

# Replace your Standing Rigging

By Jack and Alex Wilken

Over the past years, we have written about different aspects of standing rigging. This article is about replacing standing rigging that has seen better days. This might mean one shroud or stay that has been damaged, or the entire rig.

“When should I replace my rigging?” is a question we hear all the time, and it has several answers. The first is when you see signs of deformation, breakage, or corrosion—all conditions outlined in our article “Check that Rigging - inspecting those things that support your mast” from the July 2011 *48° North*. Then, there are many different suggestions as to how many years might be the safe lifetime of 1 X 19 stainless steel wire rope. The problem with these time estimates is that they depend on various factors. The environment is critical; the Tropics will shorten the life more than the Pacific Northwest. Of course, how the boat is used has an effect too, because a racing boat will usually see consistently higher loads than a day sailor. Next,

there are design considerations like the oversizing of rigging on cruising boats. This means that all loads will be a smaller percentage of the breaking strength, therefore reducing stress on the rig. You can find numbers like 10 or 20 years and as short as 7 years in the tropics, again taking what we just wrote into consideration. We have seen boats with rigging that is 30 plus years old with no failures, deformation, or obvious visual signs of degradation.

Deciding to change all or some of the rigging can be about peace of mind or following the clues in the above-mentioned article. This month’s article is about replacing your rigging with stainless steel wire rope. We are not going to try to cover the splicing of wire rope, the use of synthetic fiber rope for rigging replacement, or stainless rod rigging, as each of these would require its own dedicated article.

It would be nice if you could just get the specs on your boat and make up your new rigging from that, but each boat’s rigging needs to be measured.

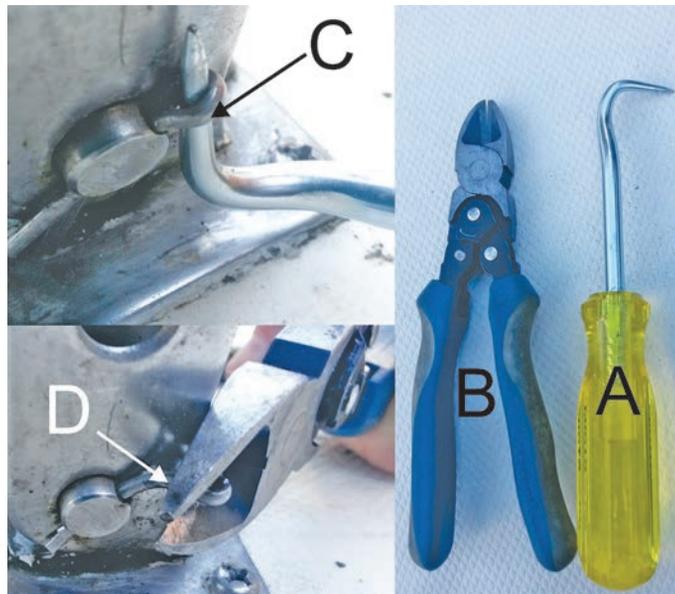


Figure 1: Removing cotter pins is easily done with a cotter pin puller, “A”, or side cutters, “B”. The cotter pin puller can be worked into the eye of the cotter pin, “C” and then levered out. The side cutters bite into the cotter pin, “D”, and then are pried out using the side cutters as a lever.

This is for various reasons, not the least of which is that boats get modified by their owners as the years go by. Choosing how you plan to do this project is a place to start. The shrouds and stays will need to come off the mast, but you can either do this with the mast still stepped or with it off the boat. With the mast down, laying on saw horses or stands, you will be able to remove all the rigging at once, but if it is still up, you will want to leave in place sufficient support to keep the

mast aloft. Forward and aft lowers or aft lowers with a babystay will allow you to remove the upper shrouds and the headstay/backstay, and the reverse will also work. This will require that someone goes up the mast and does some of the dismantling while in a bosuns chair, not the most stable working condition, but certainly doable.

No matter which way you go with this project, unstepping the mast or in the two stages, you will need to loosen turnbuckles and remove cotter and clevis pins. Start a couple of days early with penetrating oil, being careful not to get any on the deck. Sometimes, we find a turnbuckle that does not respond and we need to use a heat gun; do not use an open flame because too much heat can destroy it. When you do get it to move, work it back and forth applying oil as you go. Make sure to hold the upper end of the turnbuckle or the lower swage on the wire so it will not twist and loosen or tighten the lay of the wire. Removing cotter pins is most easily done with side cutters or a cotter pin puller (Figure 1). A pin punch of a little smaller diameter than the clevis pin you are removing with a hammer works well, but it may be a three-handed job if the pin is aiming overboard. Whether you do all the rigging at once or in two stages, it may be helpful to print out a rigging diagram of your boat to mark up with measurements and terminal fitting identifications ([www.sailboatdata.com](http://www.sailboatdata.com)).

Before you start taking things apart, take a look at the whole rig. Make sure the rig is tuned correctly and that there is still adjustment on all the turnbuckles or backstay adjusters, (reference *48° North* from June 2013 - “Mast Tuning - increase your boat’s performance and safety” and May 2016 - “Install an Adjustable Backstay”). Are there any extra toggles or turnbuckles without toggles that should have them? Mark all the turnbuckle thread positions. We do this with vinyl tape, often called ‘electrical tape.’ Since you will be loosening the turnbuckle, the tape you put on the threads will remain in place.

When the rigging is off the mast, it can be measured. This will include the diameter of the wire rope as well as

the length from the center of the hole in the terminal to the one at the other end, or to the end of the tee or stud. The diameter can be measured by either a rigging gauge or calipers (Figure 2). The tape measure should be longer than the longest piece of rigging. It is important that there be room to stretch out the rigging full length to measure it. This can be a location that is long enough with a solid place on the ground to anchor one end of the stay or shroud and the tape measure so that they can be pulled out tight to get the most accurate measurement. At this point identify the two end fittings; there are many possibilities. Do not assume anything. Lay out the old wire with turnbuckle on it at the position of the mark on the threads. Then, when you draw or lay out the new wire, do it with the turnbuckle at 50% thread extension.

Measure the diameter of the hole for the eyes and forks as well as the width and thickness of the body and/or slot of the fork. There is a standard marine eye and fork, but these are not always what are used by boat manufacturers, or the last person who did rigging on the boat. Stem ball and "T" terminals as well as threaded studs are the other commonly used fittings, but the nomenclature often varies. In some cases, for a given wire size, there may be more than one pin size or thread size for studs, so, if you do not want any surprises, measure

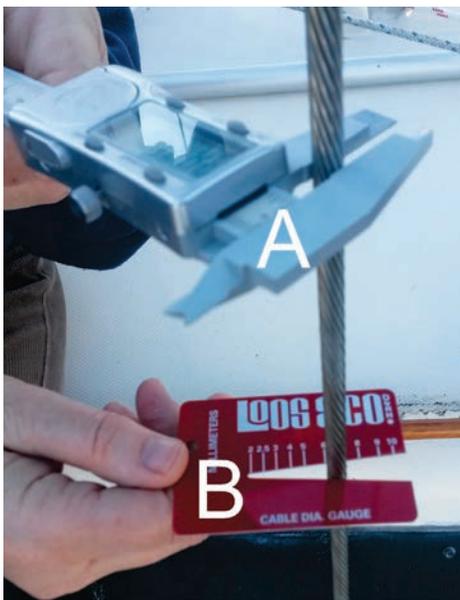


Figure 2: The diameter can be measured by either calipers, "A", or a rigging gauge, "B."

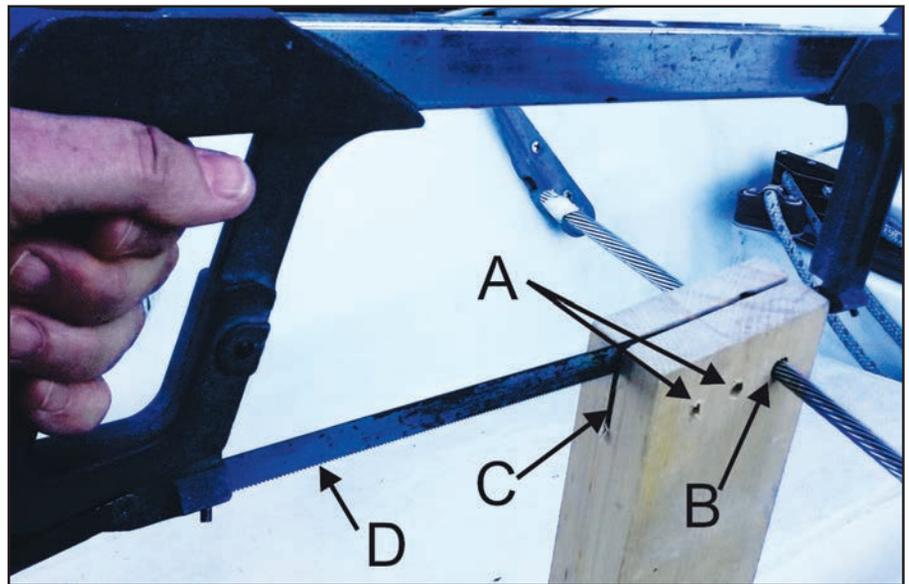


Figure 3: This piece of hardwood is drilled with different size holes, "A" and "B", to accommodate various sizes of wire. The guide slot "C" was cut on a table saw. The hack saw has a new fine toothed blade (32 Teeth Per Inch), "D." The hardwood must be held in a vise or clamped to something solid.

and record everything. All clevis pins must fit the fitting into which they go, so, no 7/16" holes with 3/8" clevis pins, for example. We make a drawing of the rigging and then dimension it with details for the fittings. Print out drawings of individual fittings and dimension them. Measure twice before you order or begin cutting your rigging. Assuming you are using 1 x 19 stainless steel wire rope, you still have the choice between 316, 304 or compacted wire rope. 316 is more corrosion resistant while 304 is stronger for the same diameter. The compacted wire rope in 316 is similar in strength to 304 with 25% less stretch than either 316 or 304. In order of price, high to low, it is compacted, 316, and 304.

Having chosen which wire rope you will use, let us look at what you want to put on the end of each stay or shroud. Beyond whether it is a marine eye or threaded stud, etc. is the choice of swaged fittings which must be installed by a shop that has the proper equipment. These are large hydraulic affairs, and it is important to check to see that the shop has a good reputation for the work that they do. Without the right equipment, they cannot do a good job, but this is not a guarantee of their quality control. The other way to go is to use compression fittings. There are three major manufacturers of these, and the biggest difference is that one

is completely reusable while the other two require that you use new cones when reusing. Installing compression fittings require some cutting device for the wire, two or three good adjustable wrenches depending on the sizes of fittings that are being installed, a small straight screw driver, and, preferably, a vise. This means you or a rigger you trust can do the job. The cost will be higher the first time, but if you keep the boat long enough to replace all or some of the rigging again, you can, as we said, reuse the fittings. This, of course, is a big plus at sea or in some remote area of the world where no big swaging machine is available. These fittings are incredibly strong if assembled correctly. After the initial assembly, you open it up and inspect that everything is as it should be, so there is a high level of security.

Headsail furlers often need the lower fitting on the headstay to be a compression fitting so that the wire can pass through the extrusion. If you are using a swaged fitting at the top of the headstay, you will want to remove or cut the old upper fitting off so you can use the old wire to pull the new wire through the extrusion. This does not always work, but your best chance is by using very thin tape- we use splicing tape- to marry the two wires end to end. Then feed the new wire in at the top while putting very little tension

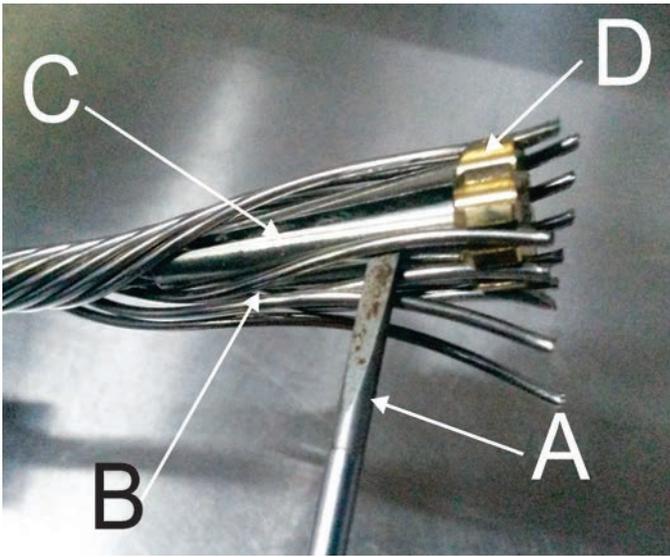


Figure 4: When inserting the cone, "C", into the 1 x 19 wire rope to install a compression fitting, we use a small, straight screw driver, "A", to separate and arrange the individual wire strands, "B". This fitting has a wire separator, "D", to space the strands evenly around the cone.

on the old wire that is coming out the bottom. The old wire is a guide to get the new wire past any obstructions. If you can avoid taking the whole furling apparatus apart, it is a plus.

The wire can be cut with levered cutters as long as you are careful to hold everything straight so you do not wind up with crooked cuts. A vise is important in this case. The next choice is a fine toothed hack saw blade, 32 Teeth Per Inch, with a cutting guide

(Figure 3, page 43) and cutting oil. Sometimes an angle grinder is used, especially, with larger diameter wire, but we avoid it because of the amount of heating of the wire.

Each manufacturer gives detailed instructions for mounting their product. That being said, they are all similar, and we use a small straight screw driver to separate and arrange the individual wire strands (Figure 4). The use of polysulfide or some

non-acidic sealant as well as thread lock is a common practice, and we have not seen any negative chemical interactions, or contraindications, over the years from.

Renewing your rigging is like many projects on a boat: when you break it down into a logical set of steps or separate, smaller jobs, it will not look overwhelming. If you are going to the tropics, go 316 for the wire rope. It is not uncommon to see a swage fitting at the upper end of rigging and compression fittings at the bottom where the swages suffer the most from corrosion; this does save weight and money and lets you lay the old and the new rigging piece side by side for the final length adjustment. Again, measure twice, cut once. When you are done and looking at your new, gleaming standing rigging, it does give a very nice feeling.

*Jack and Alex Wilken are experienced boat builders and have cruised extensively. They each hold a 100-ton USCG Captain's License and are the owners of Seattle Boat Works LLC in Seattle.*

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