

# Electrical safety

BY ROB LAYMON

**E**lectricity has been with us for less than two centuries, but still long enough to reorganize all life around it. Electricity was a handy tool of Zeus, who hurled destructive lightning bolts, a great force of nature, at least as powerful as fire. However you choose to look at it, one thing is clear: you must be careful around electricity.

While boating-specific electrical casualty numbers are scarce, generally some 1,322 fatalities resulted from contact with or exposure to electricity between 2011 and 2022, according to the Occupational Safety and Health Administration (OSHA). Most, 70%, of these workplace fatalities occurred in non-electrical occupations. The other 30%, though, did occur in electrical occupations, according to OSHA.

Electricity, the movement of electrons from one atom to the next through conductive material, always seeks to return to the ground, even if it has to pass through your body to do so. Electricity always takes the shortest path to ground and the path of least resistance.

In the 130 years since it

became a public commodity, we have developed systems to harness this great power and habits surrounding it to minimize risk. On boats, which exist in a great pool of electrical conductivity, knowledge of these systems is crucial.

The following is a brief primer on electrical basics and safety

- Check all wiring, connectors, and electrical components – the whole system – for signs of wear, failure or deterioration of any sort. Saltwater likes to eat things and especially electrical equipment. Keep your eyes open.

“I see it almost weekly. The big danger is faulty circuit protection and sloppy wiring,” said Robert Jaeger, an American Boat and Yacht Council Certified Electrical Technician, of Marauder Marine in Port

Richey, Fla. “Most new boats will come with a factory circuit breaker panel, but have ancillary circuits run off that.”

- Use equipment specifically rated for marine use. This includes all electrical equipment and wiring. Marine-rated components are built to withstand the harsh marine environment.
- If you have not already, install Ground Fault Circuit Interrupter (GFCI) outlets throughout your boat, if possible, but especially where water runs, such as the galley or head. GFCIs are designed to break the

electrical circuit and shut it down if they detect a fault, within as little as 1/40th of a second. They work by comparing the amount of current going to and returning from equipment along the circuit conductors.

“A GFCI should be used in any indoor or outdoor area where water may come into contact



**When it comes to managing electricity on board, don't take shortcuts.**

**A ground-fault circuit interrupter (GFCI) is a must for all AC outlets on your vessel.**

with electrical products,” said Daniel Majano, senior program manager of Electrical Safety Foundation International. “The National Electrical Code currently requires that GFCIs be used in all kitchens, bathrooms, garages and outdoors.”

- Make sure all electrical systems are grounded. Lack of grounding can cause electrical shock and fires. A good ground connection is essential for safety and the proper functioning of the system.
- Use good circuit breakers or electrical fuses and don't overload them. Make sure you know which breakers control which circuits.

“Circuit protection is a big issue also,” Jaeger said. “One of my biggest focuses is to make sure you have a dual system, a bank each for house and battery, and make them truly dedicated. And if you want, you can use a combiner switch, which will put the two banks together if the situation demands.”

- Keep all contacts dry and safe. Seal all connections with the right marine sealant to prevent the incursion of water and use waterproof connectors.

- Know the power demands on your circuits and avoid overloading them. Try not to run too many electrical devices at the same time. Also try to distribute the load evenly.
- The American Boat and Yacht Council (ABYC) and common sense say the minimum wire size on a boat should be 16 AWG unless the wire is bundled with others that can support it. With smaller gauge wire, cost savings are minimal and chances of failure are significantly higher.
- Make sure wiring has not become loose at the joints or connections and that the insulation has not degraded. These situations can lead to dangerous electrical problems like fire and electric shock.
- When performing any maintenance on your electrical system, make sure your boat power is off. It's also a good idea to post a notice saying the power is off and work is in progress so nobody switches it on accidentally.
- Make sure you have all necessary equipment handy, including gloves and eye protection. Also, work in as dry a place as possible, and have all appropriate checklists and instructions ready.
- Perform regular visual checks of switches for external damage. Chips, cracks and fractures mean

water can get into them and damage wiring. If you believe there is damage, turn off the breaker to that circuit or turn off the power altogether and investigate further. Of course, contacting a marine electrician is also a good idea.

- Keep the properly rated fire extinguisher nearby when working with electricity. Keep an extinguisher on board at all times in an easily accessible place. Remember how to deal with electrical fires: first cut the power to the circuit in distress.
  - Ensure that you and your crew know basic electrical safety and the location of critical features like the main electrical panel and the battery switch.
  - Check batteries on a regular schedule to verify they are properly mounted and the terminals are clean and corrosion-free. Cover your batteries, if possible, to prevent accidental short circuits.
  - Regarding batteries, Jaeger recommends using sealed instead of wet lead-acid batteries, because wet batteries require maintenance that many boat owners forget to perform.
- “If you can eliminate wet lead-acid batteries and put sealed ones in their place, you won't be spilling acid in the bilge or getting dangerous gas near the

Ensure your vessel has the correct type and number of fire extinguishers aboard.



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battery bank,” said Jaeger. “Spend the money on a good-quality battery, have a good-quality charger and cycle them. Get out there and use your boat.”

- When not using electrical equipment, especially in areas prone to moisture, disconnect the power supply to prevent potential hazards.
- Have a marine electrician inspect your boat’s electrical system regularly to ensure everything is in good working order and to address potential issues.

“The Electrical Safety Foundation International (ESFI) strongly recommends hiring a qualified, licensed electrician to perform any electrical work and always hiring qualified electrical workers to conduct electrical work on the jobsite,” Majano said.

The ESFI also cautions that electricity can be a danger to swimmers, who might unknowingly put themselves at risk by swimming near electric-powered boats and docks where the electric current is not properly grounded. And we haven’t even talked about fuses and circuit breakers yet. Fuses and circuit breakers play probably the most critical role in a boat’s electrical system, and it’s important to utilize them properly.

- Fuses and circuit breakers protect against overcurrent

that occurs when the circuit experiences an excessive current flowing through it. This can result from a short circuit, an overload or some other fault in the system. By breaking the circuit when the current becomes excessive, fuses and circuit breakers prevent damage to wiring and electrical equipment.

- They prevent fires caused by the heat of excessive current. By breaking the circuit before heat levels reach dangerous levels, fuses and circuit breakers reduce the risk of fires onboard, something anyone who’s ever experienced a boat fire will take very seriously.
- They safeguard electrical equipment. Electrical devices and components are designed to operate within specific current limits. If these limits are exceeded, the equipment can be damaged or destroyed. Fuses protect valuable electronics, appliances and other devices from being damaged by protecting them from this excess.
- They enhance safety. By preventing short circuits and overcurrent issues, fuses and circuit breakers contribute to the overall safety of the boat and crew. They help prevent accidents related to electrical faults, such as shocks or fires, making the boat a safer environment

for everyone on board.

- They make for easy and cost-effective maintenance. Fuses and circuit breakers are typically cheap and easy to replace compared to the cost of replacing damaged equipment. They also act as an alert for trouble: when a fuse blows, it often indicates a problem in the system that needs to be figured out.
- They provide circuit segmentation. By using circuit breakers and fuses, you can segment the electrical system into different circuits. This means that if one circuit fails or a fuse blows, it won’t affect the entire electrical system. This segmentation helps in isolating problems and maintaining partial functionality of the boat’s electrical system.
- They prevent damage to the battery. Wherever electrical faults occur, fuses and circuit breakers blow out first, thereby preventing a buildup of current that can overheat the battery or cause other hazardous conditions.

Above all, don’t be afraid. “When utilized properly, electricity is safe to use,” Majano said. “By understanding basic electrical safety principles and adhering to safe practices, you will remain safe and avoid an electrical accident or electrocution.” ■