Use of an Isolation Transformer to reduce marine corrosion

by

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After the last bottom cleaning, the crew wrote me a note saying that they felt electricity in the water at the shaft and propeller. That was a wake-up call for me. We had been attached to the same dock for a year or two, with no problems, but now apparently there was a problem. Since that time I have done some studying about boats and electricity. I don't pretend to be an expert, but I think I may have some answers to my questions.

Scott Fratcher wrote an excellent article titled "Marine Corrosion Survey" at yachtwork.com. In the article he defined two types of corrosive electrical nasties, Electrolysis and Galvanic Action. Galvanic action is the electrical current formed when dissimilar metals are placed in saltwater. Two dissimilar metals form a battery. All that is required is a connection between the two metals and metal dissolution and transfer will take place. Galvanic action is a worry on a sailboat, but the good news is that it is somewhat slow and the zinc sacrificial pieces will generally protect your more costly parts. The two dissimilar metals can be both on your boat, coupled through the bonding system, or from your boat to another boat connected through the a.c. ground of the dock.

Electrolysis is much more destructive as it is the result of electricity generated by active sources such as a faulty pump winding or a generator in the harbor. This corrosion can be produce rapid destruction of underwater metal parts.

We hired an electrician to check out the boat and dock. He found 10 volts between the a.c. ground and the saltwater caused by a corroded ground connection in the service box. This is a very high voltage, much higher than the on-board zinc savers in the Catalina 350 would handle and is in the Electrolysis regime. If left alone I was probably looking at severe damage. Another concern was the danger of swimmers around the dock. There has been stories of swimmers being killed by swimming through electrical currents in the water around a dock. The local dock owner fixed the existing problem, but who is to know when this or another problem will occur.

After all of this I decided to try to protect myself from corrosion and danger, as much as possible. The problems can pop up simply by the addition of a different boat at the marina, a corroded ground, or thousands of other changes. After study I decided that an isolation transfer would provide considerable protection. With an isolation transformer the dock power and ground is totally separate from the boat. The boat is a stand-alone entity with the engine block as ground. The a.c. 110 volts is supplied across the transformer coils with a shield between the windings. In this way the boat is protected from external sources of galvanic action and electrolysis. Of course, galvanic action can still occur on your boat between connected together dissimilar metals, so we still need the zincs.

The isolation transformer I selected is the 3.6 KVA IsoG2 Shoreline Isolation Transformer produced by Charles Industries in Illinois shown in Figure 1. I purchased it off the internet from iMarine. It is rated at 30 amps, 110v. While my boat was wired with two independent 30 amp circuits, one for the air

conditioner one for the boat, I have always supplied these through a splitter and a single 30 amp cord and source. I have never blown a circuit breaker so my belief is that a single 30 amp source is adequate.



Figure 1 Charles 3.6KVA IsoG2 Shoreline Isolation Transformer

The transformer weighs 60 lb. so I wanted to install it at a central, solid location that would stand up to pounding in heavy seas. I elected to use the aft port lazarette as shown in Figure 2. That location has the added benefit on being near the shore power plugs.



Figure 2, Isolation transformer located in the aft port lazarette

My main concern was the support of that 60 lb. dead weight. Accordingly I backed-up the vertical bulkhead with a ½" Starboard piece which rests on the cockpit floorboard. In this way hopefully the installation is solid. I suppose I will ultimately find out if I made a mistake.



Figure 3, Installation of the transformer with back-up by a ½" Starboard resting on the cockpit floorboard.

I used the Method 1 wiring connections recommended by the transformer company. I ran the incoming 30 amp service through one of the existing breakers to the transformer input terminals. The boat a.c. was connected to the output terminals. The Air Conditioning unit was powered through the second on-board breaker. The circuit diagram is shown in Figure 4.

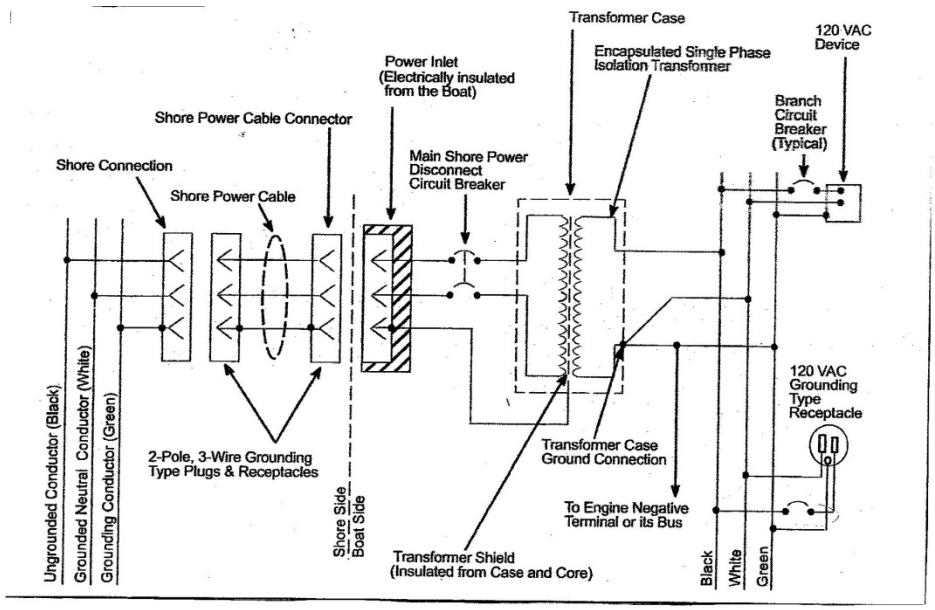


Figure 4 Method 1 Circuit Diagram