Add Backing Plates to Your Mast and Boom Hardware

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by
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s/v *Beatrix*

Not long ago, I was checking the machine screws which held my gooseneck hound to the mast. I backed them out to renew the anti-seizing and, when I tightened them, two of them kept turning: the threads had stripped! It's a 28 year old mast so this was not surprising. Over the years, and with several owners, perhaps the anti-seizing had been neglected and corrosion had taken its toll; perhaps the threads were tightened too hard (by a previous owner, of course); or maybe this is just a generic problem that comes from hanging hardware on a mast or boom with a cross-section that allows for barely three threads.

Whatever the cause, mast and boom hardware such as winches, cleats, vang attachments, and the gooseneck hound, are all screwed into very thin aluminum. With age and use threads become weakened and fasteners will no longer hold. There are several solutions to this problem including up-sizing the fasteners or using stainless or Monel blind (pop) rivets instead of screws. But up-sizing requires re-drilling the hardware and results in even less threads through the cross-section. Blind rivets are suitable only when the shear stress is low, the forces on the fitting are compression loads, and there is no shock loading.

For strength and durability the best solution is to add an aluminum backing plate which is permanently attached inside the mast or boom. This backing plate is generally a piece of ½" x ¾" aluminum rectangle stock drilled and tapped to match the hardware mounting holes. This method works with old hardware with stripped mounting holes but there is no reason not to use backing plates when installing new hardware. In the case of high-stress tension-loaded hardware such as a rigid vang, I believe it is essential.

The required tools are:

- Two "alignment rods". Make them yourself from thread stock or machine screws with the heads cut off. See below for details on how to do this.
- Seizing twine in two colors.
- A very strong small magnet.[2]
- An ordinary steel nut (not stainless)
- Tapping equipment: tap drills, taps, and a tap wrench to fit both the final fasteners and the alignment rods.
- A small hook made from seizing wire, sized to fit through a mounting hole and snag the twine.

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[2] I generally buy neodymium rare earth magnets from online retailers such as www.kjmagnetics.com. The one I use is a cylinder 1" in diameter and ½" thick. You have to be very careful with these magnets because they can destroy your computer, distort your radar, skew your compass, and stop your uncle's pacemaker. The only safe and accessible way to store it on a boat is to let it attach itself to an ordinary steel screw fastened to the overhead.

There are several tricks to doing this job, but the key method is using the magnet on the OUTSIDE of the mast to pull the steel nut on the INSIDE of the mast. Two lengths of seizing twine are tied to the nut which is inserted at a halyard exit or other opening in the mast. When the magnet drags each line across the mounting hole it is fished it out with the wire hook. The backing plate is attached to the other ends of the two lengths of twine by using the home-made threaded "alignment rods" which are screwed into the backing plate. Pulling on the seizing twines until the alignment rods exit the mount holes will pull the backing plate into place. At this point the backing plate can be permanently fastened to the inside of the mast or boom with a machine screw or a pop-rivet. The final steps are: drilling and tapping the backing plate for the final mount points, installing the hardware, and letting go of any worry that your hardware will fall off the rig.

Let's go through the technique, in detail, by the numbers:

1. Fabricate the "alignment rods". (Photos 2 & 3)

    a. Find two pieces of thread stock that are least 1" long and 75% or less of the diameter of the machine screws used for mounting. E.g. 10-24 for a ¼-20 mounting bolt. The material is not important: it can be brass, steel, or stainless. Brass is easiest to work with. You can also cut the head off a machine screw.

    b. With a file or grinding tool make a tab at one end of the thread stock. Drill a hole in the tab through which you can tie a bit of seizing twine. The little tab allows you to pull the alignment rod through the mounting holes on the mast without binding.

2. Fabricate the aluminum stock to be used for the backing plate. (Photo 1)

    a. Acquire a piece of aluminum rectangle stock ½" thick by ¾" wide with a length at least 1½" greater than the maximum distance between the mounting holes. Use a marine grade alloy like 6061 which has some corrosion resistance. If there is an aluminum fabricator nearby, they might have some scraps you can use; otherwise small pieces of specialty metals are readily available from online suppliers such as www.onlinemetals.com.

    b. Very carefully drill and tap two holes for the alignment rods. These holes must exactly match two of the hardware mount holes. If the hardware has more than two mounting holes the rest of them will be drilled and tapped once the backing plate is in place. Use the hardware itself as a template for locating the holes. Use a centering drill if you have one. Note that we are making threaded holes for the alignment rods, not for the final mount.

    c. The edges of the aluminum that face the inside of the mast should be rounded to loosely conform to the inside curvature. Either a file or a belt sander can do the job easily. It is important to avoid a "hard point" at the edge.

3. Thread the alignment rods into the backing plate. Tie a length of seizing twine to the tab at the end of the alignment rod. If the holes are not symmetrical and the backing plate must be aligned in a specific direction, use colored twine to mark which rod comes out of which hole. (Photo 4)

4. This is the fun part. Tie both lines to a steel nut. Using the extra-strong neodymium magnet, drag the nut towards your original mounting holes (if you are mounting new hardware, you will already have drilled them). Use a wire hook to fish each line from inside the mast. Cut off the lines that are connected to the nut. The nut will either be lost down the mast or you can use the magnet to drag it back to the opening from whence it came. (Photo 6)

5. Insert the backing plate into the halyard exit, or other opening, and use the two twines to pull it towards the mounting point. You may need to have a third piece of twine to keep backward tension on the backing plate as you ease it towards its destination. Pull the alignment rods through the holes. This usually goes fairly easily. You now have the backing plate snug against the inside of the mast. (Photo 5-8)

6. While firmly holding onto one of the alignment rods, remove the other rod and replace it with a regular round-head machine screw. Tighten that down and do the same with the rod you have been holding. The backing plate is now bolted to the mast with temporary undersized screws. (Photo 9)

7. The backing plate needs to have a permanent fastening to keep it in place without the hardware being attached. There are three methods you can choose from:

    a. Put a blob of adhesive (e.g. 3M 5200) that will glue it to the inside of the mast. If you do this, be careful that it doesn't rub off on anything inside the boom or mast that you might NOT want to be glued to the inside.

    b. Drill a hole clean through the mast and plate and install a long aluminum pop rivet; only one is necessary. (Photo 10)

    c. Drill and tap right through the mast and backing plate to accommodate a small machine screw to hold the backing plate in place.

8. Now that the backing plate is in place, all that remains is to drill and tap for the final fasteners. One at a time remove the temporary screws and re-drill and tap for the final threaded hole. Be careful at this stage because you don't want to break the tap! Use tapping fluid and, preferably, a new tap. Old, dull taps are harder to use, do not cut clean threads, and are much more likely to break. If there are more than two mounting holes for your hardware now is the time for drilling and tapping them. Repeat this for both of the initial mounting points. (Photo 11)

9. If the hardware has more than one mounting point, screw the hardware to the mast using the initial two holes. Use the hardware itself as a template to locate the positions of the remaining holes. A touch with a drill will mark the center-point of

each hole. Remove the hardware, fasten the backing plate at each end with machine screws, then drill and tap the remaining mounting holes. Use tapping fluid for a clean hole and clean-cut threads.

10. Mount the hardware. Clean the tapping debris from the holes. Don't forget the anti-seizing compound[3] which is essential whenever using dissimilar metal fasteners such as stainless into aluminum. (Photo 12)

Even with backing plates, it is important to check the fasteners often; they can and will work loose, particularly those fastening the gooseneck hound and a rigid vang. Once a year, back out the fasteners and refresh the anti-seizing compound.

Installing backing plates in critical hardware can be tedious, but your rig will be safer and stronger and you, by yourself, will have made it so.

WORD COUNT: 1612

[3] Several anti-seizing compounds are effective. TefGel™ and Lanocote™ are two that work well.

PHOTOS

These photos were taken with the mast out of the boat, but the technique will work fine with the mast in place.

Figure 1. A cleat and a line clutch with their backing plates ready for installation. The white block of 2" Starboard™ was used as a drilling alignment block.

Figure 2. One of two "alignment rods" is inserted in the backing plate.

Figure 3. Close-up of the end of the alignment rod showing the flange and hole drilled for the twine.

Figure 4. The backing plate ready for installation. The steel nut atop the cylindrical magnet will drag the lines along the inside of the mast, following the magnet which is on the outside.

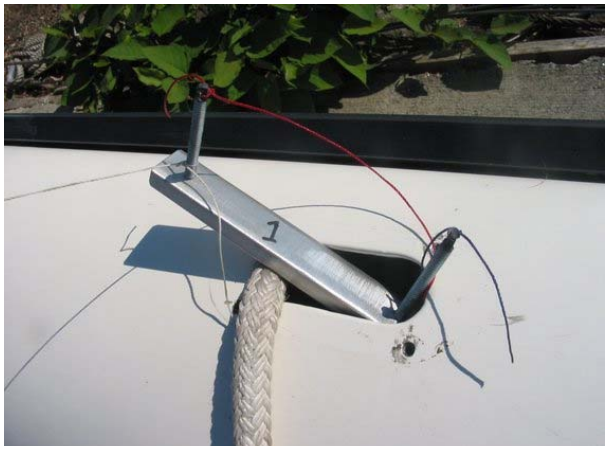

Figure 5. Inserting the backing plate into a halyard exit opening. Note the red and green seizing twine attached to the threaded alignment rods. The white line is to keep back tension on the assembly as it is moved into position.

Figure 5 (alternate). Inserting the backing plate into a halyard exit opening. Note the red and green seizing twine attached to the threaded alignment rods.

Figure 6. A wire hook is used to snag the twine which has been dragged past the holes by the magnet (on the outside) and the steel nut (on the inside) to which it is tied. The far twine will be hooked next. The colors tell you which line goes to which hole.

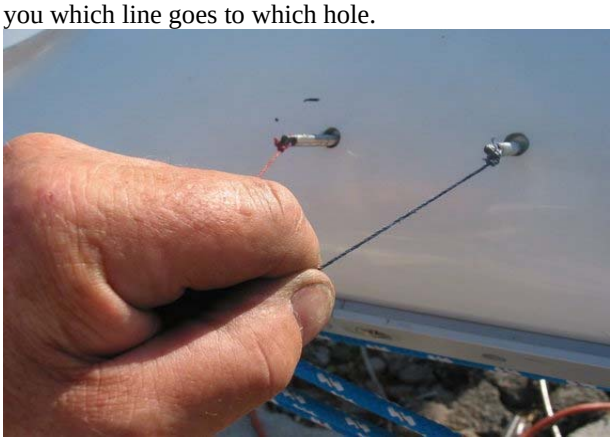

Figure 8. The red and green twines have been hooked out of the mounting holes. By pulling tightly on the two lengths of twine, the backing plate moves into position on the inside of the mast.

Figure 10. With temporary holding screws in place, a hole was drilled for a pop rivet which now fastens the backing plate in place. An alternate method is to drill and tap for a small machine screw.

Figure 7. The twine now runs inside the mast from the backing plate to the mounting holes.

Figure 9. While holding tight to one alignment rod, the other is removed and a temporary machine screw is used to hold the backing plate in place. Remove the final alignment rod and add a temporary screw in the second hole.

Figure 11. Tap and drill to the proper size for the permanent mounting bolts. Use tapping fluid and a new tap.

Figure 12. The hardware is now secure on the mast.

ALTERNATE PHOTO SEQUENCE (GOOSENECK HOUND BACKING PLATE)

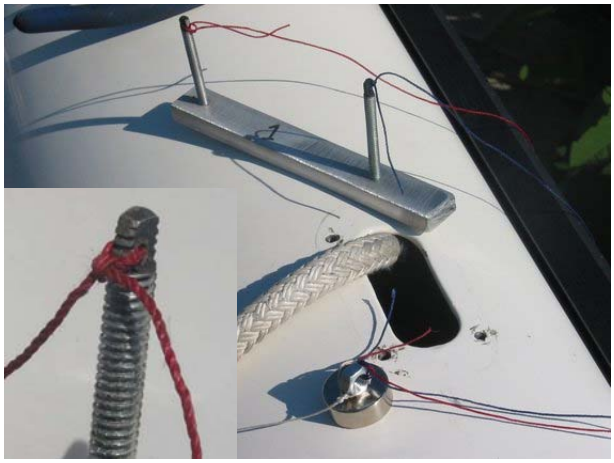

Figure 1. Backing plate components ready for installation. Note round heavy duty magnet, colored twine, and "alignment rods" with flanges. The steel nut atop the magnet will drag the lines along the inside of the mast, following the magnet on the outside of the mast.

Figure 2. The twine is extracted with a wire hook once the magnet/nut combination is moved past the mounting holes.

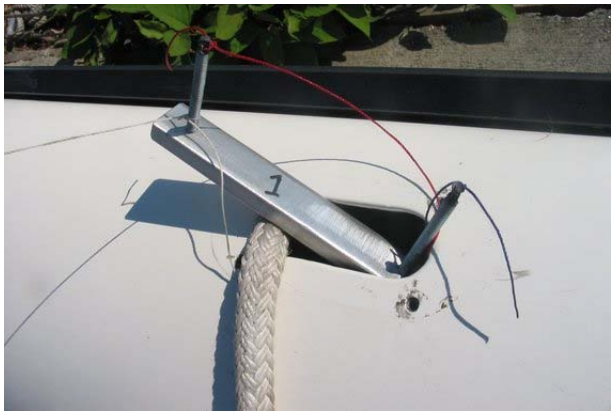

Figure 3. Inserting the backing plate into a halyard exit opening. Note the red and green seizing twine attached to the alignment rods. The white line is to keep back tension on the assembly as it is moved into position.

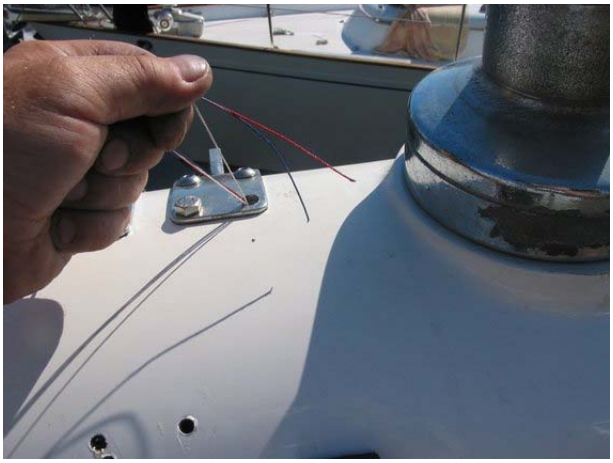

Figure 4. Pulling the backing plate into place.

Figure 5. The alignment rods in place, still screwed into the backing plate.

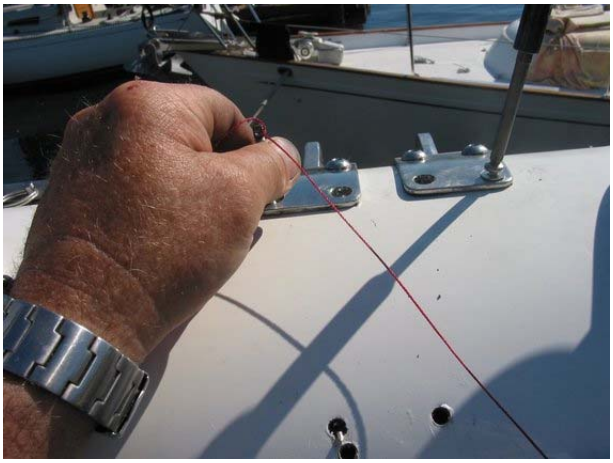

Figure 6. While holding one rod tight, remove the other and screw a temporary fastener in place.

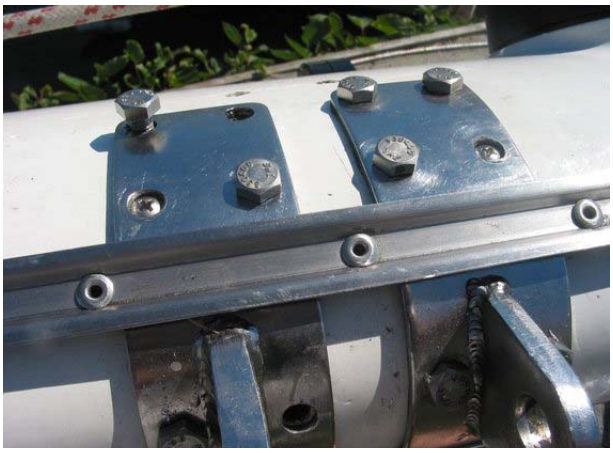

Figure 7. With the temporary screws in place, the inner holes are drilled and tapped. Looking at the second row of fasteners you will see the temporary screws on the ends and the final inner fasteners in the middle.

Figure 8. With the temporary fastener removed and the outer holes are drilled and tapped. This step is repeated for the other outer hole (to left) and the job is complete.