

June 2023 Newsletter: Fuel Tank (no) Support

Photo Essay: Fuel Tank (no) Support

Structural failures of fuel tanks are nearly always traceable to either installation or construction flaws, with the former being far more common. In a word, and regardless of tank material, it's all about support. The less a tank is stressed, the more likely it is to be long-lasting.

Ideally, tanks should be supported continuously across their entire bottoms; this usually entails placing the tank on, and through bolting it to, a sturdy shelf. Metallic tanks should be elevated about $\frac{1}{4}$ " above the shelf surface, on strips of non-compressible material (rubber and rubber-like material should not be used as they will compress), which can include prefabricated fiberglass, known as GP03, or Coosa, high density core, which in turn should be fully bedded to the tank bottom, using polyurethane bedding compound. This approach will prevent the tank from standing in water, and it will prevent water from migrating between the shim material and the tank itself, where corrosion could gain a toe-hold. For more on fuel tank installations see this article.

The tank shown here is resting in this vessel's stringers alone, applying significant point loads, which often leads to stress cracking. Furthermore, two of the four rubber strips that were placed between tank and the stringers have fallen out, leaving a gap, as well as eliminating the tension on the securing fasteners, both of which were found to be hand tight. This is a 30-knot vessel, which can experience significant slamming loads, further stressing this installation.

Ask Steve

Steve,

I am getting ready to install my new 42-gal poly tank in a boat that I'm doing a complete restoration in... stringers, transom, everything.

I went to dry fit my tank and noticed a substantial void, anywhere from 3/8 on edge to 1-1/2, in middle. Because it's tapered, I can't simply slip some rubber underneath, whatever I use must also be tapered.

The tank is locked in by two fiberglass straps that are notched into the tank via grooves in the top of the tank. How should I support the bottom of the tank? I plan on leaving a 2-in canal down center.

Any thoughts or specs would be greatly appreciated. Is this even something to be concerned about? The edges of tank are touching and makes contact but that's it.

Thank you.

Sincerely,

Albert Carvahlo

Albert:

The bottom of the tank must be supported, and this is especially so for a poly tank. Many builders would simply lay a PVC pipe in the bilge as a limber tube and then set the tank in foam. While that was common for quick production building, the preferred approach is a shelf. The shelf material needs to be strong, and stiff, enough to support the weight of a full tank under anticipated slamming g-loads, and of course it

needs to be rot-proof, so fiberglass or fiberglass based. A cushion between the tank and the shelf, a sheet of rubber mat, will reduce chafing.

Once exposed to fuel, the tank undergoes a one-time expansion of 2-6%, which must be considered in the installation, using either an adjustable bracket or cushioned supports. The latter's lifespans are often limited, so a proper ridged but adjustable support is preferred.

For more on that subject, see this article on fuel tank installations.

Steve,

I own an 86' trawler with twin C-18 Cats, twin Northern Light 36KW generators, and a 12-8D 24VDC House battery bank. The Xantrex 4000W inverter/charger is the sole charger to the house battery bank.

Recently, the Xantrex unit failed and I had no way to charge to house battery bank. What form of redundancy would you recommend for this problem? A separate battery charger? What size? Or perhaps a generator driven alternator... again, size? Your thoughts, please.

Thank you in advance.

Alfred Fisher

Alfred:

For arrangements of this type, an auxiliary charge source such as an AC-powered charger, is both common and necessary for two reasons. One, as you've discovered, a single charge source becomes a potential single point of failure, which can take down the whole DC system. Two, AGM batteries are capable of initially accepting up to 100% of their amp-hour capacity, and

thus the more charge you can provide for them during the bulk phase of charging, the better, as it will shorten the overall charge cycle when operating from the genset. Twelve 12-volt 8D batteries, at 24 volts, yields about 1300 amp-hours, roughly 50% of which is usable. Replacing that 650 amp-hours will go more quickly if you can utilize an inverter-charger as well as a stand-alone charger, again for the initial bulk phase. A 100-amp stand-alone charger would not be at all uncommon.

You might find these two articles useful:

- <https://stevedmarineconsulting.com/inverter-installations/>
- <https://stevedmarineconsulting.com/wp-content/uploads/2015/10/Battery-Banks-and-Charging-Systems-Venturer-August-2014.pdf>

Hi Steve,

I have a two-year-old sail boat that is displaying blistering below (and just above) the waterline. The hull is 100% vinyl ester resin infused foam core and the boat has been in the water in the tropics since launch.

Build products used include: Hull Resine Swancor 901-VP, Gelcoat DSM Neogel 8373-W-9910, TDS Tuff Coat barrier coat, and TDS Cukote antifouling.

I don't understand how the water is getting through the barrier coat and being absorbed into the gelcoat in such a short period – but I am hoping the VE resin in the foam core has prevented further penetration of the VE resin infused hull.

My questions are as follows:

1. What would cause relatively new hull coatings to blister

so quickly?

2. Assuming the bubbles extend below the gelcoat (I will know definitively once we haul out) would removing the gelcoat (by sanding) below the waterline and, assuming no moisture is present in the VE infused foam core, recoating the hull with two pot epoxy sealants (with subsequent barrier coat and antifouling coatings) be adequate protection for future. If so, would you recommend removing all the gelcoat (entire hull below waterline) or only where blisters have been detected/removed?
3. And finally, would the application of laminate layers using VE resin as recommended in your 2006 Blistology article be required if there has been no absorption into the foam core?

Appreciate any advice you may be able to offer.

John Lovatt

John:

Gelcoat of the ISO/NPG variety is one of the most often used polymers in boat building. It is regularly applied below the waterline. Having said that, much research has been conducted regarding the interface between all types of gelcoats, and laminating resin, including vinylester. It's one of the main sites where water soluble material (WSM) accumulates, which is the catalyst causing blisters to occur via molecular diffusion. Furthermore, it is linked to blistering as a result of stress boundary micro-shearing, which is caused by gelcoat/laminate resin shrinkage variations. In summary, any boundary between differing resin types is prone to WSM accumulation and weaker interlayer adhesion. Generically, ISO/NPG gelcoat has remained an industry standard and while I'm not familiar with BUFA Composites specifically, they seem to be international suppliers of quality resins and other chemicals.

There's also the possibility that the named gelcoat was not used, or it was not applied or catalyzed properly, or the application environment was contaminated, all of which could lead to blister formation.

There is also the possibility that the barrier was not applied properly. It's manufacturer dependent, however, high solids barrier coats must have a dry film thickness of 10 mils. That usually equates to about five rolled-on coats. If it's too thin, water might permeate.

For question 2, all of the affected gelcoat should be removed carefully, avoiding waviness, and replaced with a high-quality epoxy-based two part proprietary barrier coat, preferably one that is made by the same manufacturer as the anti-fouling paint you intend to use to ensure compatibility. You should strive for application of the anti-foulant within the chemical application window to achieve a molecular bond. More on that here.

For question 3, applying VE resin alone is not necessary if the hull laminate is VE, and if you use a barrier, and without glass fiber reinforcement, it will not achieve the necessary thickness to provide a barrier to moisture in any event. In your case, the gelcoat seems to be the issue, once removed the blister issue should be resolved. Technically, VE resin is impervious to blister formation, however, the full barrier application (often two coats are applied for a primer effect alone) is a belt and suspenders approach.

For others, this two- part series may be of interest:

- https://stevedmarineconsulting.com/wp-content/uploads/2014/03/Blistology-Pt-1-PMM-Jul_Aug-06.pdf
- https://stevedmarineconsulting.com/wp-content/uploads/2014/03/Blistology-Pt-2-PMM-Jul_Aug-06.pdf