August 2024 Newsletter – Stainless Steel Raw Water Plumbing

Photo Essay: Stainless Steel Raw Water Plumbing

Stainless steel is undoubtedly the most commonly used boat building hardware alloy, and with good reason… it's durable, strong and for the most part maintains its luster for years with little attention. While alternatives like bronze exist, stainless steel fills an important niche. However, for all its attributes, stainless steel does have weaknesses, some of which are insidious.

In order for stainless steel to remain corrosion-free, it must have a ready and continuous supply of oxygen, either by exposure to air, or oxygenated, i.e. moving, water. As long as the air supply is present, stainless steel can maintain its tough but transparent oxide coating. Rob it of oxygen, and stainless steel will quickly transition from passive, and corrosion-free, to actively corroding; this is known as crevice corrosion.

Yet another malady that is peculiar to stainless steel is known as carbide precipitation, or weld migration. This occurs when high carbon stainless steel is welded; the elements that afford stainless steel its corrosion resistance are driven out of the regions adjacent to the weld. This phenomenon can easily be avoided by using low carbon, denoted by an L suffix (such as 316L) stainless steel alloy.

In the example shown here, a section of welded stainless steel pipe is freely corroding at the weld, and leaking. This is

likely the result of weld porosity, a welding defect, which entrapped water, which in turn lead to crevice corrosion. For raw water plumbing, bronze or glass reinforced Nylon are preferable to stainless steel.

Ask Steve

Steve,

I read your 2020 article on Ground Plate Installation with interest. I did precisely that with a previous vessel back in 1985 and used it solely for “lightning protection” under the old “cone of protection” concept, which appears to be no longer accepted. Last year I installed an engineered dissipating system at the top of the mast of my current vessel. It doesn’t use grounding cables and plates.

I am writing you on the topic of electrical system grounding. Conventional wisdom is to use the engine block as the “ground”. I perceive a key component of this wisdom seems to be the need for sacrificial zincs to absorb galvanic issues – which are placed on the propeller shaft. What are your thoughts on using a ground plate, whether a longitudinal or square plate, as the ground. My issues with using the engine block stem from the problems that arise when bilge water comes in contact with the oil pan of the engine, creating an alternative path that results in a potentially dangerous situation and battery drain / oil pan leak. Twice in 30 years this has happened – when I have failed to daily attend to pumping the bilge during prolonged battery disconnected periods. The last time being last week (I am currently in a re-wire of AC/DC systems from source through panels – to upgrade and clean them up – old system was original construction). The net effect is a hole is made in the oil pan that results in a mess and very difficult repair, i.e. remove,

repair and replace the oil pan. I recognize that Dynaplates are not electrical system ground plates – but a thick pure copper plate with silver soldered and bolted on pure copper bar drilled out and tapped bolt connection – should be.

Please provide me with your thoughts. I don't recall why I elected not to do it last spring, but now, I am focused on the ugly mess I am dealing with and revisiting the issue.

Ernie Artiz

Ernest:

ABYC Standards do allow for the engine block to be used as a grounding bus, however, there are nuances which I believe actually preclude this form being done in most cases. The relevant standard, E-11.17.1.1, states, *"If a DC grounding system is installed, the DC grounding conductor shall be used to connect metallic noncurrent carrying parts of DC machinery and engine blocks to the engine negative terminal or its bus for the purpose of minimizing stray current corrosion and ensuring a fault current path in the event of a short circuit",* I've added the highlight. If the engine block is current-carrying, i.e. the block is used to convey starter or alternator current, as is often the case, then it should *not* be bonded, it should not be used as a DC grounding or bonding bus. It would of course still be connected to the DC negative circuit.

Typically, propeller shaft anodes protect only the shaft and prop. Because the shaft, and its anodes, are connected to the engine through the oil-filled medium of the gearbox, it is very unlikely any current would flow. Even if it did, via a proper shaft brush that met the ABYC-mandated 1-ohm maximum resistance, shaft anodes would still not provide any protection to the engine, internally or externally, even if the pan were immersed in bilge water; these components are simply too far removed from the anodes to be afforded any

protection. The average $20 shaft brush, by the way, is ineffective as it is incapable of achieving the 1 ohm or less resistance requirement. In order to meet this standard a silver slip ring brush must be used, more on those here.

Regardless of whether or not your engine block is bonded, allowing the oil pan, particularly if it is steel, to become immersed in water is never a good idea. Even in the absence of stray current, a steel pan will quickly rust. Furthermore, an engine block being bonded, or simply connected to DC negative, will not promote corrosion (bonding does reduce the likelihood of stray current corrosion, more on that here. While the water may present an alternate return path, it is in the negative side of the circuit, and would be no different than a bonded through hull, strut or ground plate for that matter. If the starter positive cable were to become immersed, that would be an entirely different matter, and stray current corrosion would likely occur.

If the engine block is not current-carrying, i.e. the starter and alternator use separate DC negative cables, then it can be bonded, however, the bonding cable must be large enough to safely convey full fault current – it should be only one connection/cable – in the event of a short circuit from the largest ungrounded cable, which is typically the starter's positive cable.

Regardless, I am not an advocate of using the engine block as a bonding or DC grounding bus per se, for non-current carrying blocks, I prefer to see one DC negative cable, and one large bonding cable, connected to the engine block, and all other connections made via a separate bus bar. Again, current-carrying blocks should not be bonded.

There are advantages to installing a solid copper ground plate, primarily for lightning mitigation, more on that subject here and here. If installed, it should be connected to the vessel's bonding system in accordance with ABYC TE-4.

Hello Steve,

I have a couple questions concerning your article on Selecting Primary Fuel Filters in your eMagazine dated April 19, 2022. In the article you state that if a filter element shows no vacuum restrictions, there’s no reason to replace it.

I attended an online training course for Northern Lights generators last year. The instructor said that even if you haven’t used your generator enough to justify an oil and fuel filter change, it is still needed annually, because the filters are held together with glue and the oil and fuel breaks down that glue and the filter could fail internally. Have you heard of this happening? I personally like your idea, of not changing the main fuel filters if the site bowl is clean and free of contaminants.

Second question, concerns converting my two red label Racor 75/1000FGX fuel filter/water separators, installed on my Cat 3208NA engine, to being ABYC marine compliant. Your article states that you can simply add a heat shield and install metal drain valves and plugs. Is that all there is to it? Or should I replace them with new blue label Racors? I do have a vacuum gauge installed, as well as a water in fuel (WIF) sensor.

Thank you for being such a great source for learning about proper and safe boat care and maintenance.

Jeff Robinson

Jeff:

I know the instructor, he is a colleague and friend, and while we agree on most technical subjects, this is one on which we do not agree. I have no issue with annual filter replacement, even if the vacuum gauge indicates the filter is clean, however, high quality, OEM filter elements will not

disintegrate if they remain exposed to fuel for longer periods. Do you think every filter element is changed annually? Tens of thousands of filter elements remain unchanged for years in many cases. If they were disintegrating it would be widely reported. I've replaced hundreds, perhaps thousands of primary filter elements in my career and have yet to encounter one that was failing because of prolonged exposure to fuel. A conservative approach calls for replacement when warranted by high vacuum readings, or annually, whichever comes first. This is the article to which you are referring. This article on vacuum gauges may also be of interest.

Indeed, for recreational, i.e. non-USCG inspected, vessels primary fuel filters can be converted to the MA configuration (which is ABYC compliant) with the addition of a heat shield and UL Marine approved metallic valve. There is no need to replace the entire filter assembly.

Hi Steve,

I have been addicted to your column for years, thank you!

I have a 40ft SABRE 2008, with twin Cummins 5.9 QSB's 425hp, and Duel Garmin 7212 chart plotters.

Do you recommend prophylactic separation of the Cummins electrical connections and the Garmin connections, and placement of a dielectric spray or grease on a regular basis? If so, what product would you recommend?

Thank you for all your help throughout the years.

Elliot Siegel

Elliot:

Engine harness multi-pin connector plugs are among the most

common causes of propulsion system malfunctions, from erratic gauge readings to engines failing to start or stop. They are often not inspected until trouble arises; and herein lies the problem.

Some of these plugs use a sleeve type design, that in theory excludes water, these are usually round, while others have no such protection, they are frequently flat. Regardless of which type of plug is used, they should be separated and inspected if that’s never been done during your ownership. Look for corrosion or signs of overheating. If the former is present, it can be cleaned with a proprietary spray electrical contact cleaner and a stiff non-metallic brush, and then compressed air if available. If it looks like the plug has overheated or arced, unless the damage is very minor, it may need to be replaced, likely with a terminal strip.

If your plug is in good shape, or if it cleans up back to new condition, you can apply a *light* coat of dielectric grease, include the sleeve to enhance water resistance, available at most auto parts stores, and of course on line. Once applied, it should be good for the life of the plug.