August 2016 Newsletter

Photo Essay: Generator Enclosure Chafe Protection

Text and photos by Steve D'Antonio

When I carry out a vessel inspection, wiring security and the potential for chafe is an ever present concern. Both AC and DC wiring offer the potential for short circuits, heat generation and fire, while AC wiring faults can lead to outright electrocution or electric shock drowning or ESD (for more on this subject see http://stevedmarineconsulting.com/safe-shore-power-and-electrocution-prevention-2/).

Most modern shipboard generators are housed within acoustic enclosures, and in many cases wiring for AC, DC and control circuits, as well as fuel and raw water, must pass through the enclosure. The enclosures themselves are typically made from thin sheet steel, the edges of which can be quite sharp. You can no doubt see where this is going, in the attached image 120 volt AC wiring passes through the enclosure, exposing the wiring to the enclosure's sharp edge. Making matters worse, the anti-chafe grommet is beginning to become dislodged. I've encountered this scenario on countless occasions, and each time I see it I cringe. If an AC ?hot' wire were to make contact with the enclosure, the enclosure could become energized. If a person where to then touch it and a grounded object, such as the generator block, a nearby engine or raw water strainer, he or she would complete the path to ground, and be electrocuted in the process.

Check your generator wiring where it passes through the enclosure. Wires passing through enclosures, particularly metal ones, should be equipped with chafe protection that can't be dislodged, ideally in the form of a grip-type strain relief connector.

Ask Steve

Hi Steve,

You have helped me in the past and am very grateful.

I have been studying and repairing the bonding system on my boat. I started checking all the bonding connections and noticed that the thru hulls that were not bonded properly were developing the green corrosion. So I started running replacement wires and redoing all the connections including adding a grounding bus bar to bond all the connections together instead of connecting them in series like some of them were. The bonding system is connected to an underwater sintered bronze plate, and there is no zinc connected to it that I can tell. I am still chasing wires, so maybe the bonding system is connected to the rudders, where there are zincs.

So I did a little more research and discovered some other websites that recommend that no underwater thru hulls be bonded together due to hot marinas.

So now I am confused.

Thanks,

Ernesto Colon

Ernesto:

Bonding and grounding are among the most misunderstood systems aboard fiberglass cruising vessels.

I'll begin by busting a few myths, while there are ?hot? boats (more on that in a moment), there is, with few exceptions, no such thing as a ?hot marina? per se. The concept of a marina causing corrosion is fraught with misunderstanding, the primary component of which is the mistaken assumption that shore power faults in a marina's dock wiring can somehow cause corrosion. With very rare exceptions, shore power, 120/240 volts AC does not and cannot cause corrosion, corrosion is purely a DC phenomenon. Having said that, plugging your boat into shore power at a marina effectively connects everything aboard your boat that is bonded or grounded, to every other boat in the marina, as well as steel bulkheads, which could result in accelerated zinc (or aluminum) anode consumption, and ultimately underwater metal corrosion, aboard your boat.

The ?hot? boat scenario is one in which a neighboring boat is ?leaking? positive DC voltage into the water, known as stray current. That current can travel through the water to your boat, enter at underwater metals, props, shafts, rudders etc. (props and shafts are bonded, albeit not very effectively unless equipped with a high quality shaft brush, via the engine by default, you can't avoid this), causing damage to these components. This sort of corrosion, whether it begins aboard your own boat or a neighbors, can rapidly cause a great deal of damage, it can consume a propeller in days. The voltage levels are comparatively high, those of the battery, 12 or 24 volts. A shore power ground connection, which completes the circuit path, nearly always needs to be in place for this to occur. However, this sort of corrosion is less common, especially the case where it begins aboard another boat. More common is the scenario where your boat's zinc anodes are protecting the underwater metals of boats around you, via your bonding system and shore power ground connection. Known as galvanic corrosion, it's slow and steady, it occurs over weeks and months, and it's relatively common. Galvanic voltage is comparatively low, fractions of a volt.

Galvanic corrosion can be prevented by using an ABYC compliant galvanic isolator in the shore power circuit. These are inexpensive and easy to install, they should be included aboard every vessel equipped with shore power. They do have one weakness, they may not prevent stray current from making its way aboard your boat as they are incapable of blocking more than about 1.4 volts. For the ultimate in marina corrosion protection, you'd need to install an isolation transformer, these are larger, more costly and more difficult to install than galvanic isolators, however, they also offer more advantages, in addition to corrosion prevention, they also offer reverse polarity and in water electrocution protection.

Now on to your question, should you bond (a fiberglass hull)? The answer is yes, absolutely. Bonding affords you a variety of advantages including electrocution prevention, protection in the event of a near or direct lightning strike, and a reduction of galvanic and stray current corrosion. If you bond underwater metals and then effectively connect the bonding system to an underwater anode, all of those metals will receive protection. Of course, and once again, you should install an ABYC compliant galvanic isolator.

As an aside, the green patina or ?verdigris? that appears on bronze and other copper alloys is entirely normal, it's not harmful.

For more on bonding systems, see http://stevedmarineconsulting.com/galvanic-isolators-and-zinc-anode-selection/ and http://stevedmarineconsulting.com/bonding-systems-and-corrosion-prevention/

Steve,

As always when I have a question I turn to the expert.

We are on the hard and I hope to perform some upgrades to systems if not in the winter then in the early spring.

Two of these, which we don't have on board, are an oil transfer system and the other being engines synchronizer.

We have 2 Ford Lehman 135 Diesels, naturally aspirated. Each engine holds 19qts of oil and it is a PITA to use a probe down the dip stick tube to change the oil. It's also very difficult to, by ear, synchronize the 2 engines and I've heard of the Glendinning synchronizer.

I wanted your input, now that you are in a position to offer brand name suggestions, what your opinion is.

Thanks.

Best regards,

Charles Williamson

Charles:

Oil pump out systems are a valuable feature for nearly any motor vessel. Plumbing drain lines to the engine and generator crankcase, as well as the transmission, makes oil changes easier and cleaner. In addition to choosing the right pump, the plumbing must also be set up properly to ensure reliability and leak free operation. More important than a specific pump brand is the type of pumping mechanism. Less expensive pumps rely on oil resistant rubber impellers. While these work, their lifespans are short. Geared pumps, on the other hand, are far more desirable, they last longer and are more tolerant of dry operation. These are available from, among others, Oberdorfer, Reverso and Marco.

Make certain that the drain at each pan is equipped with an isolation valve, at the pan, not just at the pump's manifold. The valve should remain closed at all times other than when oil is being drained. The isolation valve will ensure that the engine or transmission cannot be inadvertently drained of oil should a hose develop a leak. Hose should be robust, and crush, kink and vacuum collapse resistant. While not a prerequisite, the steel braid inner jacket variety is preferred, such as Parker FR 221 fuel hose. Hose of this sort cannot collapse under a strong vacuum, and it is extremely damage resistant.

Finally, make certain it is plumbed to the absolute bottom of the oil pan. Many oil pans include a plug at the bottom of the sump, as well as one on the side. The side fitting should not be used as a drain as it will leave behind a substantial quantity oil with each change. This is a common error that I encounter aboard both new vessels, as well as after-market, oil pump out systems.

Regarding synchronizers, the Glendenning is the gold standard in synchronizers, it's the only system I would consider. The folks at the company are very good for support as well.

Katie,

A question for SDMC's newsletter...

Am refitting an old steel boat. Will be installing Li-ion and AGM batteries for house, starting, & thruster/windlass purposes. Have spoken with the tech support at the manufacturers. They feel ABYC rules for battery 'containment' hasn't kept up with new technology, and the need for leakage containment is over-promoted, and other than to protect the terminals, there is little need for full enclosure. I know the conventional wisdom is to box up batteries with a gas vent. Have you considered rethinking this conventional wisdom?

Mark Andrew

Mark:

Battery installations and containment continue to confound many builders. Where flooded batteries are concerned, full, box-type containment makes good sense, they capture leaking or spilled electrolyte, and they contain battery explosions. The latter do occur from time to time with flooded batteries, I've witnessed a handful in my career. ABYC guidelines do call for ?containment?, however, 100% containment is not required, so the ?need? for a box is inaccurate. Admittedly, for immobilized electrolyte SVRLA batteries like AGM, and gel, and LiIon, 100% containment does seem like overkill. In those cases, I'm comfortable with trays, which serve to secure batteries against movement, which is a requirement for ABYC compliance. Non-boxed batteries are also easier to inspect and they dissipate heat more efficiently. The positive terminals must be completely, not just ?letter of the law', insulated to prevent short circuits.

Lithium ion batteries are another matter entirely. As most boat owners know, there have been issues with them, some of which have been spectacular. Albeit a different Li Ion chemistry, Boeing's experience created, or renewed, understandable concern within the marine industry. As they never definitively identified, or shared, the cause, some say it was extreme low temperature dendrite formation, Boeing's solution was more of an, ?address the symptom rather than the cause' approach, it included housing batteries in a metallic box that would, if overheated, vent outside the aircraft. Should the same approach be taken for a boat? It's difficult to say, ABYC has yet to release a revised battery installation standard that addresses these batteries. If you choose to be an early adopter and go with Li Ion batteries, I would, at the very least, rely on trays, if for no other reason than they serve as good support and immobilizers. I also see no reason why the installation should not comply fully with the ABYC E-10, ?Storage Batteries' chapter.

Finally, you might also check with your insurer, rumor has it some insurance companies will not insure vessels equipped with Li Ion batteries, or if they do they charge a premium to do so. If that turns out to be the case, they may also have guidelines or requirements regarding the installation of these batteries.

Hello Steve,

We are in the planning stages for our next sail boat. It will be a new off-shore mono haul, 54-60 LOA (Oyster / Gunfleet / Hylas / HR). Our plan is to do a circumnavigation in 2-3 years from now. I read with great interest your exchange with Nigel Calder in one of the trawler magazines about hybrid propulsion and I whole heartedly agree with your take, which leads me to my two, somewhat related questions:

1) Most newer diesel engines, even the Yanmars, feature common rail diesel injection. While this is a proven technology in cars, trucks and other industrial equipment, I am worried about the "cutting edge" technology once you are stranded in the South-Pacific Islands with no access to spare parts and no highly qualified mechanics that owns the computer necessary to reset or re-program the controller.

2) More and more yacht if this size also come with distributed power system. While this technology significantly reduces the number and size of electric wires in the boats, it again depends on brand specific parts and programming to trouble shoot/repair.

In both cases, I am most worried about a lightning strike after which not only all electronic would be fried, but now also could not run my engine and all of my digital powers switches/nodes would also be history.

What's your take?

Thank you.

Daniel Wolff

Daniel:

Thanks for the note, comments and for the queries, you've posed some very good questions, very good indeed. They are the right questions for someone who is preparing to cruise offshore for extended periods.

As far as common rail engines are concerned, these days it would be difficult to source a new diesel engine above 100 hp that wasn't electronically controlled, so I'm not sure you have much of a choice. Doom and gloom was predicted by detractors when these engines were first introduced to the marine market, many scrambled to get the last of the mechanical engines. Few of those predictions came true, electronic engines have proven incredibly reliable, and more efficient, and self-diagnostic, and less smoky, and quieter at idle?you get the point. One of the reasons these engines are so reliable, unlike other new marine industry products, is because they had millions of over the road miles under their fan belts, in commercial over the road trucks, before the first one was ever installed aboard a boat, they were thoroughly vetted. Having said that, with more electronics comes more vulnerability to voltage issues and of course lightning. For a sailing vessel, if you did have a choice, I would choose a mechanical engine, however, unless you opt for a remanufactured engine, I don't believe you'll have a choice.   At least you will have an alternative means of propulsion in your sails. The vessel's lightning protection system should, at a minimum, comply with ABYC chapter TE-4. For more on lightning see http://www.proboat.com/2016/04/3530/

Distributed power is another issue entirely, it's far from a foregone conclusion, the majority of production builders have chosen not to use it, at least not yet. Indeed, it offers a range of advantages and versatility, especially if you are one of those people who gets a kick out of dimming your lights or changing your thermostat via your phone or tablet. My primary concern, however, in addition to a lightning strike, which is a statistical rarity, is after sale support. Since distributed power systems made their first appearance a number of manufacturers have come and gone, and even those that have stayed have moved through several generations of products, with parts availability for earlier versions spotty at best. I would ask your builder of choice what assurance they can give you for a ten year support window, and what will they do should the manufacturer they (and whose product they will no doubt mark up, and profit from) choose for the DP system go under, or stop making or supporting your vessel's system? Even with iron-clad assurances, I would be very reluctant to opt for a DP system on a vessel of this sort, one whose system reliability is so vital, and one for whom support may be many thousands of miles away should a failure occur.