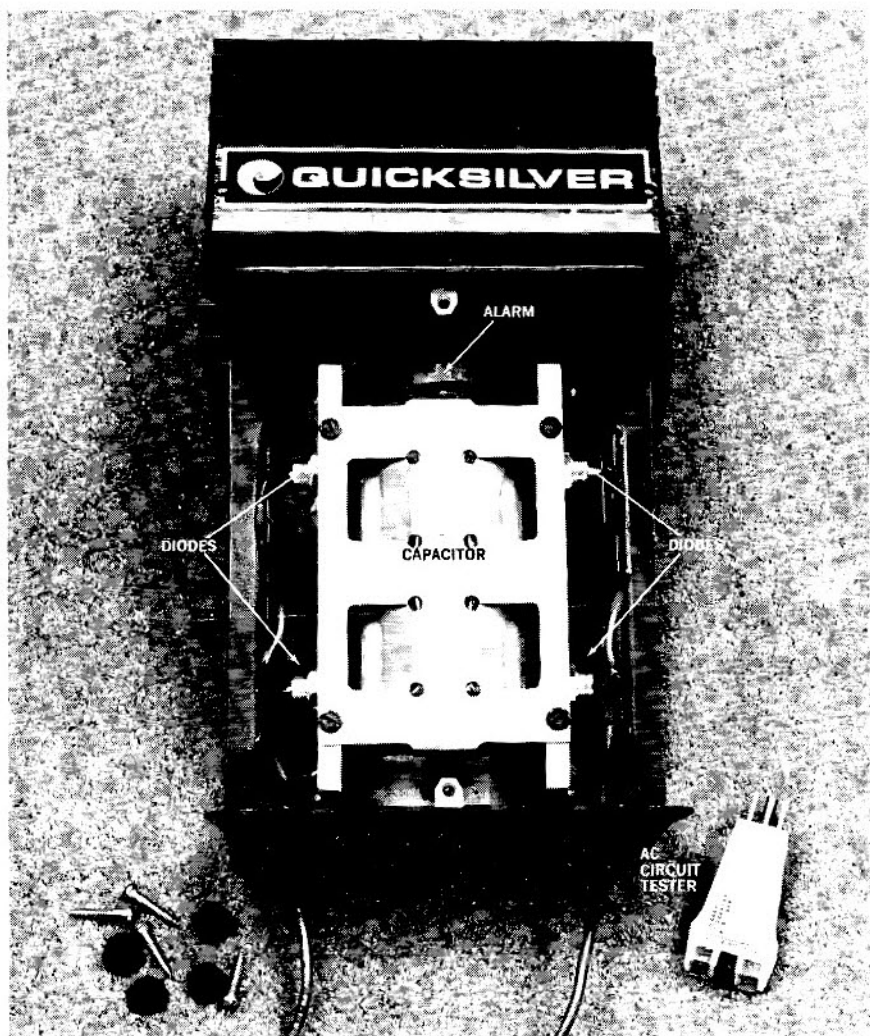


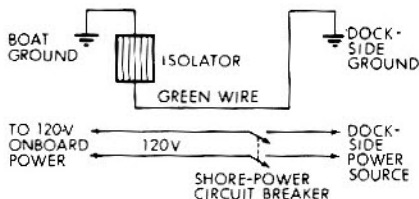
This black box  
for your boat  
helps fight  
**dockside  
corrosion**



Placed in AC line (see circuit diagram), the Quicksilver Isolator (above) passes alternating current, but blocks DC through ground lead with diode/capacitor circuit.

By **BOB STEARNS**

Several years ago a fishing friend, while trolling far offshore in blue water, shifted into neutral to gaff a fish hooked by one of the anglers aboard his I/O-powered 25-footer. A few seconds later, with the catch stowed safely in the fishbox, he shifted into forward gear to resume trolling speed.



Instead of forward motion, his effort was rewarded by a dull metallic thump, followed by the rising whine of engine rpm that signified no propeller

resistance. Assuming that the prop was fouled and its rubber hub slipping, he rushed to the transom—just in time to see his entire outdrive unit disappearing into the clear, green depths below!

The cause was not a collision with some underwater object. The culprit was dockside corrosion, quietly and almost invisibly eating away at the aluminum surrounding the stainless-steel bolts that held the outdrive in place. Finally, enough material had wasted away around the head of each bolt so there was nothing left for the bolts to hold onto.

It's not an uncommon problem—although our lesson may have been. Fortunately, there are ways you can keep dockside corrosion in check—including the use of a new electronic device from Mercury. But first you must know what you're up against.

### Direct-current buildup

Although corrosion—in one form or another—is more prevalent in salt water (because it conducts electricity better), it happens in fresh water, too. And at dockside, the problem worsens.

That's when boats are connected to shore-side AC electric power. Safety regulations require that a three-wire power cord be used for this, and that one of the wires (usually color-coded green) be used to ground the boat electrically. This wire connects all of the electrical equipment, including engines, with an electrical ground ashore to prevent potentially lethal electrical shocks.

That's fine, but it also connects every boat in the marina together, allowing a buildup of stray direct current to nibble away at your outdrives, outboard lower units, propellers, and any other metals attached to the hull that are in the water.

Enter the new Quicksilver Isolator from Mercury Marine. It's a black box that, when inserted in the ground-wire circuit, effectively isolates your boat from stray direct current. The boat is no longer connected in a common circuit with other nearby boats.

And once it's out of that circuit, stray-current corrosion can no longer take place.

Yet, by the nature of the Isolator's design, according to Mercury's Oscar Benson, product manager for accessories, the Isolator "does not in any way interrupt the ground wire's purpose: protection from shock hazard caused by faulty AC wiring."

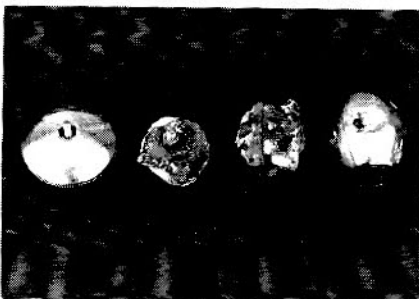
The Isolator is a seven-pound, 8½-by-7½-by-4½-inch aluminum box that is mounted permanently in the boat. Inside, a circuit consisting of a single large capacitor and two pairs of series-connected silicon diodes acts as an extremely effective galvanic filter: Alternating current can pass with no resistance, yet no direct current can get by in either direction. (In the past, 150-pound isolation transformers have been required to remove the DC.) And no DC means no stray current corrosion. In addition, the new Isolator also has an alarm buzzer built into the circuit to warn you if a fault occurs in the AC wiring.

The design specifications of the Isolator are impressive. It can handle up to 5000 amperes long enough to pop a fuse or circuit breaker, and may be used with dockside outlets rated up to 50 amps for either 120 or 240 volts. Yet the cost—about \$200—is still less

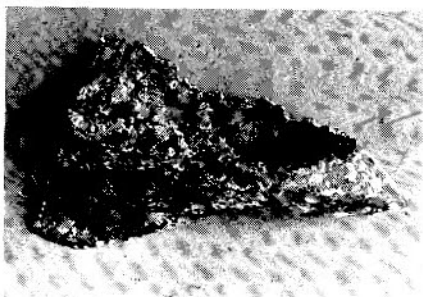
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### Galvanic series (abbreviated version)

Anodic end (least noble)	Magnesium Galvanized iron Zinc Aluminum Cast iron Low-alloy steel Stainless steel Brass (naval, yellow, red) Tin
Cathodic end (most noble)	Copper Silicon bronze Stainless steel (passivated) Monel alloys Silver Gold

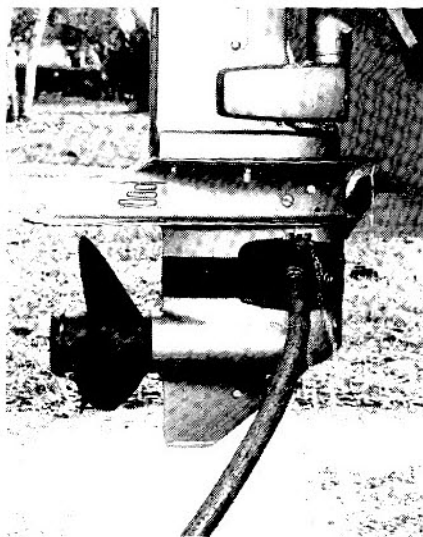


**Sacrificial anodes**—zincs—are used to protect underwater parts. Replace them when about halfway gone (middle two).



**Lower-unit gear housing** shown has been destroyed by stray current corrosion. Damage was done in just a few months.

[Continued]



**Corrosion on land?** It can happen. Before winter layup, flush well with fresh water to prevent cooling-system corrosion.

than an isolation transformer of similar capacity.

Sound like good insurance? It is, but there's even more you can do to protect the family vessel.

### Planned sacrifice

It takes more than direct current in the water to cause corrosion. Dissimilar metals are also required to complete the damaging equation.

Forms of corrosion—either galvanic (from natural voltages produced by a chemical reaction between the boat and sea water) or from stray current—behave essentially like the process by which some metals are plated: The electric current passing through the solution (in this case, water) causes the transfer of ions from one metal to the other. The stronger the current and the greater the dissimilarity between the metals, the faster the rate of ion transfer.

The dissimilarities of various metals are well-known. (See abbreviated table of galvanic series, covering metals most commonly used by the marine industry. The higher on the list the metal appears (it's called more active, least noble, or anodic), the more easily it gives up ions when immersed in a current-conducting solution. Those toward the bottom of the list tend to take up those ions "donated" by metals above them, and these "takers" are usually referred to as more noble, or cathodic.

The greater the dissimilarity (the farther apart on the table), the faster the more anodic metal gives up its ions, and therefore, the faster it wastes away.

Typical examples are aluminum and stainless steel. Since the aluminum is more anodic than stainless steel, it becomes the "giver," while the more cathodic stainless steel becomes the "taker." The result is that the aluminum eventually wastes away to a white powder. The stainless steel remains unaffected.

To an extent, the dissimilarity of certain metals can be used to our advantage for protection of underwater components.

Typical outboard and stern-drive lower-unit housings are aluminum, while the propeller shafts (and frequently the props themselves) are stainless steel. But, according to the list, zinc is a more active "giver" than aluminum. So, manufacturers cleverly attach a piece of zinc to the aluminum housing. The aluminum is now protected, since the zinc becomes the active metal and will waste away—instead of the aluminum.

This method is known as cathodic protection, and the zinc itself is referred to as a sacrificial anode. This is a fine idea and it works well—but it's a bit troublesome if the anode you must replace happens to be under the hull, for example.

### Canceling out the problem

There's still another type of cathodic protection. It's called an impressed-current system. In this, a sensor measures the amount of damaging direct current in the water around the boat, and creates another direct current of equal but opposite polarity to effectively "cancel" it out. This canceling current—only a few thousandths of an amp—is drawn as needed from the boat's 12-volt battery.

Impressed-current systems, particularly when backed up by an extra sacrificial anode, are very effective, except in one particular situation: that same old dockside problem where AC shore power is involved. Here the levels of stray DC are simply too great for an impressed-current system to handle. Also, in some cases, if the impressed-current system is fooled by excessive stray currents in the water, it can supply more "protective" current than is actually needed. The result: even more corrosion.

I found the Mercury Quicksilver Isolator very useful, and think it's good insurance in conjunction with a sacrificial anode or impressed-current unit. Based on my experience, it's worth the cost. The Isolator is made by Mercury Marine, 1939 Pioneer Rd., Fond du Lac, Wis. 54935. ■