April 2024 Newsletter – Steering Components

Photo Essay: Steering Components

Steering falls into what I call one of the three critical systems, along with propulsion and raw water plumbing/watertight integrity. On many vessels, the “steering flats”, the area where steering gear is located, are either difficult to access, infrequently visited, or both; and that’s a recipe for failure.

In the attached image, a hydraulic steering ram articulating ball end fitting is shown, which is interfaced with a rudder tiller arm using a conventional hex head cap screw. This interface is critically important, the fastener must be tight enough to ensure its movement, along with that of the ram end ball, is fixed to that of the tiller arm; they must all move together, ensuring that any friction occurs between the outside of the ball, and the inside of the ram end cage that supports it; this area is lubricated with grease, that is replenished with the visible zerk fitting. The fastener must not be allowed to move within the bore of the tiller arm. Zerk fittings are becoming increasingly rare, many ball ends are now “lubricated for life”. I’m a fan of zerk fittings, there’s something cathartic about applying a few strokes of grease to a important component.

In the accompanying image, the ball is clearly “dry”, as is the zerk fitting, it does not appear to have been greased recently, if ever. Check your steering system for zerk fittings and be sure to service them regularly, even if grease is visible, adding new grease will displace the old, which can become dry and contaminated with water, metal and dust.

Ask Steve

Steve,

I own a 2003 38 Tiara Open with 450 hp 3126B Caterpillar engines.

The boat was recently surveyed by a mechanic who told the buyer that the mufflers had rubber drain plugs. He stated that this was dangerous as the proximity of heat could melt the plugs and result in a sinking!!

The buyer withdrew from the transaction in reliance upon this surveyor.

My questions… where is this plug, are rubber plugs inappropriate and where would one get replacements?

Thank you.

Peter Merchant

Peter:

Without photos I'm surmising that the "wet", fiberglass mufflers are equipped with drains (for winterization purposes, they are located at the bottom of the muffler), and those drain holes are filled with expanding rubber plugs, like those you might find in the transom of a small vessel. Again, I can't be certain, however, I suspect that's not original equipment from the builder, so this may be a modification performed by a previous owner. If those plugs are below the waterline and there is no riser between the muffler and the transom, that could indeed result in flooding if the plug failed or was removed.

The temperature of a properly designed and operating wet

exhaust system typically does not exceed 165 degrees Fahrenheit; it’s unlikely this could affect the plugs any more than it would affect the fiberglass components. Having said all that, expandable rubber plugs are not ideal for an application like this, if the plug dislodged, flooding could result, and while mufflers are required to have drains for ABYC compliance, they should be positive, metallic plugs or valves. I would imagine those could be relatively easily retrofitted. Walking away from the deal for this reason alone seems extreme, a fix could have been negotiated.

Steve,

Recently discovered paint missing around multiple thru hulls and around strut connections (twin engines). Boat spent winter at private dock (Glebe Creek off Potomac). Anodes in good shape. Boat, 52′ Ocean Alexander, initially for a different repair. I have asked my yard to check boat for cause, also electrician who installed service to dock is hopefully inspecting for any issues. Owned vessel since October 2017, no issue until now.

Galvanic isolator installed on boat, having it checked. Electric service to the dock was installed between May and July 2022. Boat was at our dock from July 2022 except for several trips around the Bay until October ’22. The boat was docked in Deltaville at Norview for 2-3 weeks last October for completion of some engine work.

Any incite is appreciated.

Bill Noftsinger

Bill:

There are several potential causes for halos appearing in bottom paint adjacent to underwater hardware. The most common

is cathodic over-protection, i.e. too much zinc. Over-protecting underwater metals leads to the production of alkaline around them, which can attack bottom paint. For fiberglass vessels, it’s not harmful per se, except to the paint, however, it can cause damage to both timber and aluminum hulls.

Another cause is leakage of shore power, 120 volts, through bonded underwater metals. This can be caused by faulty wiring aboard, or on the dock, including reverse polarity (your reverse polarity light, located on your main panel, should illuminate if this is present, assuming it is working; it too should be tested). This too is not necessarily harmful to a fiberglass hulls or most underwater metals, however, it is an indication of a serious fault, *one that can be deadly*, so it should be identified and resolved quickly. More on that subject here.

Testing for these phenomena is relatively easy provided you heave the requisite skill and experience. Initially, the polarity can be tested with a test tool like the one shown here. This, or one like it, should be in the tool bag of any technician who is troubleshooting electrical issues.

Then, a silver/silver-chloride reference cell can be used to measure the amount of protection being provided by anodes. Other tests would include measuring current flow on your shore power green grounding conductor, as well as the blocking effect provided by your galvanic isolator, which is a must for any vessel equipped with shore power; it should be an ABYC A-28 compliant “fail-safe” version, or isolation transformer, if present.

Well-meaning, but untrained, technicians can waste a considerable amount time tracking down perceived causes for corrosion, and electrical-related issues in particular, while lightening your wallet. Corrosion is, in my experience, by far the most misunderstood and misdiagnosed issue within the

marine industry. Ideally, in order to find the cause most expeditiously, analysis should be carried out by an ABYC certified corrosion technician, you can find these by searching here.

This article on haloing may be helpful, as well as this one on testing cathodic protection levels.

This article on galvanic isolators explains how they work and why they are necessary.

This article_on corrosion in general may also be helpful.

Hi Steve,

I have a boat repair shop in Sitka, Alaska which builds and repairs aluminum boats. When I started the shop in the mid-eighties, aluminum hulls were very rare. Today in this region, aluminum is the most popular hull material, especially for sport boats.

Over the past 30 years we've learned a lot about what works and what doesn't. One of the most common hull problems we get is pitting in the bilge. Very often it's under a fuel tank or other structure, hidden from inspection. The pitting is typically wide-spread, and closely spaced. We find it any place where stagnant bilge water accumulates. Often the boat owner asks us to do a weld repair, but that's not always practical; it's very time consuming and difficult to achieve a sound repair. In most cases, where the pitting isn't deep enough to threaten the hull integrity, we mechanically clean the pits to bright aluminum, and thoroughly acid-wash the hull plating. We then prep and coat the entire bilge area with Ameron 235 or another epoxy coating for aluminum. We also explain the situation to the boat owner and impress on them the importance of a dry bilge for an aluminum boat. That has been our repair for the past 10 years or so, and we haven't

had any comebacks or failures.

I am very interested in hearing your thoughts on the subject, and also how we can prevent pitting in the first place.

Best regards,

Michael Litman

Michael:

I've been to Sitka several times, as recently as last summer, and have enjoyed among other things the Russian Cemetery and Raptor Center.

Aluminum corrosion is one of the least well understood phenomena in the marine industry. Counterintuitively, in most cases, aluminum is best when left uncoated; under those conditions it is exposed to air, which in turn allows it to develop its ultra-tough oxide film, which deters but does not entirely prevent at least one type of corrosion, more on that in a moment. When robbed of interaction with air, when exposed to stagnant bilge water for instance, as you note, it can go from a passive to a freely corroding state. A ready supply if fresh air is key to its longevity.

Aluminum is susceptible to several types of corrosion; the one that you describe is referred to as poultice, and all that's required for it to occur is moisture, and an oxygen-poor environment.

Being the third least-noble metal in the galvanic series, aluminum is also highly susceptible to dissimilar metal or galvanic corrosion. When in contact with any other metal save two, zinc and magnesium, and in the presence of an electrolyte, i.e. water, fresh or salt, aluminum will corrode to greater or lesser degrees. Inattentive electricians who drop copper wire clippings into the bilges of aluminum vessels may be guilty of causing galvanic corrosion damage. Ideally,

copper alloy plumbing should not be used aboard aluminum vessels, and where it must be used, it should be encapsulated in paint, or a drying corrosion inhibitor such as CRC HD Corrosion Inhibitor, to prevent leakage or run off, even condensation, from HVAC carrying with it salts of copper, which can embed themselves in aluminum plating, where they will eventually take their toll. Mercury-bearing switches and thermometers should also never be used aboard aluminum vessels, as mercury is nobler than aluminum, and will cause corrosion if released into bilges.

Aluminum is also susceptible to stray current corrosion, primarily DC (from batteries), however, high current AC (from shore power) scenarios are also known to be injurious to aluminum as well.

Aluminum is amphoteric, which means it is susceptible to attack from both acid and alkaline chemicals.

In spite of all these vulnerabilities, aluminum is widely used in the marine, aviation, automobile and many other industries. Provided one understands its vulnerabilities, it can serve well in these roles.

Your “dry bilge” advice is sound, however, in my experience, it’s simply not followed. Where an aluminum hull is concerned, there’s only one thing worse than a wet bilge, and that’s a wet, dirty bilge. Dirt and debris serve to keep aluminum both wet and deprived of oxygen. Hygroscopic materials like insulation, carpet pile, and timber can all accelerate the poultice corrosion process. Even non-hygroscopic materials like rubber can still trap stagnant water against aluminum.

Once again, counterintuitively, paint coatings are one of the leading causes of poultice corrosion. If, or when, the coating is breached, water can migrate between it and the aluminum, where poultice corrosion will thrive. If one must

coat aluminum, the key to paint longevity, and keeping corrosion at bay, is maintaining the integrity of the coating. Where ever it must be penetrated, by a fastener or flange for instance, it must be amply bedded in sealant, to fill the inevitable breach that occurs as the fastener's head or flange base makes contact with, and fractures, the paint. I do my very best to convince my clients and readers to avoid painting aluminum where ever possible, although anodizing is acceptable, and above all else, *avoid powder coating* aluminum, as its adhesive strength is very low, far lower than two-part paints, and even most single part paints.

I suspect your acid wash and two-part epoxy approach has been successful because that coating is able to remain mostly contiguous, i.e. un-breached by fasteners and other fittings. Beware, however, if the coating is penetrated via the smallest nick, scratch or ding from a dropped tool, engine part, or loose gear, water will make its way under the coating, where poultice corrosion will gain a toe-hold. You should make it clear to your customers that this coating must be inspected regularly for such damage, and the telltale poultice blisters that inevitably follow. If caught early, touch ups are possible.

More on aluminum corrosion here, here and here.