# August 2023 Newsletter: Livewell Pump Installation

## Photo Essay: Livewell Pump Installation

Raw water plumbing fittings, particularly those below the waterline, must be rugged and reliable. ABYC Standards dictate that, “A seacock assembly, including the thru-hull and tail piece, shall be securely mounted so that the assembly will withstand a 500 lb. (227 kg) static force applied for 30 sec to the inboard end of the assembly, without the assembly failing to stop the ingress of water”. Additionally, the standard mandates that, “Threads used in seacock installations shall be compatible (e.g., NPT to NPT, NPS to NPS).” As simple and straightforward as these guidelines appear, I routinely (as recently as just days ago) encounter violations committed by not only boat owners and DIYers, but industry professionals and boat builders, some of whom are well known, with otherwise excellent reputation, and who profess to be ABYC compliant.

In the accompanying image, taken aboard a relatively new vessel, live well pumps have been installed directly atop a pair of seacocks It is highly unlikely these assemblies would pass the aforementioned static load test, particularly with the added leverage of the plastic pump or heat exchanger, where the load must be applied. Ideally, the only think that should be threaded to a seacock, is a pipe to hose adapter, after which other components can be plumbed using flexible hose, thereby eliminating the leverage issue. It seems some installers and builders believe they are improving the reliability of the installation of raw water plumbing by eliminating a section of hose. In fact, they are increasing

the vulnerability with added leverage.

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# Ask Steve

**Steve,**

I have been reading everything I can find on your website regarding diesel fuel tanks and systems.  We have a sailboat with a leaking 58 gal. diesel tank.  The attached short video shows the leak bubbles in soap solution with 2 psig in the tank.  The tank was built in 2004, and is 304 stainless.  The original builder did not retain records to indicate whether it is 304, 0r 304L.  Judging by the way the welds have corroded, it is probably just 304, but I don’t have the experience to say for sure.  I pressure tested the tank at 3 psi for 10 minutes.

As I see it, I have three options.

First, a weld repair to the spot where it is leaking.  This requires a competent sheet metal welder, and the work would have to be done with the tank inside the engine compartment, but it can be turned so that the weld area is accessible from the deck hatch.  Since the overall condition of the weld is unknown, other leaks can develop at other locations later on.

Second, I can lay a bead of polysulfide aircraft fuel tank sealant all around the bottom welds, and partially up the sides.  The tank does not have inspection plates, so I would cut 6 inch holes in each chamber to add them and provide access to apply the sealant.  This could fail due to inadequate surface prep, or operator error, or tank flexing and separating the sealant from the steel surface.  Alternatively, or even additionally on top of the paste

sealant, I can use the low viscosity sealant and coat the bottom of the tank to seal the leak.

Third, I can cut up and remove the old leaker and install new aluminum tanks.  There would be two tanks each sized to fit through the deck hatch, and plumbed together with a 5/8 inch A1 hose.  I can either fill both through the existing deck fill, or add a second fill to speed up the fueling process.

The advantage to new tanks is that I can get more fuel than the old single tank, since there is unused space in the tank compartment.  This will probably require additional support.

I’m leaning towards new aluminum tanks since this seems to have the lowest risk of future leaks.  I have a preliminary quote from SP Sheet Metal in Cape May, NJ.  Can you recommend them?

Do you recommend NPT drain plugs in the bottom, or a stripper tube?  The athwartships dimension of the tanks will have to be less than 30 inches since I can only put inspection plates on one side, unless I want to remove the tank from its compartment to access other inspection plates.

I’ve been reading your website for three years.  It has been a great help to me.  Thank you for your time.

Rich Scillia

**Rich:**

Stainless steel, while approved for use by American Boat and Yacht Council (ABYC) Standards, provided they meet the established guidelines, is an unpopular material for fuel tank fabrication.  In your case it sounds as if the failure is the result of a material defect, i.e., the corrosion adjacent to the welds as a clear indicator that the alloy is not low carbon, which makes it unsuitable for welding, which in turn is a violation of ABYC Standards.

It is, therefore, likely the problem will continue to manifest itself even if spot repaired, either by welding or patching. Furthermore, patching with compounds or coatings is especially challenging in the case of a used fuel tank, as it is extremely difficult to clean the surface adequately prior to their application. If, when, the coating fails it will manifest itself as yet another problem, a clogged fuel filter or pick up.

Your plan for tank replacement, while unpleasant economically, it the best approach. You might consider off the shelf roto-molded polyethylene fuel tanks as an alternative to aluminum. If you opt for the latter, my recommendation would be for uncoated/unpainted, while ensuring they cannot stand in water, and water cannot be trapped against them.

Drains are permissible on diesel tanks, if you are having the tank fabricated from aluminum, you can include a well in the design, one that will capture water and debris, which can then be removed via a drain in the bottom, not side, of the well. The well should be fabricated of no less than ¼" 5000 series aluminum alloy; all plumbing, NPT thread is common and acceptable, that makes direct contact with the tank should be stainless steel. If the bottom of the tank is not accessible, a stripper tube whose pickup extends to the bottom of the well is an alternative.

Inspections plates should afford access into every baffled chamber, they can be installed in the side or top, even if accessing them means unshipping the tank. Tanks should be pressure tested before they are installed.

The tanks themselves, as well as their installation, should be fully ABYC compliant.

Finally, while I'm unfamiliar with the fabricator you mentioned, you should rely only on those who specialize in fuel tank fabrication, and are familiar with ABYC Diesel Fuel

Tank design requirements, rather than generic fabrication shops.  Tank fabricators, competent ones, will help you avoid design errors, and they will, or should, understand ABYC guidelines, with which the tank should comply.  These include…

ABYC H-33 Diesel Fuel Systems

33.18.4 Design, Construction, and Testing

33.18.4.1 Nonintegral fuel tanks shall be capable of withstanding mechanical strength tests as described in H-33.21.

33.18.4.2 The test pressure shall not be less than three psi (21 kPa) (see H-33.21.1).

33.18.4.3 The tank design shall be such that no exterior metallic part of the tank will trap water when the tank is installed as intended with the boat in the static floating position.

33.18.4.4 If baffles are provided, the total open area provided in the baffles shall be a maximum of 30% of the tank cross section in the plane of the baffle. Baffle openings shall be designed so that they do not prevent the fuel flow across the bottom, or trap vapor across the top of the tank.

33.18.4.5 Threaded connections into fuel tanks shall be in accordance with American Standard Taper Pipe Thread (NPTF) and shall provide for thread engagement in accordance with TABLE 5.

33.18.4.6 Rigid tubes and fill pipes that extend near the tank bottom shall have clearance to prevent contact with the bottom due to flexing of the tank.

33.18.4.7 If the fuel pick up tube and/or return tube is not furnished as part of the tank, the tank manufacturer shall provide a detailed construction print of the installation.

33.18.4.8 Each tank shall be tested prior to installation to the maximum pressure indicated on the tank label. The fuel tank shall evidence no leakage under such testing. The test pressure shall not be less than three psi (21 kPa) (see H-33.21.1).

Finally, you may find these articles useful…

- Diesel Fuel Tank Design
- Fuel Tank Installation
- Diesel Fuel Tank Cleaning
- Stainless Steel Corrosion

**Steve,**

I have a 1968 41 Hatteras with 500 HP Caterpillar C7.1 engines, with about 350 hours.  We have two 200-gallon fiberglass fuel tanks (original).

We are having problems with one of the fuel tanks. Our Racor 30-micron fuel filter is now getting clogged at the diffuser.  Due to the tier 3 compliant engine, the engine will show an error code and will throttle back to about 1,600 RPM.  This happened on our last 2 offshore fishing trips. We have to call CAT to get them to clear it out with their software.

We are thinking about cutting a two-inch hole at the top of the tank near the back of the tank where it’s somewhat accessible to possibly install a polisher.

I don’t want to pull up the whole deck.

I read your article on fuel polishing, but I’m not sure what some reasonable options might be.  It’s only a 200 gallon tank and we have changed primary and secondary filters religiously.

If you were me, what would you do?

Thank you.

Brian Zieverink

**Brian:**

Fiberglass is among the most durable and long-lived materials for diesel fuel tanks, it is my tank material of choice, so the likelihood of success in this case is very good, once cleaned the tank should be as good as new.  That's not something I'd necessarily say for a vessel of this vintage, with metallic tanks.

If the filter is clogging chronically, then the only long-term solution is to get into the tank, and preferably into every baffled chamber.  There are off the shelf inspection port kits that can be installed, however, because the tank is fiberglass, you may have to make flanges using thickened epoxy, to create a true surface to which the port's gasket can seal.  I've done this on Hatteras models.

For a vessel of this age, it's very likely the tanks will be heavily contaminated, to clean them I'd recommend, once again, access into every chamber, and then use of a hot water pressure washer.  You can read more about this process here.

Once that's complete, or in conjunction with the tank access project, you could install a polishing system, one that picks up from the bottom of one end of the tank, and returns to the bottom of the other end of the tank, thereby creating a current across the tank bottom.  I've written about fuel polishing systems on several occasions; I'm not sure which article you read, however, this one is the most comprehensive, it's written for marine industry professionals.

**Hello Steve,**

In your experience, has anyone ever defined for you the

meaning of “Diesel Fuel Lubricity”, beyond just the words? I have looked high and low for a technical definition by anybody and I have found nothing.

Put another way, outside of the ultra-low sulfur diesel fuel excuse, do you know what causes diesel fuel to have poor lubricity?

Thank you for your time.

Kindest Regards,

Mike Colburn

**Mike:**

Diesel fuel lubricity is a function of the fuel’s ability to prevent wear between surfaces.  It is measured using an ASTM – D6079 HFRR High Frequency Reciprocating Rig Test, which creates a measurable wear scar.

It’s important because fuel is the primary lubricant in high pressure fuel injection pumps and injectors, where parts are subject to thousands of pounds of pressure, high rates of movement and in high heat.  The fuel’s lubricity, provided it’s adequate, keeps friction and wear to a minimum.

While I believe claims are exaggerated, ultra-low sulfur diesel fuel can have issues with lubricity, as the removal of sulfur, using a process known as hydro-treating, also removes some of the fuel’s lubricity (contrary to popular belief, the sulfur itself is not a lubricant in diesel fuel, it is its removal process that results in loss of lubricity).  The lubricity is then replaced using an additive, often bio-diesel, which is added at the fuel or distribution depot’s rack.  In rare cases it’s possible this additive step is omitted, or carried out incorrectly, resulting in off-spec fuel whose lubricity is below the acceptable threshold

More on diesel fuel here, and additives here.