Technical Note

Marine Inverter/Chargers

512-0087-01-01 Rev 1

Grounding Inverter/Chargers on Boats

Introduction

When installing an inverter/charger on a boat, and the time comes to ground the chassis of the unit, there are several things to consider in order to meet standards, ensure safety and to prevent galvanic corrosion of the boat's submerged metal parts.

The danger of isolated AC and DC grounds

In the electrical system on many boats, AC ground is intentionally or accidentally isolated from DC ground (DC negative). If it was intentional, it was done to prevent galvanic corrosion while connected to shorepower. This practice, however, raises safety concerns. The two grounds should be tied together as recommended by the U.S. Coast Guard and the ABYC (American Boat and Yacht Council). The reason is, if the grounds were isolated and a short circuit were to develop between AC HOT and the boat's DC system, DC ground or bonding system, there would not be enough fault current to trip the AC breaker on the dock. Instead, the whole boat would become energized at a 120-volt potential. If a person were to make contact between a metal part of the boat and ground on the dock, they could be electrocuted. In addition, the "hot boat" sets up an electric field in the water surrounding the boat. Any swimmer near the boat could become paralyzed by this field and may drown as a result.

Preventing corrosion

For safety reasons, the two grounds should be tied together, but then the boat becomes vulnerable to galvanic corrosion. The reason for this is that when the boat is grounded through the shore cord, the boat's submerged metal parts become one element (or plate) of a battery (actually a voltaic cell). The water serves as an electrolyte, and any other grounded metal in the area (metal dock parts or submerged metal on other grounded boats), becomes the other element (or plate) of the battery. The AC ground wire effectively connects the two plates of this battery together, and a significant amount of DC (galvanic) current generated by this battery will flow in the AC ground wire. Depending on the type of submerged metal on the boat, and the types of grounded metals on surrounding boats, the boat in question could be the positive or negative plate of this battery. If it is the positive plate because its metal parts are more anodic or less noble than the surrounding grounded metal, then galvanic corrosion begins. To solve this problem, a galvanic isolator can be installed in the shorepower ground wire just after it enters the boat. This device will allow AC fault current to pass to keep the boat safe, but block DC galvanic currents to prevent corrosion. Isolation transformers will also perform the same function.

Grounding the inverter/charger chassis

What does this have to do with the installation of inverter/chargers? ABYC also recommends that the chassis of an inverter/charger be connected to DC ground. The chassis is already tied to AC ground via the AC

input and AC output green wires, so grounding the chassis to DC ground will create a bond between AC ground and DC ground that may not have existed on the boat before. If this is the case, galvanic corrosion begins and the inverter gets the blame for it.

The solution is to go ahead and ground the inverter/charger chassis to DC ground to meet ABYC recommendations, and also add a ground wire between the AC ground bus and DC ground, since this is where the primary bond between the two grounds should be established anyway. Then a galvanic isolator or isolation transformer is added at the shorepower inlet to prevent galvanic corrosion.

Part number: 512-0087-01-01 Rev 1

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