December 2025 Newsletter – Lithium-Ion Batter Terminals

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Photo Essay: Lithium-Ion Battery Terminals

It is a truism, lithium-ion batteries, used in house battery bank systems, have become veritably standard equipment in today's recreational vessels. It seems, hardly a craft over 30 feet, and many under, is built without using this technology. The reasons for this rapid embracement are twofold. One, the performance is head and shoulders above that of conventional LA (lead acid)/AGM batteries; offering higher capacity and lower weight for the same footprint. Two, the cost has dropped enough to bring them into parity, if not beyond, LA batteries, when taken from the perspective of cycles and amp-hours produced over the battery's lifetime.

It is also undeniable that a black cloud of sorts hangs over lithium-ion batteries where fire is concerned. It's controversial to be sure, as there are several sub-categories of lithium-ion battery chemistry (lithium iron phosphate, or LFP, is the most popular in the marine industry, and deemed one of the most stable and safest), with varying capability, and with some presenting higher overheating and fire risks than others.

Many of the vessels I inspect, and all of those I'm currently involved with building, are equipped with lithium-ion battery banks, some of which even use these in starting and thruster applications, along with house banks. With the caveat that the batteries are supplied by a recognized, and respected

manufacturer, and that they are installed in full compliance with that manufacturer's guidelines, as well as ABYC Standards E-11 AC and DC Electrical Systems, and E-13 Lithium-Ion Batteries, I believe these systems are as safe, and in many cases, thanks to the ample monitoring capabilities, safer than conventional LA batteries (if one reviews the material safety data sheets [MSDS] for both battery types, those for LA batteries are far more ominous.

There is, never the less, a weak link, and increased potential for overheating and fire, where lithium-ion systems are concerned, albeit indirectly. Because this battery chemistry is capable of accepting a very high rate of charge, i.e. hundreds of amps, as well as producing high current for onboard consumption, primarily from large inverter banks, in both cases for extended periods of time, the risk is elevated. It is, however, important to point out, the batteries themselves aren't the issue, again not directly; it is their high current nature that stresses an electrical system that has heretofore, using LA batteries, been for the most part safe and reliable.

Thus, those installing and servicing lithium-ion batteries must posses a high level of attention to detail, because a single misplaced wire, washer or loose ring terminal, can spell disaster where lithium-ion batteries are used, particularly in the case of larger banks.
In the example shown here, a recently installed lithium-ion battery's ring terminal is dramatically loose. Such a scenario will almost certainly lead to arcing, overheating and possibly even fire.

Ask Steve

Hello Steve,

We appreciate your participation with Trawler owners' groups. I also enjoy and learn from your e-mails and social media postings.

My wife and I have a trawler… lately, in rough conditions, our domestic water supply is a brownish color with fine sediment. We opened the stainless-steel water tanks and saw light rust and golden colors on the baffle welds and side welds, and brownish sediment on the bottom. We thoroughly cleaned the tanks.

We have a 12" square access on top and no access to three sides and the bottom. With the baffles, access and sighting is limited inside. It would be extremely difficult to remove the tank. Our water maker provides the only water that goes into the tank.

What can we do to prevent further corrosion? Should we anticipate leaks in the future?

Do facilities have the capability to spray a coating over the entire inside?

We may install a 5-micron filter between the tank and water pump to stop sediment from entering our water usage.

Thank you, Steve.

Paul Rupple



FYI – We had a 1200w Relion lithium battery house bank installed 2019. On this past summer's lay-up, I messed up and left the inverter on and solar off. Returning to the boat in October, the battery voltage was 2 volts. With lengthy charging, I'm thrilled to report the bank came back and has been operating fine this winter.

Paul:

Stainless steel, even the most corrosion resistant alloys, can be susceptible to a phenomenon known as crevice corrosion. This type of corrosion occurs when stainless steel is exposed to stagnant, and thus oxygen depleted, water. Without a fresh supply of oxygen, stainless steel cannot maintain its otherwise tough, corrosion resistant oxide coating. Potable water tanks are, unfortunately, are an ideal environment for this to occur, you can read more about this type of corrosion here.

Ideally, your tank will have been constructed from 316L alloy stainless; 316 series stainless is exceptionally corrosion resistant, and it is non-magnetic. Is your tank magnetic? The L suffix denotes 'low carbon', which is mandatory for any

stainless steel that is to be welded. If the alloy is not low carbon, the areas around the welds can suffer from another phenomenon peculiar to stainless steel called weld migration, or carbide precipitation, wherein elements within stainless steel that afford it its corrosion protection, are driven out of the weld area, which typically leads to those areas behaving like mild steel, and corrosion adjacent to the welds. It's possible, but not certain, that is what's occurring in your case, however, if there is discoloration around other welds on the exterior of the tank, that would support the possibility that non-low carbon stainless steel was used to fabricate the tank. Alternatively, the weld material itself may not be suitable for the application (if it was 304 alloy for instance), and only it is corroding, that would be the lesser of two evils. You can learn more about this subject here.

Ideally, all tank designs should include access into every baffled chamber; this is a drum I pound with boat builders on a regular basis. Access port kits are available, and can be added to most existing tanks if necessary. One manufacturer of such kits is Sea-Built, the ports you use should be stainless steel.

Regarding tank coatings, I have yet to encounter one that works. The challenges are, cleaning the inside of the tank adequately to ensure adhesion, and fully encapsulating all the many faceted baffle surfaces is nearly impossible, particularly in a tank with limited access. If water migrates behind the coating, it will accelerate the crevice corrosion process.

Finally, the reverse osmosis (RO) water produced by water makers is slightly acidic, and that can accelerate the corrosion process. There are filtration systems, called remineralizers, whichcan be installed on RO systems to reintroduce some of the minerals that have been removed, thereby moving the product water's pH level closer to neutral.

That could slow the corrosion in your case.

I’m sorry I don’t have a more optimistic response. While stainless steel was once the most desirable material for potable water tank fabrication, today better options, such as fiberglass and plastic, exist. While I hope it isn’t necessary, if the tank needs to be replaced, it can be cut up in place and replaced with two smaller polyethylene tanks.

Steve,

We’ve read your May 1 2023 article for Waterway Guide covering portable fire extinguishers, and your June/July 2010 Professional BoatBuilder article on Fixed Firefighting Systems.

We’ll find it easy to follow your May 2023 advice on hand-held units on our new-to-us 2005 Monk 36, distributing four or five small BI / BII units around the boat.

For Clean Agent extinguishers our decisions seem more-complicated:

Like many mid-size boats with a small engine space (instead of a Room) that’s accessed through the salon sole, it would be a great idea to keep our engine hatches closed in the event of a fire. So, installing break-out ports to use a hand-held seems like another great idea, that might actually be superior to an automatic FFE system. Using a Clean Agent extinguisher instead of dry chemical to fight an engine room fire, a third great idea.

But to use break-out ports one needs an extinguisher with a hose, and the smallest (Amerex, anyway) unit that’s equipped with a hose is 11#. That’s a big unit to mount in a 36 footer’s salon. But might not be big enough, when following the agent weights suggested for Fireboy-type automatic

systems. Assuming a small 350 cu.ft space would require 15 pounds of agent, while 500 cu.ft would require 22 pounds, for an Auto system.

A diligent boat owner wants our work to be useful – there's no sense in installing fire ports, and then buying a $500 5# Halotron unit that can't be used with them. And might be too small to be effective anyway. But a practical owner of a mid-size boat wonders how he'll mount a portable 15# and an 11# in a small salon.

Which might drive the decision towards:

1. Do nothing
2. Use an automatic system

Maybe there's no in-between.

Can you offer any advice about whether using portable Clean Agent extinguishers is really a practical option?

Neil Skogland

Neil:

I'm not sure why you consider a portable fire extinguisher with a break out port superior to a fixed fire extinguisher. The portable fire extinguisher with access port should be considered a last resort, where there is no room what so ever for a fixed system.

Remember, in order to be ABYC compliant, diesel engines and forced ventilation systems, must include an automatic shut-down device, and that's not possible with a portable fire extinguisher. Therefore, I'd select option B. That approach eliminates any guesswork regarding space volume as well. Remember to mount the unit as high as possible in the compartment, and include a manual discharge, which is also a requirement for ABYC compliance.

Steve,

My 33-foot 1989 sailboat experienced strange anode erosion last summer (Long Island Sound). It has had rapid zinc loss in the past and I changed to aluminum anodes a few years ago. The lead keel has “popped off” certain sections of barrier coat regularly. The boat has bronze prop, prop shaft and prop strut. I use a zinc coating on prop and shaft to inhibit barnacle growth. Bonding system was cleaned and tested last spring before launch. Half-cell to engine ground reading in the water was -1,008 mV.

Any thoughts on reasons for anode appearance and keel issues? Can they be related?

Bill March

Bill:

A few thoughts come to mind. Do you have a galvanic isolator? If not, I would strongly recommend you install one, every vessel that has shore power should be so equipped, and it must be of the fail safe, and ABYC A-28 compliant, variety.

Paint failure on the keel could be the result of over-protection; more on that here however, it could also be unrelated.

I have used zinc based anti-foulants on running gear for a few years and have not experienced any anode or paint anomalies.

Are your anodes Mil-Spec?

For reference cell testing, instead if using the engine ground, try testing individual bonded underwater metals, to confirm they are all equally protected.

More on reference cell testing here, and galvanic isolators

here.