



Galvanic isolators protect against corrosion caused by connections through the AC shore ground wire.

## Galvanic Isolators

The best way to protect your boat from stray current corrosion

**A**T THE START OF THE boating season, one problem many boaters encounter is corrosion. If a boat is properly protected from corrosion, serious problems rarely occur. However, without protection, corrosion can destroy propellers, thru-hull fittings, and any other submerged metal on the outside or inside of a boat. Corroded metal is typically below the waterline where it can't be seen, so problems can develop before boaters know anything is wrong. Additionally, the actual source of corrosion can be very difficult to find and eliminate, for boat owners and marinas alike. Regularly maintained corrosion protection devices can prevent these issues on your boat.

There are many factors that affect corrosion on a boat. To protect their boat, boat owners typically aim to reduce the sources of corrosion that can be controlled. Zincs, or their

equivalent, that are regularly inspected and changed, can prevent any slow sources of corrosion from damaging propellers or thru-hulls.

### CORROSION SOURCES FROM SHORE POWER

While corrosion is normally a slow process, it is sped up by any electric current. This current is commonly enabled by connections to shore power.

To understand how the shore power connection plays a role, think about what happens when two sides of a battery are connected together with a wire. Current flows rapidly through the wire. Batteries are easy to make, for example a "potato battery" is a popular science fair topic that will produce electricity from a potato. A row of boats in their slips can create a "battery" between the boats, or between a boat and shore. The result is that each boat is like a different terminal on a battery. If the boats are then connected together through their shore power

cables, the cables act like wires connecting the battery terminals. Current will flow quickly between the boats, causing swift corrosion. Hence boaters aim to isolate their boats from the other boats in the marina at the shore power connection, using a galvanic isolator (discussed later).

### STRAY CURRENT CORROSION

Stray currents are frequently the source of major corrosion problems and typically there is no quick fix. They can eat through zincs in hours, weeks or months, leaving submerged metal on the boat exposed to devastating corrosion. The majority of significant stray current corrosion problems are the result of electrical issues within a boat. However, they can be caused by issues on shore and can affect neighbouring vessels through a shore power connection or through the water. Some, but not all, stray current corrosion problems can be eliminated by isolating the boats at the shore power connection.

To truly solve the corrosion problem, the root electrical problem needs to be addressed.

**ISOLATING BOATS AT THE SHORE POWER—THE BAD WAY** The bad way to isolate boats at the shore power connection is a dangerous compromise that needs to be addressed if you've inherited this setup on your boat. To interrupt the current's path and eliminate the corrosion, some boaters would cut the AC grounding (green) wire on the shore power. Even though this solved the corrosion problem, it created a dangerous situation as the grounding wire is a safety built into AC power. Disconnecting it removes the AC fail-safe that safeguards passengers and nearby

## STRAY CURRENTS ARE FREQUENTLY THE SOURCE OF MAJOR CORROSION PROBLEMS AND TYPICALLY THERE IS NO QUICK FIX

swimmers, and AC power is lethal.

We can't stress enough that this was a terrible manipulation of the AC system, which was only done because there wasn't another solution to the corrosion problem.

A safer solution utilized by some boaters is leaving the shore power disconnected as much as possible. While this isn't a direct safety concern, it will typically mean that battery lifetime is shorter because the battery charger is left off. There are now better solutions.

**GALVANIC ISOLATORS** A galvanic isolator is a modern solution to protect your boat from corrosion. Galvanic isolators protect against corrosion caused by connections through the AC shore grounding wire. It breaks the corrosion current path and isolates your boat, preventing some sources >

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ABOVE A fail-safe galvanic isolator is slightly more expensive, but worth the extra cost.

of corrosion, while keeping the safety grounding connected. Finally you can protect your boat safely.

It is important to use fail-safe galvanic isolators. Older galvanic isolators and non-"fail-safe" isolators typically disconnect the AC ground when they fail, again removing the AC safety protection. This is a situation boat owners should always avoid. A "fail-safe" galvanic isolator is slightly more expensive but comes with the assurance that if something goes wrong with the isolator, it is designed to always maintain the grounding connection. A failed isolator will no longer protect against corrosion, but will keep the critical AC fail-safe intact.

It is also important to note that galvanic isolators don't eliminate all stray currents and all corrosion sources. Zincs or other anodes are still critical components of a corrosion protection system and can quickly corrode, even with a galvanic isolator. Furthermore, for a galvanic isolator to work, all AC power must pass through it, so it's best to have it right beside the AC shore power receptacle on the boat.

The retail price for a fail-safe galvanic isolator is typically between \$200 and \$400, depending on its current rating and other features.

Finally, while we encourage our clients to cautiously undertake DC wiring, we strongly advise against touching AC wiring unless they're properly qualified due to the high safety risks. Having a galvanic isolator takes care of both safety and corrosion concerns, without the trade-off that plagued boaters for a regrettable length of time. ☺

## CORROSION

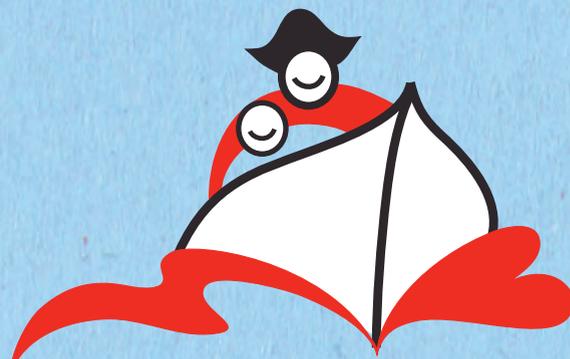
In order to reduce corrosion, we have to understand how it occurs. Anything that causes or allows an electric current in a submerged metal will speed up corrosion. Preventing electricity from flowing will prevent corrosion.

What situations can affect this? Keeping a boat in salt water increases corrosion because salt water conducts electricity much better than fresh water. Different metals, if they are submerged near each other, will naturally create a battery effect with their own small currents between them (this is called galvanic corrosion).

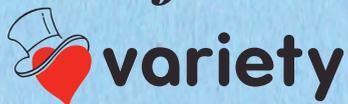
Fast flowing water in moorage channels creates an effect similar to electricity and causes corrosion slowly over time. Stray currents, a serious concern, are created by a variety of electrical issues, for example a high voltage wire submerged in the water. This causes rapid corrosion.

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Jeff Cote is a systems design engineer and owner of Pacific Yacht Systems, a full service shop delivering marine electrical and navigation solutions for recreational boats. Visit their website and blog for info and articles on marine electrical systems, projects and more.  
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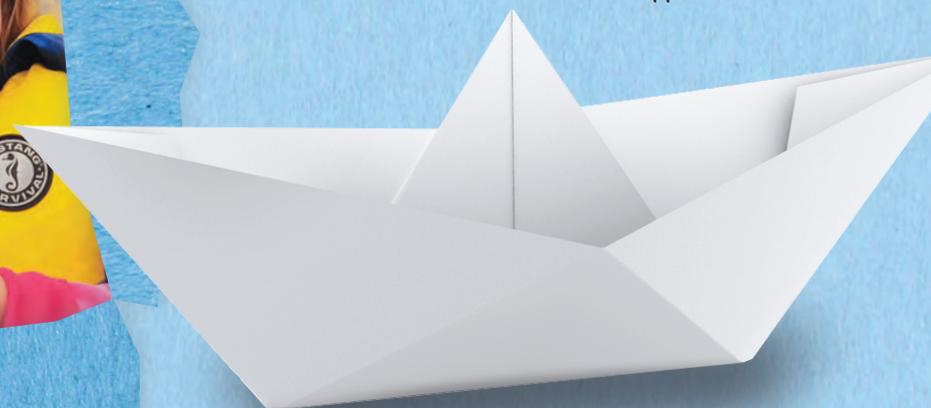
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- Skipper Will



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