# January 2017 Newsletter

Text and photos by Steve D'Antonio



## Photo Essay: Boiling Water with Batteries

A few years ago the thought of boiling water using battery power would have been scoffed at, a crazy notion that simply defied logic or the technical capacity of the systems available at the time.  Today, however, it's far from unusual, along with powering just about anything else you can think of via batteries and inverters, including air conditioning.

Inverters have been commonplace aboard cruising vessels for twenty-five years.  Of late, however, their capacity has grown in leaps and bounds, thanks in no small part to the increased popularity of household solar arrays, wherein larger capacity is a necessity. Now, a 5 kW inverter arrangement is common, and 15 kW systems are on the rise, supplying 120/240 volt power to the vessel's entire electrical panel with the exception, perhaps of the water heater (where it's possible but simply makes less sense).

The image shown here was taken aboard just such a vessel, equipped with a 240 volt inductive range, operating solely on power supplied by the battery bank and inverters. Designing vessel electrical systems to operate air conditioning units, both split and chiller systems, from inverters, typically while underway but on battery power as well, has also become relatively common. The first such system I worked on was completed 7 years ago, and it was quite unique at the time. Today, it hardly raises an eyebrow.

While the inverter capacity was the key to the growth of these systems, it should still be thought of as a package. The battery bank must be appropriately sized, along with its charge capacity, as well as alternator output, regulation and wiring, and all of this gear must be adequately ventilated to prevent overheating. Ultimately, however, it's now doable and relatively straightforward.

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# Ask Steve

**Hi Steve,**

Since your inspection I decided to take out the 10 year old insulation in my engine room and replace with new Soundown foam/rubber/Mylar and a thick damped aluminum facing. I think it'll look great, last longer and smooth out the chopped up areas in that engine room.

While removing the ceiling and forward bulkhead pieces, we found fiberglass thermal insulation. It wasn't in great shape – dark splotches, packed out and torn up.

My thought is to replace it with high R polyethylene panels from Home Depot. No mold, easy to install and maintain their R rating forever.

Any reasons why I should get some "marine" version if there is such a thing or will the home stuff be fine?

Hydraulics – I decided to change all the steering and A/P hose on the boat. Another thing that's 10 years old, has cracks and is not flexible. In looking over the lines, I found the steering lines are actually copper from the power pack about half way through the engine room. They aren't secured really well and are kind of old and bent up.

From there, they flare into the hoses and run up to the two helms.

I was thinking of replacing it all with SS tubing. Instead of spending the money on new hoses that will just get old again, the SS will look great and last forever. Any negatives to that?  It'll cost more than just new hoses obviously!

Another question:

Engine pre-oiler- my mechanic told me about this system and it really appeals to me. Simple way to pressurize the internal oil galleries etc. before engine start, heavily reducing initial wear on the engine, which is when most occurs.

Side benefit is that you don't have to pour oil into any filters when changing them. Just wipe the gaskets, screw them on and flip on the pre-oiler, which will fill the filters.

I haven't seen the actual design of the system but I don't think it's complicated – maybe a couple of small pumps and switches.

Btw, we are plumbing the fuel polisher to do the same thing for the fuel system. We will be able to change a fuel filter and not have to purge the system manually, but rather will push an electric button.

One of the mechanics told me I should filter the coolant but I think that's going a bit too far for my application!

Paul Weismann

**Paul:**

While there isn't a specific requirement regarding fire retardant materials for insulation in recreational vessel engine rooms, after all wood and fiberglass are flammable, the less flammable surface material that's used in an engine room the better.  If you used this material, facing it with something flame retardant would be preferred.

While stainless steel tubing would be the gold standard for hydraulic plumbing, it's costly and in this case unnecessary.  Copper tubing is commonly used for hydraulic steering with good reason, it's durable, reliable and corrosion resistant.  I'd replace the hoses and keep the tubing, make sure it's well supported and can't move when the hoses move.  If the hoses are made up with plated steel ends, as is commonly done, be sure to corrosion inhibit them using CRC Heavy Duty Corrosion Inhibitor.

The engine pre-oiling concept is one that's been around for decades.  Your mechanic is correct, it makes sense, however, in a recreational application it's difficult to justify, as the engine isn't started that often.  I can't recall the last time I encountered a recreational diesel that died as a result of plain, simple bearing wear.  The liability with pre-oilers is they represent more plumbing, and more potential for failure, in the high pressure oil gallery.  For a launch, on the other hand, which is being started dozens of times a day, the marine equivalent of a UPS truck, a pre-oiling system would make sense.

A fuel polisher that can be used to prime filters, however, is well worth the effort and offers little if any risk. Finally, some engine manufacturers, Cummins for instance, includes coolant filters. In addition to filtering coolant, they include an ablative pellet that maintains the proper balance of corrosion inhibitors. While it wouldn't hurt, if you monitor your coolant using test strips every few months, and have it analyzed annually, it's unlikely that a filter will add significant value.

**Dear Sir,**

I completely agree with you that radio communication has completely and utterly changed the sport of offshore sailing. When I was a young man boats were wood, sails were cotton and sailors largely were competent seamen. You want to sail? First, crew for someone experienced for a couple of years (for many this was their father). Then, your first boat would be a small one design, something between a Penguin and perhaps a Comet or Snipe. Later perhaps moving up to a Lightning or Star. Only then, after a few years of experience, seasoning, and learning to shoulder the burden of command, would someone turn to offshore sailing where the entire learning cycle would be repeated, but in larger vessels and deeper waters. Nearly every man followed this model, including Ted Turner and Dennis Connor; the only major sailor I can think of who did not was Richard S. Nye, skipper of Carina.

Over the next six or seven decades the expanding economy, fiberglass construction, and electronic communication have all conspired to drastically change sailing and especially offshore sailing, sometimes for the better, but often not. Fiberglass is much stronger than wooden construction and no one wants to return to cotton sails and manila cordage, but where today is the incredible beauty that came from the boards of Alden Rhodes, Stevens, Hunt, and so many others? Why do the voyages and books of Slocum, Pidgeon, the Hiscocks, Guzwell and the Pardys so inspire the reader that he prefers to read them over and over and forgo modern voyages where the author was harbor bound for two weeks awaiting an airlifted part for his engine…watermaker…GPS…air conditioner? Where instead of heaving to on the offshore tack until dawn, he simply turns on the satnav and radio and lets someone talk him into a strange harbor in the middle of the night. How inspiring is a tale told by a man in a storm offshore who, when the bilgewater is around his ankles and rising, reaches not for a bucket, but a transmitter?

No one would buy a plane, climb right in and take off with no experience or instruction of any kind, but many will do this with a boat. Several years ago I met a couple who confided they wanted to buy a sailboat and "take off." I advised them to purchase a pair of Lasers and learn to sail and race them while they were working and saving for their voyage. Clearly, they didn't want to hear that. No doubt they'd rather have purchased something like a Hunter 40, read "Sailing For Dummies," and cast off.

I'm probably just a grumpy old man, but I clearly remember that cruising on a Hinckley Sou'wester six decades ago was so enjoyable in large part because you were cut off from the rest of the world. No phone, newspaper, television or radio. Just the sun and stars, wind and water, and each other. Comfort was a full stomach, a dry berth, and the knowledge that tomorrow would bring a new port and a new adventure.

So long ago…

Paul J. Nolan

**Dear Paul:**

Your commentary conjured up long-forgotten memories of the path I took, in developing the skills I needed, navigation, boat handling and seamanship, to safely make offshore passages. Nearly all began with taking small steps, inshore day passages progressed to longer, multi-day inshore passages, which progressed to offshore passages. Learning how to read a chart, and dead reckon progressed to (mostly) mastering celestial navigation. Reading about the passages of others, as you mentioned, is yet another invaluable learning tool. Along the way I learned the argot of the world of boats, the sea and navigation, a necessary and important, and today all too often overlooked, step in this journey. I implore all existing and aspiring boat owners to learn and use proper nautical terminology, starting with deck, bulkhead and overhead, rather than floor, wall and ceiling. For the benefit of Marine Systems Excellence readers, a 'ceiling' is the inside part of the hull that can be seen from the cabin, rather than what's over one's head.

While I'll confess, I don't long for wood, hemp and cotton (well, maybe at a classic boat show), I welcome a dry berth and good hot food, there's simply no excuse for skipping essential steps when developing critical seamanship skills.

Hi Steve

I've read your articles on this topic of engine loading and longevity with interest, as well as other articles on the subject and I'm somewhat confused.

There seems to be disagreement around what 'loading' actually means.

Some use RPM as a surrogate, others refer to the manufacturer's rated power curve, fuel consumption at a given RPM as a surrogate for power, and also the propeller power curve. Tony Athens at Seaboard Marine categorically states (with 30 years of engine repair to back his opinions up) that marine diesels should be cruised at under 50% of rated power but you state that a diesel engine should be run at “80% of its output capacity for 80% of the time”. And you carefully explain the consequences of low-speed running. And yet others state that low-speed running is fine so long as the engines are at the manufacturer’s recommended operating temperature.

My boat has a semi-planing hull with twin 270 hp Cummins 6BTA engines and can achieve full RPM (2600) with full fuel and water tanks and other cruising gear on board (suggesting it is properly propped). At 1600 RPM I’m doing 10 to 10.5 knots (no adverse currents etc) while burning 3.5 gallons per hour per engine. This equates to 70 BHP (26% of maximum rated power) per engine using a standard fuel burn rate of 20 gallons per hour per horsepower whereas my RPM from the Cummins rated power curve equates to 197 BHP per engine, or 73% of rated max power. Also, the Cummins charts show that 1600 RPM equates to a fuel burn of 3.8 gallons per hour in their standardized testing; pretty close to my 3.5 gallons per hour.

I’m sure there is a simple explanation for these discrepancies but since it’s such an important topic for those of us with diesel engines who want to reduce our carbon footprint – and our fuel bills! – but not ruin our engines by underloading them, I hope you can illuminate the topic with your usual clarity and wisdom.

Thanks for your help with this.

Chris Sherlock

**Dear Chris:**

This is a subject that never stops generating questions, and that’s a good thing.

The 80-80 rule is a rule of thumb, and far from etched in stone.  It wouldn’t apply to many, but not all engines )and it presumes the boat builder has selected the proper size engine, something that seems to be a rarity these days, far too many vessels are over-powered, particularly those of the full displacement variety). Hard running can be problematic for them. I know and respect Tony's expertise and experience. However, where planing vessels are concerned, for instance, limiting continuous operation to 50% would, if nothing else, lead to some very dissatisfied boat owners, and may put the boat in the half on-half off plane, something that's always to be avoided. And, after all, why pay for all that horsepower if you can't use it?

The way power or load is measured isn't as critical, it's an estimation for the most part. Electronic engines include load and throttle position indicators, simplifying life for mechanics as well as operators. In the absence of these, however, a rough estimation of power can be derived from rpm and the engine manufacturer's power curve data.

The correct operating temperature issue can be deceiving as well, as it depends a great deal on what temperature is being measured, coolant, oil, or exhaust gas? Coolant will nearly always be at the right temperature as it's thermostatically controlled. Oil however, except in some rare cases, isn't (some engines rely on a closed cooling heat exchanger, which essentially keeps oil at or near coolant temperature, which is ideal). When chronically lightly loaded, oil tends to run comparatively cold, under 180°F. When it does operate in this chilly region it is much more likely to generate sludge and then varnish deposits, both of which are harmful to engines as they can block oil flow to bearings, cylinder walls, rings etc. Exhaust gas, when "cold", under 500°F has its own host of issues, including carbon/soot build up on valves, rings and turbos, which again impedes oil flow, and clog rings thereby promoting blow-by and oil consumption, all of which can also affect efficiency. In catastrophic cases the piston rings and turbocharger will become impacted with carbon, and there will be predictable lubrication failures, resulting in piston and liner scoring when the rings finally seize in the pistons, and can’t move to accommodate normal thermal cycling. Modern electronically injected engines can offset some of these issues by avoiding over fueling, however, they can’t make exhaust gasses hotter and they can’t warm up oil (unless they are equipped with an jacket water oil cooler, otherwise if the engine isn’t loaded enough to produce sufficient heat to warm up the oil to the ideal 180°-225°F then the oil will remain cool).

The bottom line is, many engines will be under-loaded on both displacement and planing vessels, particularly the latter when at displacement speed. The best alternative approach in these cases involves periodically, 10-15 minutes out of every four hours, operating the engine at higher load, high enough, somewhere between 50% and 75%, to get the oil and exhaust gasses into the ideal range. You can measure oil temperature using an infrared pyrometer on the side of the oil pan. For testing purposes, in the absence of an exhaust gas pyrometer, you can carefully measure a section of the dry pipe exhaust immediately after the turbocharger. It will be cooler than the actual gasses, but not much. Once you have that reading at a given rpm, it should remain constant, negating the need to measure it again.

**Steve,**

Thanks so much for this very clear explanation of the issues. I can now operate my boat with an understanding of what is actually happening in the engines. I do have an infrared pyrometer so I will follow your advice regarding measurements while under way.

I heartily encourage you to keep up your strong advocacy on behalf of us boaters for excellent practices in boat building and maintenance. You are doing a great service to the entire industry – even though they may not appreciate that right now!

Cheers

Chris

**Steve,**

I love your column. I am looking for a little pump that will suck up that last qt. of annoying water in my bilge especially in a little aft compartment which seems to be lower in the water than the main bilge pump can access.

Bruce Adornato

**Bruce:**

For bilge “drying” you have two options.  One, use a remote, displacement, self-priming pump.  This sort of pump is mounted well above any water, with a hose that leads down into the lowest part of the bilge.  A strainer or “foot valve” is installed on the end of the hose to catch debris and to direct the suction as low as possible, enabling more water to be removed.

The second option is to use one of the new low profile submersible pumps.  These are centrifugal, rather than displacement, and thus are not self-priming, however, that’s doesn’t matter because their pick up vents are so low they can suck up water much like a self-priming pump.  Whale Pumps makes a nice version called the SuperSub.

The remote mount, self-priming pump can probably be coaxed to get more water out of a bilge, especially if there’s a small well, so if that’s your goal I’d go that route.  If ‘most but not all’ meets your needs, then go with a low profile, centrifugal submersible model.