

## MAINTENANCE BULLETIN KEEL BOLTS

### Keel Bolt Maintenance Bulletin

There aren't many maintenance areas that are more important, or more often overlooked than keel bolts. This is true for every boat, but particularly so for J/22s, J/24s and J/80s, all of which routinely hoist the boats in and out of the water using the bolts.

Failure of any keel bolt is bad, but most bolts are part of a massively redundant system, where the failure of any one bolt is rarely immediately catastrophic. For boats that are hoisted, the failure of a bolt holding the lifting gear *can* be catastrophic and has the potential to lead to the loss of the boat, or much, much worse.

While this article is being distributed to USWatercraft and J/Boats customers, it applies to virtually all production boats, regardless of builder or brand. If they use Stainless Steel keelbolts and most of them do, it applies. Feel free to pass it along to your friends and fellow boat owners. It's pretty important.

Since they live in the bilge, keel bolts can fall into the category of "out of sight, out of mind". It is *because* they live in the bilge that they need routine care and attention.

J/22 keels are made using 316 Stainless Steel threaded rod, which is cast into the lead. The nuts, washers and lifting bar are made using 304 Stainless and are then electro polished. This has been the industry standard for many years, and has provided many years of service life.

### **Stainless Steel is corrosion resistant, not corrosion proof**

The basic resistance of stainless steel occurs because of its ability to form a protective coating on the metal surface. This coating is a "passive" film, which resists further "oxidation" or rusting. The formation of this film is instantaneous in an oxidizing atmosphere such as air, water, or other fluids that contain oxygen. Once the layer has formed, we say that the metal has become "passivated" and the oxidation or "rusting" rate will slow down to less than 0.002" per year (0,05 mm. per year).

Unlike aluminum or silver this passive film is invisible in stainless steel. It's created when oxygen combines with the chrome in the stainless to form chrome oxide, which is more commonly called "ceramic". This protective oxide or ceramic coating is common to most corrosion resistant materials. Unfortunately Halogen salts, especially chlorides easily penetrate this passive film and will allow corrosive attack to occur.

### **CONCENTRATED CELL OR CREVICE CORROSION**

This corrosion is common between nut and bolt surfaces. Salt water applications are a severe problem because of the salt water's low PH and its high chloride content. Here is the mechanism:

- Chlorides pit the passivated stainless steel surface.
- The low PH salt water attacks the active layer that is exposed.

The absence of oxygen inhibits the re-forming of the passive layer.

These three factors work together in a vicious cycle, repeatedly attacking the same small area. If the metal is under tensile stress-

like from an over torqued keel bolt nut, the pit formed can transform itself into a crack. When a crack forms the process repeats and accelerates as the surface area of the 'active' layer is now much larger.

## Prevention is the best cure

The best way to prevent corrosion is to keep salt away from your bolts. The best way to do that is to keep your bilge clean and dry. We've designed our interiors to be easily washed down. Take advantage of this. At the end of the day, when you hose off your deck hardware, stick the hose down the companionway and blast out the bilge and bolts. Pump and sponge dry and leave the floorboard off when you leave. Not only will this protect your keel bolts from corrosion, it will prevent mildew and keep your interior looking and smelling fresh.

Important note! Avoid using any cleaning products containing chlorine. Chlorides are just what we are avoiding. Read the label. Clorox, Comet, and Fantastic are all products that while good for most stuff are bad for this application. Check the label.

## Annual Maintenance

Checking your keel bolts should be part of your annual maintenance plan. Working one bolt at a time, remove the nut and washer and clean the threads with a small nylon or brass brush or scotch brite. Do not use a steel wire brush, as this can lead to other corrosion issues not covered here! Check for signs of rust. If everything looks good, use a generous coating of anti-galling compound and re-torque the nut. Most J/22 keel bolts are 5/8

## Keel Bolt Torque Table

Bolt Diameter	Torque Nm	Torque Ft/Lb
1/2"	26.0	19.2
5/8"	66.0	48.7
3/4"	130.0	95.9
7/8"	190.0	140.1

This Table is derived from information in Table A7 from ISO/DIS 12215-9.2. These values are for well greased threads. Friction in the screw and under the bolt head makes up approximately 90% of the tightening torque and approximately 10% contributes to prestressing of the bolt. The user is cautioned to use good judgment in applying these values.

Tip- If you can pull in your mainsheet, you probably don't need a big breaker bar to torque your nuts. Over-torquing is extremely bad. Particularly on the bolts holding your lifting rig, under-torquing is equally bad. If the nut is loose enough to allow movement in the bar, the bolt can be loaded unequally, leading to tension stress on one side of the bolt.

## While you are there

Since you are spending some time with your bilge anyway, this is a good time to give the rest of your lifting gear a good look over. Check your sling for any signs of wear; fraying, cuts, abrasions and the like. Your sling should look essentially new.

If you use a shackle in your system, check it too. If it is bent, rusted or shows signs of wear, just replace it. A new sling costs around 50 bucks and a shackle around 9 bucks. It is the cheapest peace of mind available.

## If you think you find a problem

If you find or suspect you have problems beyond a good cleanup you should contact a marine surveyor who can inspect and report findings. Your surveyor will have the specialized knowledge and tools to give you an informed recommendation.

## Additional Resources

Lots of info on Stainless [http://www.azom.com/article.aspx?ArticleID=1177#\\_Background](http://www.azom.com/article.aspx?ArticleID=1177#_Background)

Info on galvanic corrosion

[http://www.corrosionist.com/Galvanic\\_Series\\_of\\_Metal\\_in\\_Seawater.htm](http://www.corrosionist.com/Galvanic_Series_of_Metal_in_Seawater.htm)

Recommended Anti-Galling compound

Loctite(R) Marine Grade Anti-Seize available @ Amazon and a gajillion other places

[http://www.amazon.com/16-Oz-Marine-Grade-Anti-seize/dp/B0042T5MS0/ref=pd\\_sbs\\_indust\\_4](http://www.amazon.com/16-Oz-Marine-Grade-Anti-seize/dp/B0042T5MS0/ref=pd_sbs_indust_4)

Lifting Strap:

<http://www.waterlinesystems.net/servlet/the-208/Lifting-Strap%2C-Web-2x5%2C/Detail>