December 2019 Newsletter

Photo Essay: Refrigeration Maintenance

While it's all too easy to take it for granted, I never cease to marvel at the ingenuity of the common refrigeration system. Using a few components, a compressor, condenser, evaporator, expansion valve, and electricity, it's possible to make something that's hot into something that's cold. What's more, refrigeration systems are one of the few modern contrivances that are ridiculously reliable. Hermetically-sealed, oil-bath systems are known for running for years, decades in some cases, without missing a beat. Not long ago I sold my home, with the refrigerator that I'd installed 15 years prior, the buyer specifically asked for the appliances to convey with the home. In all the years I'd owned it, it suffered one failure, the thermostat used for the self-defrosting feature gave out. I purchased a replacement for about $30, installed it in 20 minutes, and it ran for years thereafter without incident.

However, as robust and efficient as these systems are, they can be brought down by something as simple as dust or pet hair. In order for a refrigeration system to work reliably, the condenser, the radiator-like device usually located adjacent to the compressor, where refrigerant is cooled and condensed, by releasing the heat it has absorbed from the refrigerator box to the atmosphere, must be kept clean and unobstructed. If air cannot pass easily over the condenser's coils and fins, efficiency drops dramatically, the compressor runs more often, the unit uses more energy and wears out more rapidly. The same holds true for air conditioning systems, the marine version of which relies on a refrigerant to seawater heat exchanger; if it becomes fouled the air conditioning often stops working all together.

The refrigeration condenser shown here is impacted with dust, and as a result its efficiency is almost certainly a fraction of what it should be. Keep your refrigeration condensers clean and dust free, and this includes those on household refrigerators too, whether afloat or ashore. You should do this at least annually, more often if you have pets. Cleaning requires a vacuum; however, I prefer a vacuum and compressed air. Be cautious when doing this, especially if using compressed air, wear a dust mask and safety glasses, and be sure to brief your assistant on what to do and expect. On one occasion, while cleaning the condenser on my home refrigerator, I went around the back with a compressed air nozzle, while stationing my wife on the other side at the ready with a vacuum. Shortly after I began blowing, I heard a shriek, I climbed out from behind the fridge to find an unattended running vacuum, and a mummified mouse; my wife was nowhere to be found.

Ask Steve

Hi Steve,

Regarding your most recent (November 2019) eMagazine article on on-board fires, excellent piece of advice pertaining to re-chargeable devices. We try always to do so on hard surfaces on Alchemy, easy enough as it is just Ginger and me. At a summer place that is old and wood we have a rule for the many kids and other families to never charge on beds, watch out for pillows falling on devices etc.

I am also a believer that the skipper (or homeowner) should develop (preferably with his crew) a ?fire plan?, print it up and laminate and leave it posted or accessible where it is likely to be looked at occasionally: like in the head.

This plan should include fire extinguisher locations, locations of gear/items of especial concern (life rafts, propane tanks, bombs such as WD40 cans, gasoline storage etc.), procedures (plexi-covered swing aside inspection hole into engine room so that air/oxygen is not introduced to a fire area and sized to fit a dedicated fire ext.). It should also include other firefighting apparatus such as fire blanket(s), and equipment not so designated, but perhaps useful, such as a dish washing spray nozzle at the galley sink.

Also, I would suggest MAYDAY alerts (almost) immediately (they can always be cancelled) and that the first moment the skipper thinks about abandoning ship, he/she assigns a crew to get the raft to a safe place and make other preparations. This is also an area where drills will make for faster smoother work

I would also suggest that all get their hands on an extinguisher at some time and set it off, preferably at a real fire (like in a barbecue set on the ground). In an actual fire, it is not the time to be reading directions or in any way hesitant.

Along those lines, practice drills can be very effective at ensuring a smooth, quick and effective response and ensuring that previously prepared equipment gets taken (abandon ship bag, handheld VHF, sat-phone etc.

Please come back with thoughts/questions/comments.

My best,

Dick Stevenson

Dick:

Agreed on all counts, and there's nothing like practice. I was recently a guest aboard Tony Fleming's vessel, Venture. In spite of the fact that I've been a guest on several occasions, his very able captain, Chris Conklin, never the less walked me through all of the key safety gear and procedures, from firefighting to abandon ship procedures, something he does every time I'm aboard, and Tony always follows along. This should be standard procedure for every vessel, for everyone who will spend one or more nights aboard.

Off the shelf ?fire ports' that are designed to allow a fire extinguisher to be discharged into an enclosed space, are available. I prefer fixed fire extinguishers in engine compartments, however, such a port would either be the next best thing, are an addition to a fixed unit, and certainly suitable for small engine boxes and generator enclosures.

Steve,

I found your recent article in Cruising World regarding ELCI breakers interesting. I find it is a bit difficult to keep up with the rapidly changing electrical/electronic technology.

We own a 2005 Nordic Tug 37 which we cruise a bit in the southern New England area. The gen set is a 9 kW ONAN machine.

A few years ago we added a ProMariner ProSafe Galvanic Isolator to our shore power connection. From your discussion, the ELCI device seems to address a slightly different function.

Would you suggest we install an ELCI as our main AC Power circuit breaker? Anywhere just downstream of the isolator? It probably needs to be downstream of the gen set feed as well. I am unsure if I have panel space to just replace the main AC breaker. We have a split panel for two shore power feeds, or transfer switch/breaker to feed the second panel from the first. Do i need 2 ELCI devices?

Where are these available, I don't see one in the latest DEFENDER catalog?

Regards

Bob Geary

Bob:

Thanks for the note and query, I'm glad the column piqued your interest.

The galvanic isolator, while valuable in its own right, has nothing what so ever to do with the ELCI. Galvanic isolators essentially block DC current from flowing over the shore power green safety grounding wire. Corrosion is caused by DC current flow, and thus blocking it prevents current that originates aboard nearby boats, or the dock, from affecting your underwater metals and anodes. It does not prevent corrosion that is locally induced, i.e. that which begins aboard your own vessel. The galvanic isolator must achieve this goal, blocking DC, while allowing AC fault current to pass, which is necessary to ensure on-board electrical safety. Units that are compliant with the latest ABYC A-28 standard, last updated in 2008, including the failsafe design, offer the greatest reliability and safety. You can read more about how they work here.

As far as ELCI's are concerned, in most applications a combined ELCI and circuit breaker is used as the main shore power protection. You could, therefore, replace your shore power inlet breaker(s) with one of these units. It, and all main shore power circuit breakers, should be installed as close to the inlet as possible, as any wire between the circuit breaker or ELCI, and the shore inlet is essentially unprotected by anything other than the circuit breaker on the dock pedestal, which is sometimes faulty. This circuit breaker would offer protection to all ?downstream? on-board AC shore power, however, it would not protect output from the genset or inverter.

The primary risk where shore power is concerned involves in water electrocution, where an on-board AC fault seeks a return path through the water. The ELCI significantly reduces the likelihood of this scenario, which is why there's been a push towards its adoption. The power created by a generator and inverter, on the other hand, is unlikely to travel through the water in the event of a fault, as it is not referenced to the ground ashore, and so the need for an ELCI is far lower; while you could have one for this gear, it's not mandated in this role for ABYC compliance.

If you have two shore power inlets that can be used simultaneously, then you would need two ELCI circuit breakers, one for each inlet. This link, from ELCI manufacturer Blue Sea Systems, explains more about installation requirements and options.

Steve,

I am wanting to get a tester to test my batteries.

From what I've read on your site I should go with a carbon pile tester as you haven't really confirmed that the Midtronics is definitely the way to go. You also said you have an "ARCO", but this unit is discontinued.

Can you recommend another one?

Also my boat's system is 12 volt, but it is two 6 volts combined.

By the way, all of this started because a boat yard worked on my boat and left the charger off all winter and the batteries set for months without a charge. They tested them and said they were no good and are going to cover half the cost of new Lifelines and the shipping, install, etc. My batteries were four years old so it seems reasonable to me. But pretty dumb mistake.

Regards,

Jeanette and Jimmy Stewart

Jimmy & Jeanette:

While electronic battery testers, which use conductance to determine its condition, are in their third generation, I'm occasionally skeptical of their results. I believe carbon pile testers, on the other hand, still provide the most reliable results, these place a genuine starter or thruster-like load on a battery, while measuring the voltage it maintains, and the current it produces. The error I most often see involves a conductance tester that indicates a battery is defective, when it's clearly not, and this is confirmed by a carbon pile tester.

The most common electronic tester, from MidTronics, was originally designed to test automotive start batteries, it's become extremely popular for testing batteries at auto parts stores, often to determine warranty coverage. These have been advocated by some in the marine industry, because of their compact size, safety (safer than carbon pile testing, which can in rare cases cause an explosion in a flooded battery), much smaller than a carbon pile, and feature-rich capability. Unlike other conventional load testers, it can differentiate between a weak or discharged battery and one that's defective.

My suspicion, and experience is, however, while they work well in this role, for start batteries, they can and do offer false readings when applied to larger deep cycle batteries. Batteries must always be tested individually by the way, disconnected from a bank, or at least in series pairs.

The Midtronics website mentions cars, trucks and "fleets" continuously, with a small section on marine applications. That section has a link to the website of an individual in the marine industry, an author and employee of ABYC, who has heavily advocated this product. He clearly believes in it. For automotive-like dual purpose batteries, used in smaller vessels, it's probably fine.

Conductance technology offers much, yet it's too inconsistent to be relied upon for large deep cycle batteries, in my opinion.

Always wear safety glasses when working with and testing batteries, and remove metallic watches and jewelry.

This is what Lifeline recommends for bench battery charging and testing. It's costly; I know of only one boat yard that uses this tool.

Hello Steve:

I have enjoyed reading your stuff online and particularly your section on grounding/bonding. I have a Southerly 135 Sailboat I purchased in Annapolis a few years ago, but now keep in Key West, FL. Eventually I would like to get one of your Ready for Sea inspections done when you are in South Florida sometime.

I did have a quick question if you had time I would appreciate your feedback. The attached picture shows some ?flanges' around my prop shaft. I'm not sure if they are supposed to bond the shaft or what. They don't appear to have a good low resistance connection.

Also I'm curious why that one nut is corroded while the others are not. Is it just a different metal or do I have an issue?

Thanks in advance if you can spare a few moments to respond.

Tim Hunsinger

Tim:

The ?flanges? you are referencing are the actual stuffing box carrier and ram. As the nuts are tightened, they draw the ram into the packing carrier, compressing it, and thereby creating a mostly watertight seal. Neither are specifically designed to establish an electrical bonding connection with the shaft. The shaft/prop should have its own anode for corrosion protection. If you'd like to bond the shaft you can do so using a shaft brush.

With one caveat, see below, there's little or no harm in having both a brush and anode on the shaft. In fact, unless you go with a high end slip ring type brush like the effectiveness of a standard brush is iffy at best. Having tested several different types, if you do go the economy route, the 'copper wand-style carbon brush' offers the best chance for low resistance continuity. The resistance threshold here is quite low, ABYC Standards state that the maximum allowable resistance between protected metals and anodes cannot exceed 1 ohm. That's often difficult to achieve with wired systems, much less between a contact and rotating shaft. While the shaft is spinning contact is often good, it's when it stops, and sits idle for days or weeks that resistance rises.

Brushes can, however, be a double edged sword. If the hull anodes are depleted, the shaft anode will, via the brush, provide protection to all bonded hardware, until it's depleted, which will happen quickly. Ultimately, I'd recommend a brush, while ensuring all anodes are maintained.

This article explains a bit more about brushes and how they work with bonding systems.

As far as the rusty nut is concerned, I suspect it's either of a lower quality/corrosion resistance than the others, or it has been contaminated with mild steel in the finishing process. If you replace it I suspect the problem will not reappear.

One final observation, the stuffing box is ?daisy chained? with the bonding wires, i.e. the stuffing box is now a potential current path, rather than being a more desirable dead end for galvanic or stray current corrosion. Both ring terminals should be attached at the same point. The daisy chain issue is described in greater detail in this article. When attaching the ring terminals make certain they, and the surface where they will reside, are clean, a ScotchBrite pad works well for surface prep, don't use a wire brush, and apply conductive paste to the connection surfaces before re-assembly. When complete, spray the terminals with corrosion inhibitor such as CRC Heavy Duty Corrosion Inhibitor.