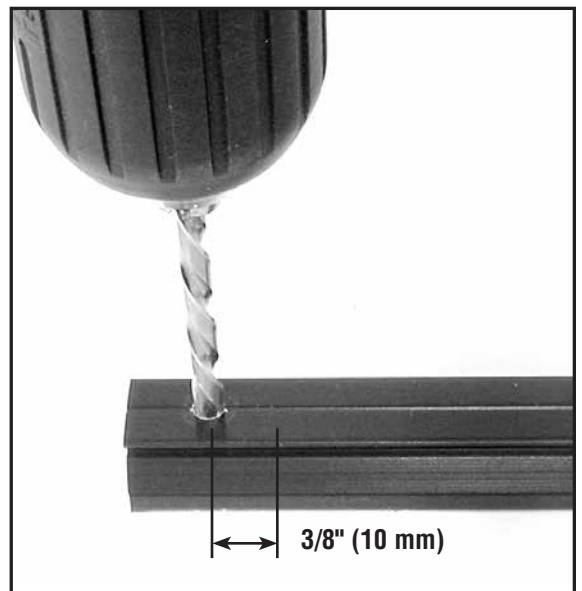
2. Deburr cut.

Slightly round track corners that will slide against mast.



3. Drill 4.5 m (3/16") top stop hole in cut end of track.

Use existing hole if top track is 30 mm (1 3/16").



Preassembly – CB System (Slug Mount)

67 mm (2 5/8") connector slug must fit feeder opening. File opening to make longer.

Use halyard with retrieval line to hoist 67 mm (2 5/8") connector slug up mast to check for burrs in groove.

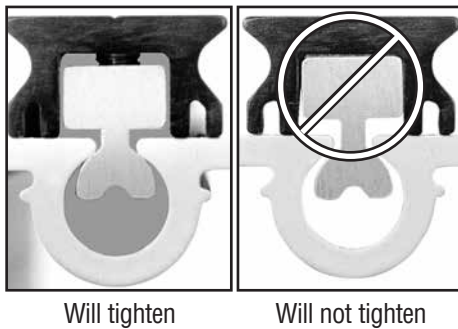
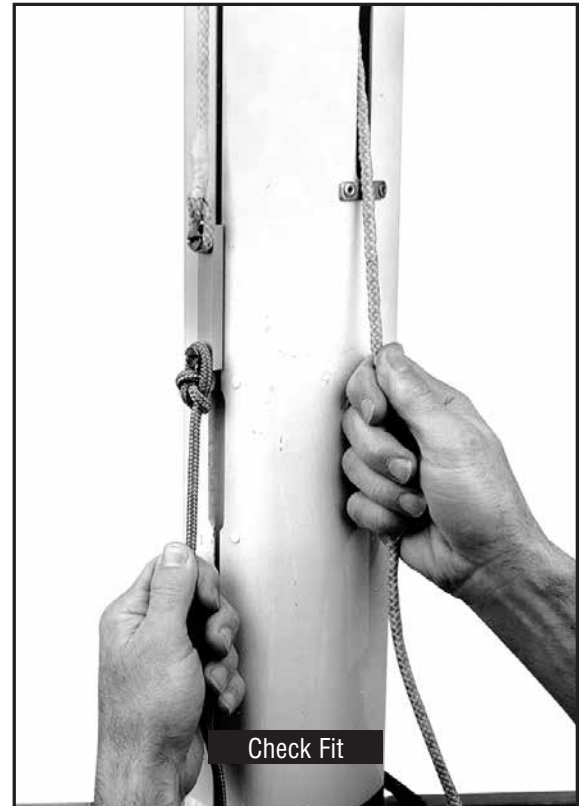
Mast prebend: May require straightening before installation.

Storm Trysail Track

Car's 40 mm (1 9/16") width must clear storm trysail track. Tracks often converge above spreaders.

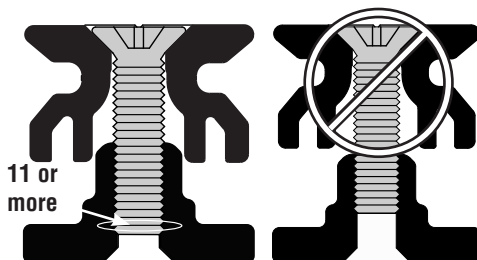
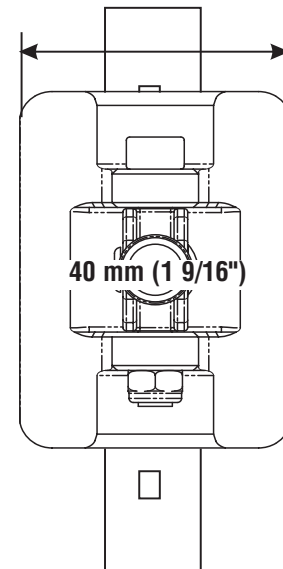
Aft face of mast must be flat or convex.

Check Fit of Mounting Slugs/Cars



Test track: Put mounting slug in groove, track section on mast. Tighten with screw. Track must be drawn tightly to mast.

Mounting screw must be long enough for mast groove. If necessary, purchase longer screws.



Warning! Screws need minimum 11 threads (turns) engaged to hold track to mast. Turn screw 360° five times after threads engage slug.

1. Slip top track slugs into mast groove. Use 19 mm (3/4") mounting slug for top stop.

Note: If top track is 30 mm (1 3/16"), use 67 mm (2 5/8") connector slug for top stop.

Install 67 mm (2 5/8") connector slug at bottom.

Mast up: Tape 32 mm (1 1/4") slug even with top of upper track.
Tape other slugs in place.



2. Squeeze one drop blue Loctite® into each connector slug hole.

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3. Thread 4 mm x 25 mm endstop screw through endstop, track, and into endstop slug.

Mast up: Remove tape. Tighten screw to hold track.



4. Slide slugs into place with putty knife. Loosely install 4 mm x 20 mm screws.

Tip: Use putty knife to see if screws are loose enough to slide in groove.

Remember: Tracks may stick when reaching a spliced area on mast.



5. Loosen top screw. Slide top track up and position next 2.05 m (6'8 7/8") track.

Mast up: Tighten bottom screw to hold track.



6. Slide 19 mounting slugs and then the connector slug into mast groove.

Mast up: Tape in place.

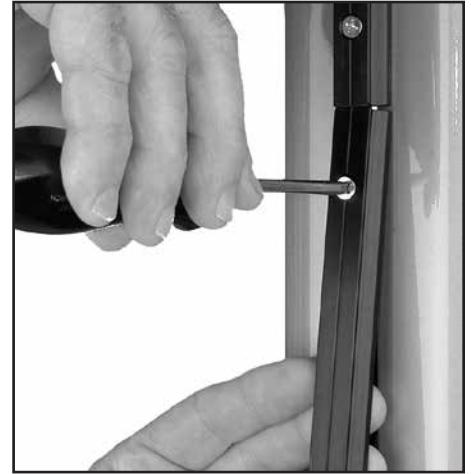
One drop blue Loctite® into each hole.

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7. Hold full-length track piece up to mast. Loosely install top screw.

Use putty knife to slide additional slugs and connector slug into place. Loosely install all nineteen 4 mm x 20 mm screws.



8. Slide tracks up enough to fit next track.

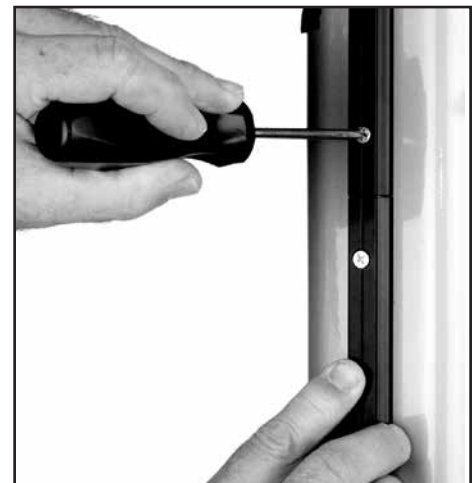
Mast up: Hold upper tracks. Loosen screw that holds tracks. Slide track up. Tighten new bottom screw securely.



CAUTION! Do not let tracks drop. Severe injury to hands and/or fingers can result.

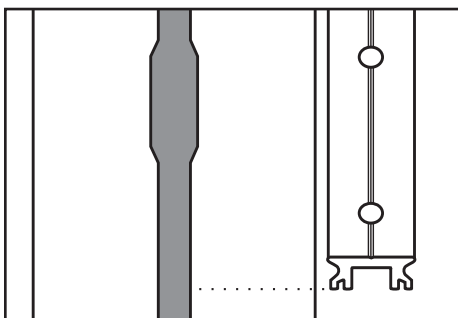


9. Repeat until full-length tracks installed.

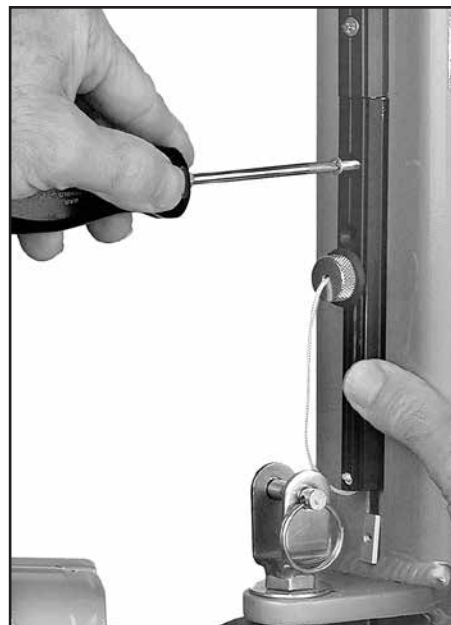


10. Raise tracks so 152 mm (6") bottom track fits.

11. Install Screwpin Endstop Kit.



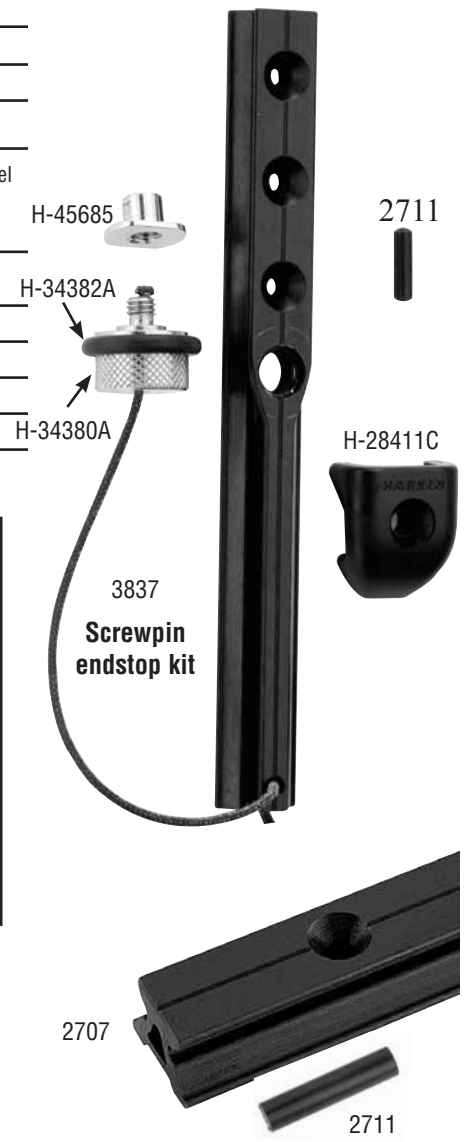
Note: If bottom full-length track blocks feeder gap, load bottom track slugs before installing track.



System AA (CB)

Track and Accessories

Part No.	Description	Includes
Purchase from Harken		
3837	Screwpin endstop kit	(a) 1 x 152 mm (6") end track with screwpin stop; (b) 1 x 2711 splice link; (c) 1 x H-28411C endstop (d) 1 x tube blue Loctite®
2707	Track (micro CB)	Use for masts without grooves or when slugs will not fit. Purchase stainless steel 4 mm (#8) screws separately. Do not use 3817 open-backed track. It requires mounting slugs. See page 11 for drill/tap sizes and mounting instructions.
2711	Splice links	One needed for each track joint
Purchase Separately		
#8 (4 mm) Flathead screws		Purchase 20 fasteners/meter of track
	Drill	3 mm (1/8")
	Tap	8-32 (M4)



Considerations for Determining Track Length.

Note: Track is longer than sail luff length.

1. Upper end: Extend track 203 mm (8") above headboard halyard attachment point to allow for sail stretch as main ages. Track must not block mast halyard exit.
2. Lower end: Place 152 mm (6") Screwpin Endstop track on mast. Make sure car clears gooseneck fittings and adjust height as necessary. Measure to lower end of track.



Important! Be careful not to lose the threaded backing plate.

Remove old track

IMPORTANT! Before removing old track, scribe pencil line down either side.

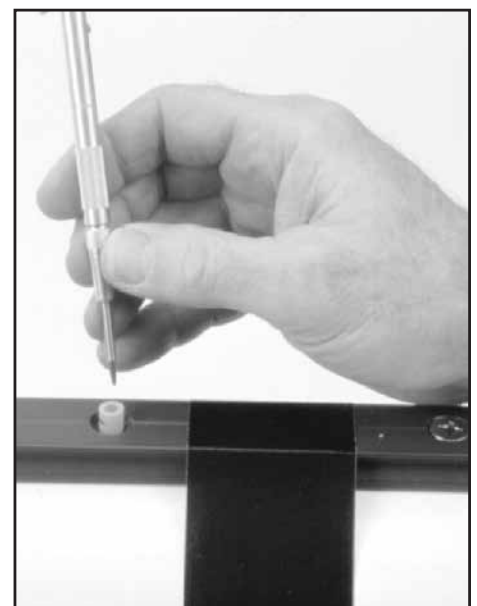
Drill, Tap, and Fasten

After old track is removed, attach string to mast to line up track during installation.

1. Start at one end of track and work down: Do not drill and tap from both track ends.

Clamp or duct tape track on mast. Center punch in center of track hole.

Tip: Use a narrow shaft spring-loaded machinist's center punch with plastic centering tube or a transfer punch.



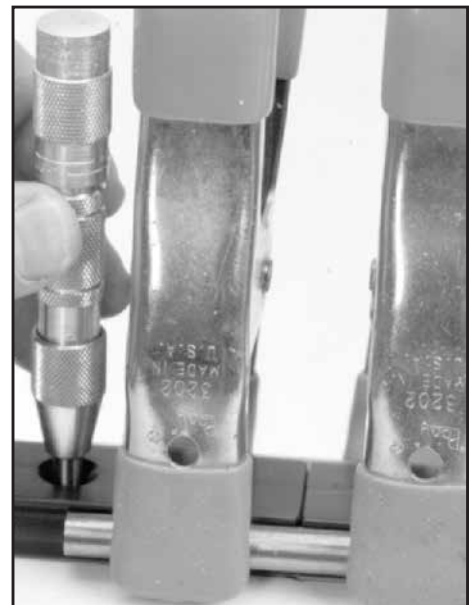
2. Drill track hole, holding drill perpendicular to mast face. Tap threads and install screws using blue Loctite®.

Loctite is a trademark of Henkel



3. Align track at joints. Use 2711 splice links and round rods or dowels on outside of track to align during installation. Hold in place with spring or “C” clamps until track is secured.

Load all cars before installing bottom track and endstop.



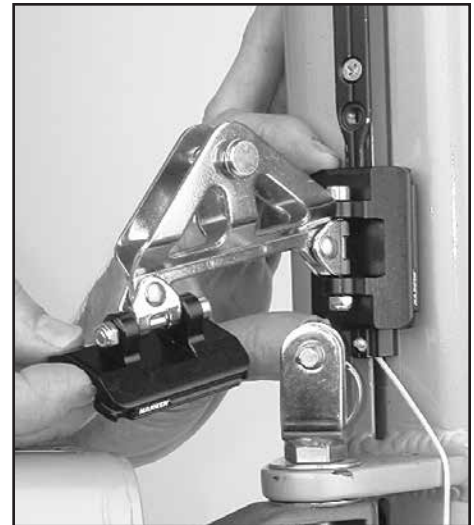
IMPORTANT! Keep balls captive by loading cars onto track without sail installed. Car must have 20 balls per side. Consult chart for correct type of balls.

DO NOT MIX CARS. High-load brown Torlon® balls are used in headboard and batten cars. Luff cars use low-load black Delrin® balls.

Part No.	Car Type	Car Length		Bearings		Number per Car	Part No.	Balls/Set	Ball Ø	
		in	mm	Color	Material				in	mm
3813	Headboard Cars	5 3/16	132	Brown	Torlon®	40	2708	20	3/16	5
3814	Slider Intermediate Car	1 3/4	44	—	—	—	—	—	—	—
3815	CB Intermediate Car	2 3/16	56	Black	Delrin®	40	HSB240	1	3/16	5
3816	Batten Car w/Threaded Stud	2 3/16	56	Brown	Torlon®	40	2708	20	3/16	5

1. Headboard cars: Hold car so cap screw head faces up. Align car on guide section of loader track and gently roll onto upper tracks. If car sticks, realign and roll onto track.

Tip: To load headboard car assembly, angle headboard coupler, roll car onto track. If necessary, remove headboard assembly.



2. Load Intermediate car (if used). Alternate with batten cars until all cars are loaded.

Mast up: Use halyard to hold cars up.



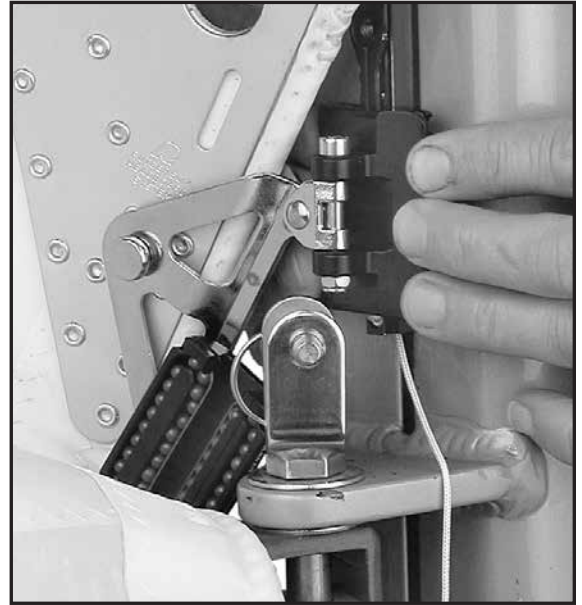
3. Install Screwpin stop.



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Delrin is a registered trademark of E. I. du Pont de Nemours and Company or its affiliates.

Load Cars with Sail

Line up car on guide portion of loader. Press car towards mast and carefully roll car onto track. Begin with upper cars and work down.



Lost Balls

Consult chart for ball type: Torlon® or Delrin®. Place car on edge with retaining clip in place. Insert balls one-by-one from center of clip and roll into return race. Do not overfill car.



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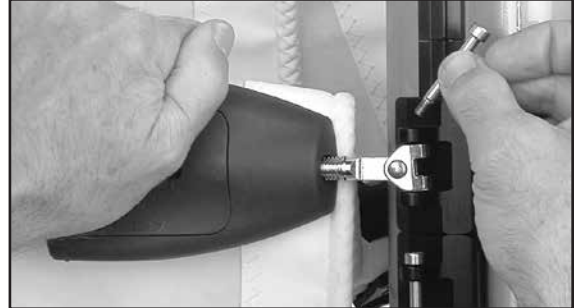
1. Beginning with lower cars, use 4 mm hex wrench and 8 mm wrench or nut driver to attach sail to cars. Tighten locknut until bottom tip of fastener is flush with nut.



2. Screw threaded stud to terminal.



3. Load toggle using 4 mm hex wrench and 8 mm wrench or nut driver. Tighten locknut. Do not over tighten.



4. Attach head of sail to headboard car with clevis pin and cotter pin.



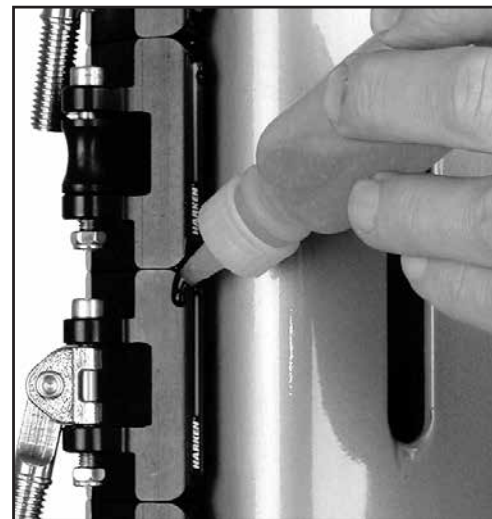
Car Maintenance/Cleaning

Clean beginning of season, or if cars bind.

Squirt detergent and water into ball bearings. Circulate by moving cars up and down. Let stand. To remove detergent, spray water into ball bearings and circulate. Clean tracks with detergent and water.

Use OneDrop™ Ball Conditioner

Once dry, use only a single drop of McLube® OneDrop™ ball bearing conditioner. Do not use spray lubricants because ball bearings may skid not roll. Apply one to two drops of McLube® OneDrop™ to ball contact surfaces of track. Roll car back and forth through OneDrop™ several times to distribute onto bearings. Wipe remaining OneDrop™ off track. OneDrop™ is preferred but you can also use one to two drops of a light machine oil. Too much attracts dirt.



Inspect

Inspect Battcars for loose locknuts. Replace. Inspect batten receptacles for loose screws.

Removing Sail

From Cars: Remove clevis pin from head of sail. Use a 4 mm hex wrench and a 8 mm wrench or nut driver on other cars.

Cars and Sail: Keep cars lined up with track when sliding off.

Inspect Cars: 20 balls per side. Replace 5 mm locknut after two removals.

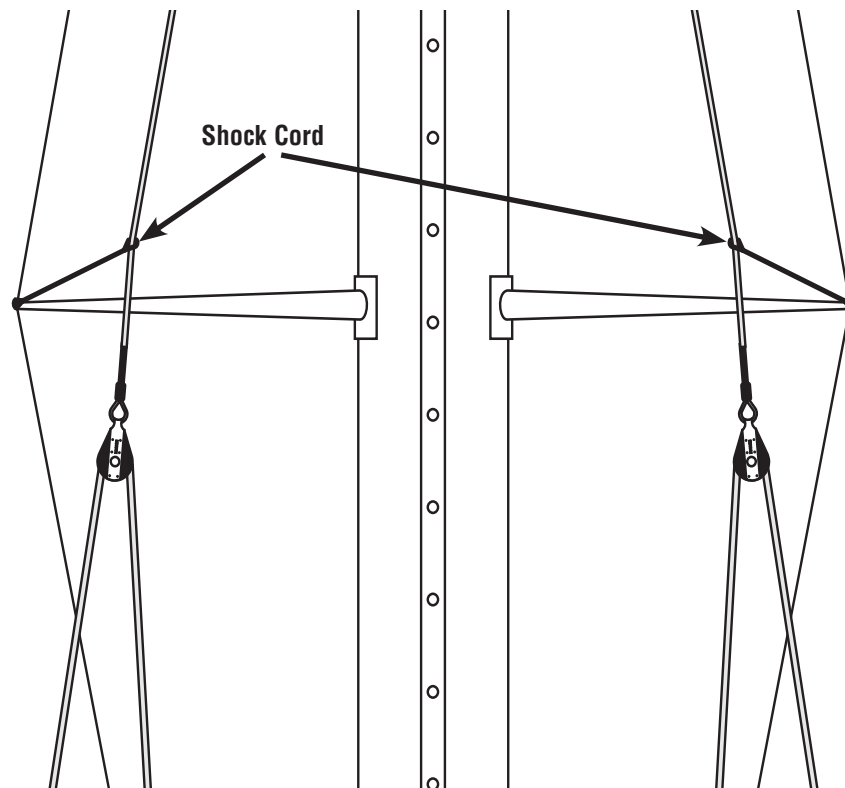
Lazy Jacks

Use shock cord to hold lazy jacks open so battcars and battens will not catch on them when hoisting sail. This will also help stop slapping of lazy jacks on sail. Attach one end to lower spreader tips and the other to lazy jacks. Make sure shock cord is long enough so boom can swing out all the way without damaging spreaders.

Operating Precautions

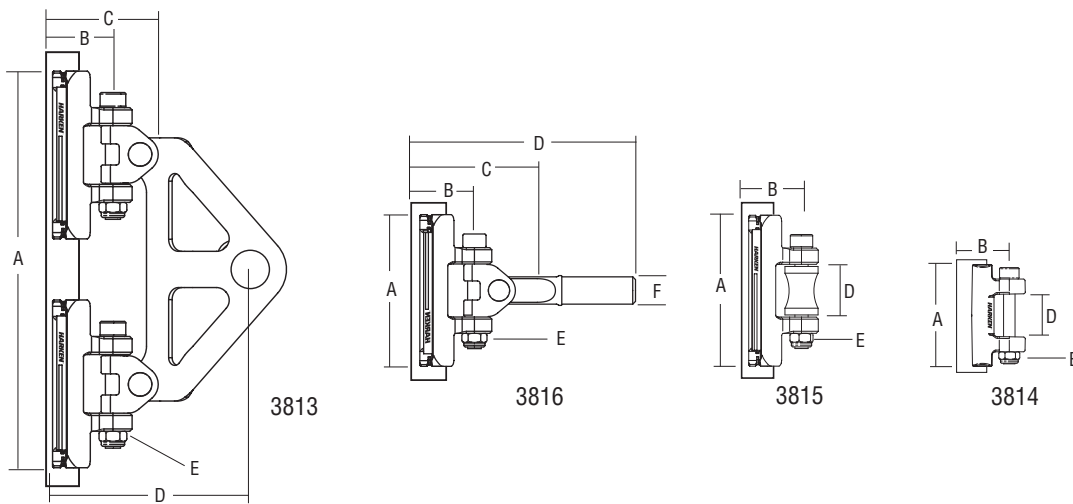
When lowering sail, do not let halyard go. Ease cars down by keeping a wrap on winch.

On boats with unstayed masts, vang must be used to prevent over rotation of upper part of sail. Over rotation can damage batten receptacles.



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Sailmaker's Instructions – CB System (Slug Mount/Drill & Tap) Dimensions/Installing Headboard Coupler Car



Dimensions

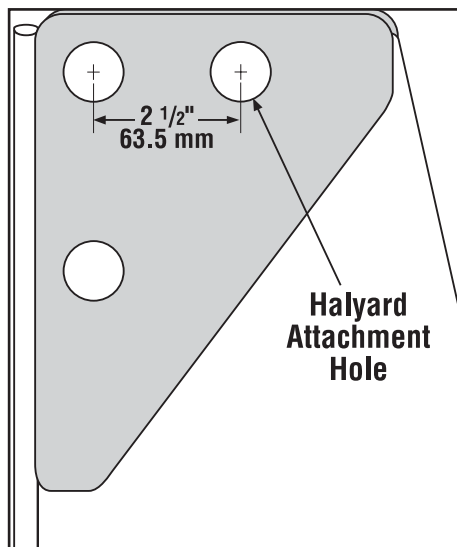
Part No.	A		B		C		D		E Locknut Size mm	F Stud Size mm
	in	mm	in	mm	in	mm	in	mm		
3813	5 ³ / ₁₆	132	1	25	1 ¹³ / ₁₆	46	2 ³ / ₄	70	5	—
3814	1 ³ / ₄	44	1	25	—	—	3 ⁴ / ₄	19	5	—
3815	2 ³ / ₁₆	56	1	25	—	—	3 ⁴ / ₄	19	5	—
3816*	2 ³ / ₁₆	561	1	25	1 ³ / ₄	45	3 ⁵ / ₁₆	84	5	10

*Batten receptacle not included

Installing 3813 Headboard Coupler Car Assembly

3813 headboard coupler attaches to standard headboards—some headboard modification required.

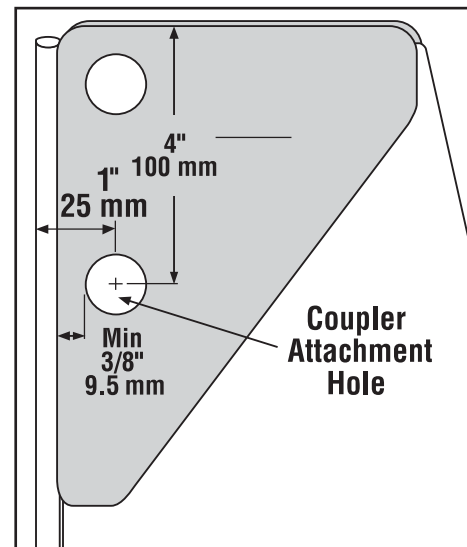
Maximum thickness of headboard plates and sail: 9/16" (14 mm)



Halyard Attachment Hole

Use aft hole if headboard has two.

If not, drill second hole to accept halyard shackle pin. Locate hole approximately 63.5 mm (2 1/2") aft of existing hole.



Coupler Attachment Hole

Drill 11 mm (7/16") coupler attachment hole so center is 101 mm (4") from top of headboard and 25 mm (1") from front edge of boltrope.

Leave at least 9 mm between front of headboard plate and front edge of coupler attachment hole.

Distance Between Attachment Points

Battens and intermediate cars placed at sailmaker's discretion. Maximum distance between attachment points is 1.2 m to 1.35 m (4' to 4'6").

Distance may be slightly greater. Contact Harken to discuss sail reshaping to eliminate luff flutter.

Note: Adding battens may reduce stack height by eliminating luff cars.

Setting Reef Points

Space reef points halfway between sail attachment points. Battens or reef points may need to be moved—Diagram A.

Note Batten fittings and cars cannot handle reefing outhaul or downhaul loads. Transfer loads to tack fitting—Diagram B.

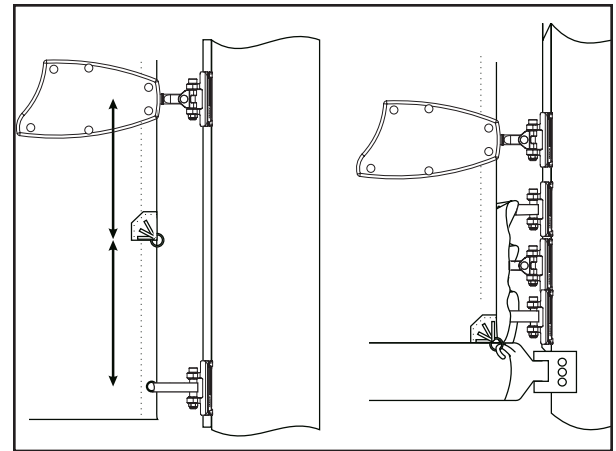


Diagram A

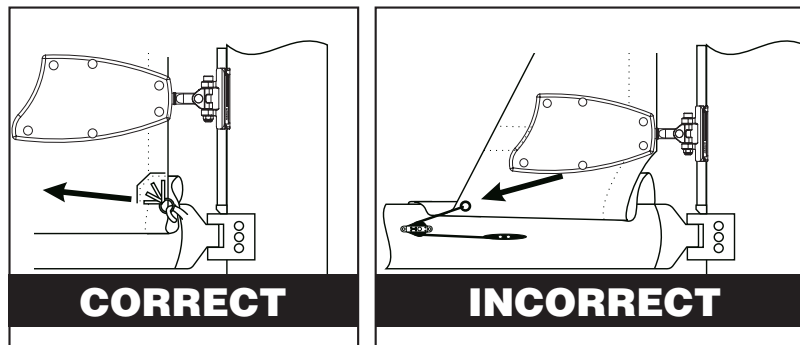


Diagram B

Sailmaker's Instructions – (CB/Slider Systems)

Attaching Sail to Intermediate Cars

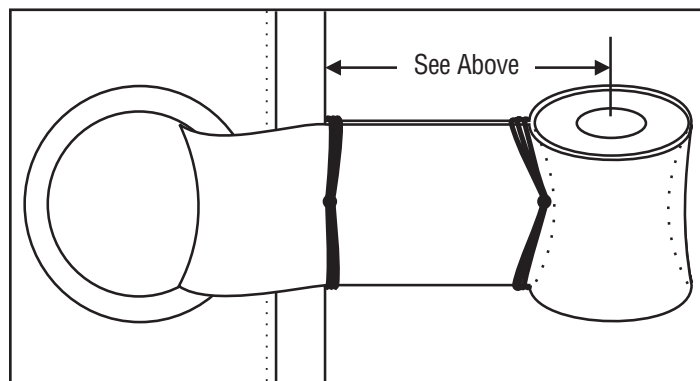
Attach Sail to Intermediate Cars

Sail setback from luff tape to intermediate car clevis pin:

3814 – 20 mm (13/16")

3815 – 20 mm (13/16")

Plastic spacers come with 3814 and 3815 intermediate cars. Seize spacer to webbing by stitching just behind plastic spacer. Seize webbing to sail by stitching up against sail.



Problem	Probable Cause	Solution
Tracks do not butt up against each other	Cut end of top or bottom track is at joint.	Make sure the anodized end is towards the full length track.
	Track weight pulling tracks apart.	Tracks will come together when you loosen bottom screw and push the tracks up mast.
Mounting slugs do not fit	Slugs wrong size.	Different size slug required. Contact your dealer.
Mounting screws will not tighten.	Incorrect mounting slug used.	Different size slug required. Contact your dealer.
Track will not slide up mast.	Slugs catching on mast splice.	Loosen screws slightly. If necessary have someone at splice area to wiggle the slug past the splice.
	Corners of cut track catching.	Use file to round off corners of track.
	Mast has too much prebend.	Ease backstay and/or straighten mast.
	Paint or other material clogging mast groove.	Clean out groove.
Cars do not fit on track.	Track and cars are not the same size.	Contact your dealer or Harken.
	Balls are missing.	Remove cars, load balls and slide cars back on track.
Sail headboard does not fit inside coupler.	Ring was not pressed far enough.	Take sail to sailmaker.

Problem	Probable Cause	Solution
Cars bind.	Balls missing from car.	Remove cars, load balls and slide cars back on track.
	Dirt in cars.	Use detergent and fresh water to flush dirt out of cars; move cars up/down do circulate; follow with high pressure water; clean track grooves.
Nut on Battcar is not holding.	Locknut has been used too many times.	Get new 5 mm locknut.
Batten receptacle does not rotate.	Nuts are too tight.	Loosen nuts slightly.
Cars jam when raising sail.	Headboard or cars are catching on lazy jacks.	Use topping lift or rod vang and shock cord to pull lazy jacks out to shrouds.
Sail will not go all the way up.	Sail is too tall or sheave is too far forward.	Have sail shortened or move sheave aft.
Vertical post or pin on batten receptacle bending.	Reef loads are being transferred to batten receptacle.	Transfer reef downhaul and outhaul loads to mast or boom gooseneck.
Reef tack fitting will not reach reef hook.	Reef point too close to sail attachment.	Move intermediate car sail attachment.

General Maintenance (see specific maintenance on page 16)

Harken equipment is designed for minimal maintenance, but some maintenance is required for optimum and safest possible operation and to comply with the Harken limited warranty. In general, the most important aspect of maintenance is to keep your equipment clean by frequently flushing with fresh water.

In corrosive atmospheres, stainless parts may show discoloration around holes, rivets and screws. This is not serious and may be removed with a fine abrasive.

With the exception of winches, do not use grease unless specifically recommended in the instruction sheet.

Flush blocks thoroughly with fresh water. Periodically disassemble blocks, if possible, and flush with detergent and fresh water. Lubrication is not required.

Important! Exposure to some teak cleaners and other caustic solutions can result in discoloration of part and is not covered under the Harken warranty.

Warranty

For additional safety, maintenance and warranty information see www.harken.com/manuals or the Harken- catalog.

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to locate Harken dealers and distributors

