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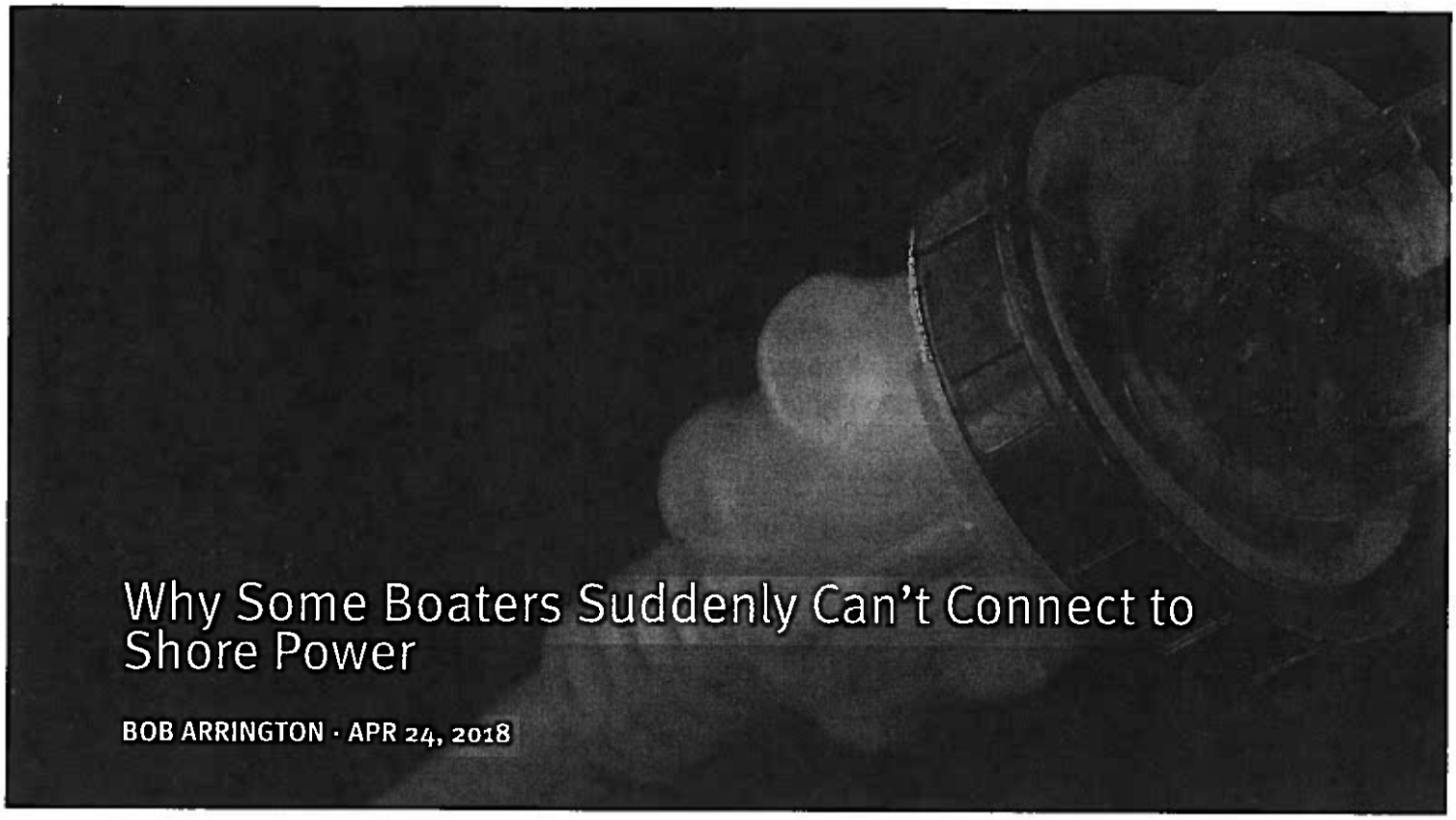

Why Some Boaters Suddenly Can't Connect to Shore Power

BOB ARRINGTON · APR 24, 2018

Boaters Across the country are struggling to connect to shore power pedestals. The reason why will shock you.

No Shore Thing

Shore power should be easy. If you frequent marinas often enough, you probably take reliable shore power for granted. However, some boaters are running into trouble connecting to shore power these days, especially in marinas rebuilt following last year's tropical storms. Marinas rebuilding piers and infrastructure are being updated to the latest code standards relating to shore power connections. As a result, many boats are tripping newly installed, more sensitive shore power breakers.

Boaters benefit a great deal from the efforts of organizations like the American Boat and Yacht Council (ABYC) and code agencies like the National Electric Code (NEC). Through their education and standards, boats and marinas are designed and built to keep users safe. However, there are times when codes and standards get ahead of manufacturing, and boaters are left with problems from incompatible systems.

Most everyone is familiar with a ground fault circuit interrupter, or GFCI outlet. For many years we've used them in our home's kitchens and baths, or anywhere something plugged into an electrical outlet could come in contact with water. You know them by the small reset buttons built into the outlet. They are mandated for residential wiring by building code for personal safety against electrocution. Electricity flows from an outlet to an appliance and back again in a loop along the hot and neutral wires in the power cord. The GFCI monitors the electricity flowing through the loop. If the device plugged in were to fall into a bathtub or get wet, thereby allowing electricity to flow into the water, the GFCI would detect the loss or imbalance of current in the loop and trip a highly sensitive breaker in the outlet. GFCI outlet receptacles are able to detect an imbalance of as little as 4 or 5 milliamps and they can react as quickly as one-thirtieth of a second. Boats built to ABYC standards also have GFCI outlets installed in the heads, galleys and exterior spaces.

When you connect your boat to shore power, it is similar to connecting an appliance to an outlet: There is a flow of electricity traveling in a loop between your boat and the shore power pedestal along the hot and neutral wires in your shore power cord. There is also a third wire in your shore power cord—that is a ground wire. If anywhere in the boat's wiring or in an appliance on the boat the neutral and ground are connected, current will be diverted from the loop, creating a "leak" of electricity from the circuit and into the boat's bonding or ground system. Due to a lack of standards in the past—or to variances in how a boat's appliances are wired— this condition could occur in a large percentage of recreational boats. Electricity flowing through a boat's bonding system by way of the ground wire results in a potential for electrical current to flow into the water around the boat. One of the primary reasons marinas post signs prohibiting swimming in the marina is due to the potential for electricity in the water, and the risk of drowning by electric shock.

To address the safety risk caused by faulty or incorrectly wired boats, in 2011 the NEC implemented a change in Article 555.3 affecting marinas and boatyards. A state's implementation of building codes typically lags behind national code bodies by a few years, so it wasn't until 2014 that states began requiring compliance with the 2011 NEC standards.

The updated code required marinas to install Ground Fault Protection (GFP)—a device similar to GFCI—in the marina's shore power system. The GFP is capable of detecting electricity leaking from a circuit in the same way a GFCI does, and it cuts off the supply of electricity to the boat. The updated code required ground fault protection to not exceed 100 milliamps of ground fault current leakage. Most marinas, however, have been opting to provide "ground fault for equipment" (GFEP) breakers at individual boat slips, which disconnects electricity to the boat at 30 milliamps of ground fault leakage. This matches a new ABYC standard for boats.

Around the same time the NEC instituted new standards for marinas, ABYC recommended boat manufacturers install a similar safety device at the entry point of the boat's shore power, called an Equipment Leakage Circuit Interrupter (ELCI). The ELCI monitors the flow of electricity in a circuit in the same way as the previously mentioned devices. If the device senses an imbalance of more than 30 milliamps, it cuts off the supply of electricity to the boat. All new boats should comply with this ABYC recommendation; however an ELCI can also be installed in an existing boat's shore wiring circuit.

Boaters connecting to renovated marinas are becoming aware of wiring issues in their boats, and these problems are the result of this newly installed, more sensitive equipment. Yet it isn't only older boats having problems; many late model boats have similar wiring issues. The exact problem within the boat can be difficult to find, increasing the frustration level of boaters and marina staff. According to Michael Giannotti, an ABYC-certified electrician and master technician from Hartge Yacht Yard who has investigated these problems for boaters in Fort Pierce, Florida, several likely culprits are reappearing on many boats, including:

- Inverters
- Household appliances, like washers and dryers
- Ice makers and refrigerators
- Generator transfer switches
- Older or faulty galvanic isolators
- Air-conditioning control boards
- Corroded electrical connections
- Faulty power cord, splitter or smart Y adapters

The items in that list are the ones noted as reoccurring most frequently, but in reality a wide range of issues can be the cause.

Having discovered some of the causes of wiring issues, professionals like Giannotti say it's especially important to follow the correct steps when connecting a boat to shore power. Here are some guidelines.

First, turn off the primary breaker in the shore power connection. Then, turn off all branch circuit breakers within the boat. Once the shore power cord is connected and locked into place, turn on the shore power connection at the dock pedestal, with the boat's main AC breaker still off. If the breaker trips immediately, you know the problem is likely the shore cord or Y adaptor. Next, turn on the boat's main AC breaker with all of the branch circuits still off. If the shore power pedestal breaker trips, the problem is likely an improperly wired transfer switch or inverter. If the dock pedestal breaker trips after an individual branch circuit breaker is switched on, it is likely the problem is a device connected to the breaker or defective control board in an HVAC or refrigerator circuit. This procedure works in diagnosing at least where the problem lies, and it's effective on most boats, assuming they have two pole main breakers for 30-amp/125-volt inlets and three pole main breakers for 50-amp/250-volt inlets.

Some marinas have developed test methods for determining if a ground fault condition exists within a boat prior to connecting the boat to the shore power network. For instance, Fort Pierce City Marina has a portable power pedestal with a GFP tester in it, and two at the fuel dock.

I unfortunately had apersonal experience with this issue after bringing our newly built boat into Fort Pierce City Marina and tripping the GFP devices in their shore power. Once we worked through the stages of denial and anger, we undertook a complete inspection of the boat's electrical system. Following the electrician's advice, we came to the conclusion it would be easier to install an isolation transformer than to re-wire portions of the boat, after making sure there were no dangerous conditions as it was wired. With the isolation transformer effectively acting as its own power supply, it creates two loops of current: one moving from shore power to the transformer and back to shore, and a second from the transformer through the boat and back to the transformer. The current that originates within the isolation transformer will never travel back to shore power. Isolation transformers may be a good solution to ground fault problems aboard your boat, and may offer additional benefits like correcting reverse polarization in the shore power and providing galvanic protection.

Whether investigating an electrical problem, or installing new electrical equipment, I recommend a thorough investigation of all of the boats wiring be conducted by an ABYC-certified electrician.

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