

Tech Tips #5

by "The Old Salt" (Bill Whitney)

Goodness! It's already June! Where did the time go? Here I am, sitting in the workshop, surrounded by boat projects, hoping I can get them all done before the end of the month. All the paint, varnish, terminal strips, wire, and other paraphernalia that keeps the discount chandleries in business seem to reach a peak in June before it gets to the boat. Hope I get it all done by the end of the month. One of the projects that I have managed to complete is to install a separate ground for the AC wiring system. It's also time to look at all of the seacocks and see if there are any signs of galvanic corrosion. Strangely enough, those were two of the topics that were on the original list of articles I was planning to write. In case you don't remember, the topics are; electrical wiring, alternators and regulators, batteries, grounding and bonding, radios and antennas, and instrumentation (depth, speed, GPS, LORAN, etc.). In this article we'll look at electrical system grounding and how it can impact your boat if you don't pay a little attention to your ground connections now and then.

Once again, I would like to solicit questions from readers. After all, this column is intended to be the place where you, the reader, can submit technical questions and either obtain answers or direction to appropriate reference material.

The DC System components in a boat are usually the easiest to understand. We have already presented its components: battery(ies), alternator, regulator, and wiring in previous articles. In general terms the battery produces the electrical energy that you need, the alternator replenishes the energy you consumed, and the regulator tells the alternator how much energy to replenish. The wiring delivers the energy to the system components. In a DC system the negative (-) side of the battery is normally connected directly to the engine block. The primary reason for this is that the starter motor usually has the highest current draw of all the other electrical components in the system; and running the negative side of the wiring directly to the engine block near the starter is good design practice, as it keeps any voltage drop in the wiring to a minimum.

At the same time it also creates a problem; especially if you have both DC and AC electrical systems. General practice is to connect the green wire of the three-wire AC system to a grounded point on the boat. That point is normally a terminal strip that is also used for the black wires of the DC system; and that's connected back to the engine block. Well, under normal conditions, when you are out sailing or hanging on the mooring, the common connection of both DC and AC grounds does not have any adverse effects. But if you have a slip in a marina, and plug in the AC system for any sustained length of time, you could be creating a condition that not only eats up your engine cooling system zincs (you do know where they are located, don't you?) but also sets up a condition that can devastate underwater boat fittings.

So, what's going on! The problem stems from the electrical system at the marina and the other vessels plugged into the system. The problem is transmitted to your boat and any other boat plugged into the system through the green ground wire of the AC wiring system that you so conveniently connected to the ocean in and around your boat via that common ground connection - your engine.

Under ideal conditions, as long as the marina wiring is installed according to the National Electrical Code (NEC), and no other boats are plugged in, you have little to worry about. Problems arise when the marina's electrical system corrodes or connections loosen with age. As the AC current in the less than ideal wiring system increases, voltages can be induced in the ground wire that create a small current through the ground connection to your engine. Another cause can be other boats that are plugged into the AC system. If they have an electrical problem, and the same common ground connection, you have a problem. Any stray ground currents created in the marina's wiring or galvanic corrosion problems created on other boats can be coupled to your boat through that green ground wire.

If you have noticed that your engine zincs seem to waste away over the course of one season, you may have a problem. The best way to avoid the problem is to unplug the AC power cord when you don't need it. This way you have removed the connection that was being provided by the green ground wire. Another way is to isolate the ground or install an isolation transformer. I don't recommend the latter solution for our size boats however, since they are both expensive and heavy. I do recommend minimizing the use of the AC shore power cord, and keeping your DC system as clean and healthy as you can.

One of the other symptoms of this AC ground current problem can also be accelerated deterioration of other underwater components of the boat. In wooden boats this can include the screws, boat nails, and other fastenings that hold everything together. Unfortunately many of these may not be visible, so you can't inspect them. You can, and should, look at all the other fittings. These include the zincs, seacocks, valves, stemhead fittings, rudder fittings, straps and engine accessories that are exposed to saltwater. Any heat exchangers on the engine should have their own sacrificial zincs. If you have never checked them or worse yet don't know where they are located, get out the engine manual (or see your mechanic) and find them. Nothing will ruin a cruise faster than having all your oil pumped out through hole in the engine oil cooler. Admittedly these are sail powered vessels, but my blood pressure doesn't need the boost it gets tacking through a crowded mooring field trying to get to my mooring. The challenge is a lot more fun knowing that you have a reliable engine to extract you from disaster should anything go wrong.

(Continued to Page 7)

Inspect the valves (and other bronze components) by taking them apart and looking at the interior and exterior surfaces. If you see a pinkish tinge on the bronze surfaces it indicates that the zinc is being leached out of the bronze. You need to investigate! Either you have an AC problem or you need to add more sacrificial zincs to protect the components from galvanic corrosion. Selecting the right amount of zinc to a hull and selecting the appropriate location for it is not that easy. If you know what was used on your boat in the past, and know where it was located on the hull, restore it to that original location and use the same size that was used originally. You can cause yourself problems if you use too much zinc.

Master Mariner Co. used to manufacture a corrosion meter that was very useful in determining the level of protection being provided to underwater metallic fittings. Basically it is a very sensitive meter, called a galvanometer, that is hooked between a reference cell that is placed in the water beside the boat and the metal fitting being tested. If the meter indicated a balanced reading in mid-scale it indicated that the fitting was not being subjected to galvanic currents that would either eat it away or deposit metal from another fitting on it. In effect it was in a neutral, protected, environment. If you can locate one of these meters or its modern replacement I think it is worthwhile to spend some time measuring each fitting, and either adding (or reducing) your zincs to get the protection your fittings need.

There are folks around that specialize in marine corrosion problems, but I don't know any of them personally. Your yard or surveyor should be able to recommend someone if you don't want to tackle the job yourself. Good luck.