

The summer sailing season is here and if you haven't done it already, it's time to check your rig. Riggtech owner, **Phill Bate**, a former America's Cup sailor explains how to check your standing rigging and what to look for.

Inspecting your rig *the right way!*

LIKE ANY GOOD load bearing structure, the rigging installation is only as good as the base it's attached to. Chainplates are neglected when inspections are done because a false assumption is often made that as they are made of stainless steel they will last forever. Crevice corrosion is the quiet culprit that can eat away at the chainplate material constantly. There are several ways the corrosion can take place. One possibility is when the oxygen volume at a particular place is indirectly cut down. For example, this can happen between bolt head and a washer that are under salt water. This isolated area of stainless steel may not



1. This shows a backstay insulator failure. The problem was not visible. It was recommended that the backstay be replaced, but the owner let it go and the mast fell down the next week.



2. Check for rust and any sign of corrosion to the chainplates. This is a good example of crevice corrosion.

have enough oxygen to rebuild the chromium-oxide film if the film is scratched or worn away due to minor movements or vibrations. If this happens, the stainless passes into its active state and corrodes freely. Truth is that the constant chemical reaction of salt and air cause never-ending damage to even the best quality stainless steel. Only polishing the material to a mirror finish will help prevent the activation of corrosion.

Providing that the mast engineering and structure are sound, the single most

important component of a yacht's spars and rigging is the standing rigging as any failure of a single stay will usually result in catastrophic consequences. Failure here can result in total loss of not only the mast, but the sails, boom, genoa furler, electrical equipment and anything else attached to it.

Standing rigging's reliability is usually gauged by its age regardless of its outward appearance, and from my experience over the past 20 years, a good time to replace standing rigging is from

inspecting your rig

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1. This photo shows broken strands at the base of the terminal swages.

2. A total failure (shown here) led to the boat's mast falling down.

3. The underside of this turnbuckle has cracked. This type of crack is not readily visible and is common in old rigging.

4. This photo shows the total failure of a turnbuckle eye which resulted in the loss of the mast.

5. Here is an example of failure due to corrosion. We were asked to tune this rig. As soon as we tried to hold the swages with a shifting spanner, they failed.

6. Here is an example of the total failure of a stainless terminal due to corrosion.

around the 7 year mark as I have seen many failures from this point on, and sometimes beforehand. There are several reasons for this which are outlined in the following text.

When we arrive at the yacht, the first thing we look for are signs which indicate the rigging age and style of fittings that have been used. As there have been several changes to fittings and brands over the years, from our experience we can usually estimate the age quite accurately.

We start with a check of the condition of the turnbuckle, wire at the base of the terminal swage and pins at deck level. We look for broken strands at the top of the terminal swages. These may not protrude from the swage but

are just sitting in position being held by the other strands in the top of the swage socket; an indication of a broken strand here may sometimes be an unevenness in the lay of the wire, proud strands which can be felt by running your hand up and down the shroud usually indicate broken strands (see photos 1 and 2).

Turnbuckles, although they look bullet proof, have their problems with potential cracking in several places and stripping of threads. The cracks can be quite easily seen when they are in the terminal swage or the locking nut, however there is a possibility that hairline cracks may exist in the bottom part of the turnbuckle body where it attaches to the toggle or the top part of an eye that

can't be seen because it is covered up by another component. Threads to the terminal swages and bronze turnbuckle bodies should also be inspected as I have seen failures in this area as well. Problems to look for here are cracks in the bronze bodies and stripped threads in both the terminal swage and bronze adjuster (see photos 3 and 4).

Terminal swages should also be checked along the length of the swaged area as it is quite common to see longitudinal and transverse cracks here. This type of cracking can be caused by work hardening of the material in an incorrect swaging process! Long term corrosion inside the swage socket is the other major factor for this kind of failure (see photos 5 and 6).

Clevis pins and locknuts also need be checked to make sure they are sound. Clevis pins can suffer considerable wear due to the incorrect sizing of the material they are attaching to, i.e. chainplate and mast tangs (see photo 7). Turnbuckle locknuts often suffer cracking from over tightening. (see photo 8).

Correct alignment and toggling of end fittings is the key to achieving a long life from standing rigging as this prevents unnecessary fatigue to the cables at the bases of the terminal swages. Poor alignment also causes unnecessary sheer loads on split pins in toggles. The side loading on the toggle can cause massive failures when the split pins sheer off and fall out (see photos 9, 10 and 11).

"Like any good load bearing structure, the rigging is only as good as the base it's attached to."

Split pins need to be individually inspected as they are a key element in the finished product of standing rigging and most attachments on the mast and boom. We always bend both sides of the split pins as this gives 100% ability of preventing a pin from falling out of its position. I have seen one side of a split pin break off and the other side unturned which means the split pin can readily fall out.

Another good reason for changing rigging in this 6 - 7 year cycle is that even though regular inspections may have been carried out over the years, it is quite common that nothing was found to be out of order. Only just recently I was removing some rigging from a mast that didn't show any signs of broken strands at all. We were replacing it due

to its age, and when rolling a stay up to take to our work shop, a strand popped out of the cap shroud in the mid section of the cable not near any attachments or spreader bends, confirming that stay wires can fail in their mid section as well as in the terminal ends and spreader bend areas.

The forestay wire is prone to breaking strands more so than most other stays. The reason for this is that:

1. Headsail furlers are assembled around them causing regular wear
2. The consistent movement of a forestay due to the headsail being attached to it has a dramatic effect on the life of the stay due to flapping, furling, etc. Regular checking of the forestay, particularly at the top end, is good practice.

7. The poor alignment of the chainplate is placing undue side load on the toggle and split pin.

8. Note the crack in the locking nut for the turnbuckle.

9. The very poor angle of this chainplate is placing side load on the toggle and split pin. This example is way out of alignment and is a potential failure point.

10. This photos shows side load on a shackle due to poor alignment of the chainplate. Again, it is a potential failure point.

11. The poor alignment of the chainplate shown in this photo can lead to the clevis pin shearing off.

inspecting your rig



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1. This photo shows the correct angle for a genoa halyard to the roller furling fitting. There is very little chance of halyard wrap in this case.

2. This photo shows the results of halyard wrap. The halyard (top) has broken and the forestay (below) is bird caged from halyard wrap. This is very common and generally caused by poor genoa halyard angles.

The top of the forestay is the most common place for the stay to fail. Failures here are generally caused by the poor lead of the genoa halyard onto the furling swivel from the mast (halyard wrap) as well as wire fatigue due to poor toggling. The correct lead of a genoa halyard is pictured here (see photo 1). Bird-caging of the forestay is very common and is caused by the genoa halyard wrapping around the forestay and continuing to furl the sail with undue force will permanently un-lay the stay wire in the forestay and halyard and in some cases break both completely. If an abnormal restriction is felt when furling the genoa, it is best to stop and check for any problem and even dropping the genoa would be best practice in this situation.

Placing the furling line on a winch and winding the sail home is bad practice as due to the power of the winch, any restriction will not be felt (see photo 2).

All the above items also apply to the mast attachments. In the mast section itself we look for end cracking around main high load areas i.e. shroud attachments, spreaders, mast head, tangs, gooseneck, vang attachment etc. Cracking in these areas is not something to be taken lightly as they are generally there for a particular reason, i.e. poor engineering, poor welding, inadequate fastening system, etc. These are indicators of more serious problems.

Inspecting your rig regularly is the easiest and most effective way of preventing expensive and potentially catastrophic problems. We recommend a thorough inspection at the beginning and end of each season, with periodic deck level inspections. I hope the information I've provided will help you do it more thoroughly and with a deeper understanding of what to look for. **V**

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