

During recent meetings and gatherings we've been asking your opinion on ways to broaden the appeal for this newsletter. Several folks have suggested that articles on various marine systems or boat maintenance may be beneficial. Hopefully, this column will be a forum for sharing the vast range of practical experience accumulated by our membership. It is also intended to be the place where you, the reader, can submit technical questions and either obtain answers or direction to appropriate reference material.

Of course since I was among the first to suggest such an article, I was elected to write the first one. Having no more direction than to "fill about a page" gave me license to write about a subject that I always seem to be questioned on, namely, marine electrical systems. Unfortunately one page won't be quite enough room. So in order to keep things manageable, and give me more material for future pages, I've divided "marine electrical systems" into the six topics that seem to be trouble areas for the average boaters. These are; electrical wiring, alternators and regulators, batteries, grounding and bonding, radios and antennas, and instrumentation (depth, speed, GPS, LORAN, etc.).

Have you ever watched someone with an electrical problem step out of their boat with that look that says "there be monsters there"? Usually the look is followed immediately by the question "Hey, do you know anything about .....?". 90% of the time the problem is easy to fix (provided you have enough money). The biggest contributor to most of the problems I've witnessed is the wiring that hooks everything together or the connectors used to join the wires to the devices. Corrosion, improper wire, undersized wire, over-rated circuit breaker and fuses, and generally poor wire installations are the "monsters" that you can control if you know the right way to do things and the things to avoid.

Never use solid wire on a boat. Solid wire is great for the house or barn. They don't move or flex very much (or at least you hope they don't). Boats on the other hand are subjected to all the abuse that the sea provides, plus the vibration of an engine in most boats. Solid wire cannot survive in this environment for very long without fracturing. The only wire that should be used is multi-strand copper wire that will flex with the boat. Ideally you should use tinned multi-strand copper wire. It has a silvery looking coat of tin alloy on each strand of wire and withstands the corrosive marine environment very well.

Always use wire that is large enough to handle the peak current load of all devices that will be connected to it. The maximum current rating for a wire is dependent on the size of the wire and its length. Using too small a wire will result in a voltage drop at the device end of the wire that may cause erratic operation. Even worse, the wire can overheat to the point of melting the insulation, causing a potential short circuit, and the fire that could result would certainly ruin your day. Most marine stores only carry wire that is meant for the marine

environment and are reasonably knowledgeable in determining the right size for a given application. BUT ---if they say they don't know, or you are not confident with their judgment don't buy. Remember the boat you sink may be your own! There are a lot of good books on the market that will help you pick the right size wire.

Always run wire from a fuse or circuit breaker on the main power distribution panel. The only exception to this general rule may be the wiring for the bilge pump and its' switch. If you are connecting directly to the battery make sure that its in-line fuse is located as close to the battery as possible. New boats are usually supplied with circuit breaker panels. The circuit breaker should be rated to protect the wire hooked to it, not the device that is being connected. In a properly designed system the device or instrument has its own fuse, either internal to the instrument or supplied externally as an in-line fuse. In most cases the fuse supplied with the equipment will protect it better than a circuit breaker. The circuit breaker and fuse should always be connected to the positive (+) side of the line. (Note: In the extremely rare circumstance that your boat has a positive ground system, call me, I would like to see it!) Most wiring schemes use white and black or red and black insulation on the multi-strand tinned wire to identify its polarity. A covering of gray or tan PVC insulation further protects these wire pairs. The black wire is normally the negative (-) side that is connected via a bus bar and heavy wire cable to the negative side of the battery, or a common point such as the engine block. The white or red wire is the positive (+) side which is connected to the positive side of the battery via the circuit breaker panel. If you are not sure of the polarity of the wiring DON'T HOOK ANY NEW EQUIPMENT TO IT! Reversing the polarity of the wiring to expensive electronics equipment could cause significant damage to it and your wallet.

Wiring systems should be well laid out with the wires neatly bundled and supported. Always run the wire in its' PVC jacket all the way from the equipment to the circuit breaker panel and then open the jacket to connect the white wire to the circuit breaker (+) and black wire to the negative (-) bus bar. Never, never run a single positive wire from the circuit breaker panel to a piece of equipment and connect the negative side to another black wire or your radio ground plate. If you do (or, God forbid, have) disconnect the wire immediately. This condition can set up an enormous electrolysis problem for all the underwater metal fittings, the engine and saltwater cooled heat exchangers.

Always run the wires in pairs all the way back to the circuit breaker panel and negative bus bar. Ideally, groups of wires should be wrapped with tie-wraps every foot or so, or spiral wrapped, and secured to a bulkhead or structural part of the boat to reduce the effects of vibration on the wire. One word of caution - avoid wrapping AC conductors and DC conductors in the same bundle. Run side by side for any appreciable length

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you can induce quite a bit of noise into the DC wires connected to the instruments. When we talk about radio installations in future articles I'll point out some other conditions to avoid relative to the radio frequency energy given off by the radio, antennas and antenna cables. As I pointed out earlier there are many excellent references on the subject of boat wiring. The "12 Volt Bible", "Boatowners Illustrated Handbook of Wiring", and other books are available from most good chandlers and catalogs. Gordon West's articles in "Sail Magazine" are excellent references, and well worth reading. In fact, the Dec '97 and Jan '98 issues of "Sail Magazine" carried two excellent articles complete with illustrations and further references.

Hopefully this "about a page" long article has stirred up some questions. Certainly your electrical system should not be viewed as a "monster". With a little knowledge and occasional tender loving care you can easily tame it and save yourself some money in repair bills.