④ IT ATE MY ZINC!

How galvanic isolators and reference electrodes bust the long-standing myth of the "hot marina." BY STEVE D'ANTONIO

MONTHLY MAINTENANCE

It's a refrain I've heard on countless occasions: "My zincs were eaten up really quickly when I was in that marina; it's hot!" It begs the question: Can a *marina* be hot, and the source of electrical water-borne current that consumes zincs, props, shafts and through-hulls? Other than in exceedingly rare cases, the answer is no.

For the most part (and again other than in very rare cases), the corrosion of underwater metals, including anodes—these are most often zinc, however they also might be aluminum or magnesium—is a DC, or direct-current, phenomenon, of which there are two types. The first and most common is referred to as galvanic, and is based on the same principle by which a battery works: Different metals are connected together either directly or by a wire, and immersed in a conductive electrolyte, be it seawater or fresh water. Doing that will result in some measurable current flow between the more noble (and more corrosion resistant) and less noble (less corrosion resistant) metals, otherwise known as cathode and anode, respectively.

The corrosion that occurs—of a zinc anode attached to a prop shaft or the vessel's bonding system—is generally beneficial, as the anode, in sacrificing itself, protects the other metals. However, it can also be harmful; for instance, in the case of a manganese bronze propeller that is connected to a AQ22 stainless alloy shaft, the latter is more noble than the former, and without the benefit of a sacrificial anode, the prop will corrode.

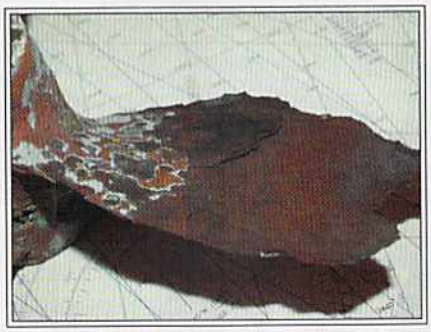
Galvanic corrosion can be prevented or minimized using different means. One, install and maintain sacrificial anodes, which should be replaced when 50 percent depleted. Second, if the vessel is bonded, make certain the bonding wiring is in good condition. Connections must be clean and tight, and imparting no more than 1 ohm of resistance between any bonded underwater metal and a sacrificial anode.

Now what about the "hot marina" issue; where does that myth originate? This is where the galvanic isolator comes into play. Galvanic isolators are inserted into the vessel's shore-power green safety ground wire, and their job is simple: block DC while allowing AC to pass. Remember, DC is the source of corrosion, so blocking it means that nearby vessels (and steel bulkheads) are prevented from interacting with your vessel via the green wire in your shore-power cord (this wire is connected regardless of whether power is turned on). Otherwise, This enables the galvanic corrosion on your vessel's underwater metals and anodes. Every vessel that is equipped with shore power should be equipped with an ABYC-compliant galvanic isolator. I encounter many boats that either never complied or do not comply with the latest revision, which occurred in 2013. Alternatively, you could unplug your shore cord; however, few owners are willing to sacrifice battery charging and refrigeration by doing so.

The other type of corrosion, which is also DC, derives its destructive power from your vessel's own battery; it's referred to as stray current. While galvanic corrosion operates at a snail's pace, stray current is rabbitlike and can inflict significant damage in days, or even hours in some cases. In most, but not all, cases the vessel suffering the damage is the source of the problem, and a galvanic isolator would be of no use in any event because the voltage level associated with stray current corrosion will easily exceed a galvanic isolator's 1.4-volt threshold. The best defense against this scourge is sound, ABYC-compliant wiring (the leakage of DC current into bilge water is among the most common sources of stray current corrosion).

Finally, rather than guess as to whether your vessel is adequately protected from galvanic corrosion, or is being exposed to stray current corrosion, you can take matters into your own hands using a reference electrode. With it, a multimeter and a little education, you can carry out your own testing in a matter of minutes. The reference electrode is connected to one lead of your digital multimeter. The other lead is connected to the vessel's bonding system, or an individual underwater metal such as a shaft, rudder stock or through-hull. The resulting readings will tell most of the, if not the entire, corrosion story for your vessel. In a future column, I will cover, in detail, reference-electrode testing procedures.

Steve D'Antonio offers services for boat owners and buyers through Steve D'Antonio Marine Consulting (stevedmarineconsulting.com).



The brass drain plug about to fail in this strainer is proof that brass should never be used in raw-water applications (left). Stray current corrosion is particularly destructive because it occurs so rapidly; this prop (middle) was likely consumed in a matter of days. Every vessel that has shore power should be equipped with an ABYC-compliant galvanic isolator (right).

STEVE D'ANTONIO (3)