Completing the Engine Installation

By Pete Dubler

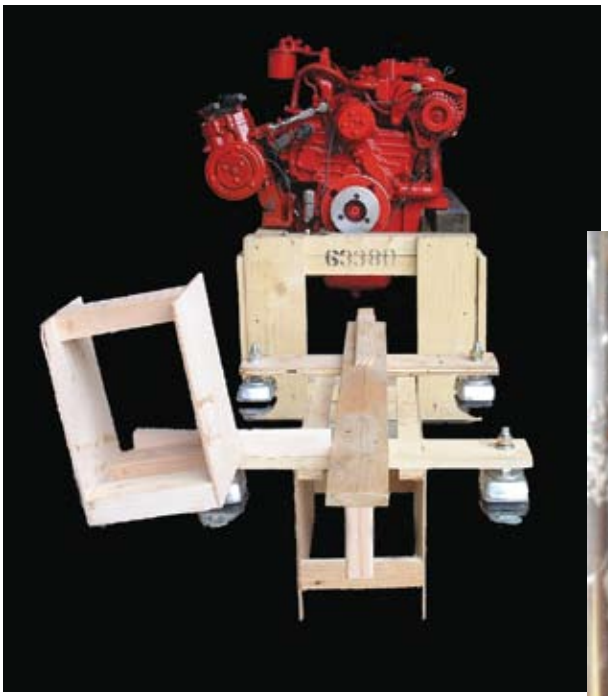
Details, Details

Eleven words I never thought I would utter in the same sentence: "My boat engine delivery was delayed by a volcano in Iceland." Such was the spring of 2010, but no worries—more time to prepare the engine compartment.

With the fuel tank and engine out of the way, the wide-open spaces beckoned for a cleaning and facelift. A good half-day of soaking and scrubbing revealed clean fiberglass under the 30 years of grime on our Pearson 424, *Regina Oceani*.

The next job was to eliminate the drainage problems in this part of the boat. Low spots fore, aft and under the engine bed were eliminated by filling them with structural foam covered by fiberglass. This established at minimum a shallow but constant downward slope from the transom to the bilge. After all, water will not flow uphill to get to the bilge. I also discovered that the lateral beams all lacked limber holes, creating six independent water reservoirs around the engine. Limber holes were created by drilling oversize holes through the beams at the lowest and most medial point in the "reservoirs," filling them with thickened epoxy, and then, after the epoxy set, drilling smaller holes through the epoxy. This technique prevents water from seeping into the beams.

A full gallon of white bilge paint—three coats—brightened up the whole under-cockpit "garage" and the engine bay. Although the paint took well to all of the old fiberglass, I learned the hard way to honor the primer recommendations of the paint manufacturer, as the paint over the new fiberglass never set. I ended up scraping that paint off, using the recommended primer and repainting.



WIRES TO NOWHERE

The space from the old fuel tank was put to good use. Aft of the engine bed, I glassed in a platform to mount the 6hp Kubota diesel with a 200-amp alternator and SCUBA compressor that I designed and constructed over many years in anticipation of this refit. For easy access to the dip sticks (one on the Kubota and one on the SCUBA compressor), I added a watertight floor hatch in the cockpit.

Having previously removed a full trash barrel of "*wires to nowhere*" (to be read aloud with a booming announcer-type voice) on this boat, I would not have believed the number of new "*wires to nowhere*" (as well as a new species, "*hoses to nowhere*") I found as I cleaned up the engine compartment. Between removing these extra wires and hoses and relocating the fuel system valves and filters (we'll cover the new fuel tank and fuel system in a later installment), it is hard to tell that the before and after pictures came from the same boat.

Finally, the engine arrived. Ahhh... that beautiful new red paint. A two-ton rolling shop crane that I bought used and sold after the engine was installed was a handy tool to have around to move the engine, raise it off its pallet for accessory installation and load it back on the truck to take to the boat. The transmission slipped right into place as the adapter kit provided by Beta Marine was well-engineered (although someone forgot to include studs in lieu of bolts for the bottom-mounting points, so I quickly fabricated them from 7/16" threaded rod). The transmission has a neutral lockout safety switch. I wired this switch in-line with the starter solenoid wire on the beautifully constructed engine wire harness. There were three unused wires in the harness, which would be used if one had to extend the length of the harness. I commandeered these for the engine-driven refrigeration compressor clutch and external alternator regulator field and ground wires.

WIRES TO SOMEWHERE

Special attention should be paid to wiring. Neat, well-labeled, color-coded, properly-sized wires are worth every penny of cost and minute of time, averting future "*wires to nowhere.*" The old eight-gauge ground wires were stiff and their insulation brittle, so between the engine, generator, rudder shaft, prop shaft strut, V-drive, etc., an amazing 50 feet of new ground wire was installed. The gauge panel, which includes a key switch and stop button, was wired in parallel to a below-deck key switch and to start, pre-heat and stop switches adjacent to the helm.

The alarms of the gauge panel were wired into the existing ship's alarm panel. A few wires were added to connect the external alternator regulator and engine-driven refrigeration compressor clutch. After that, the engine harness snapped into the connectors on the gauge panel, and all the low-current electrical wiring was complete.

As for the high-current wiring, I put the starter on a separate 2/0 feed from the starter battery, through a safety cutout switch, which can prove handy if the starter solenoid ever gets stuck. The alternator had its own 2/0 cable to the positive distribution terminal near the house battery bank. The existing 2/0 ground cable received a trim and a new terminal to complete the high-current wiring.

A BLESSING IN DISGUISE

In order to test the fit of the engine and align the mounting holes of the new engine bed, I constructed a wooden mockup of the engine

with its accessories. This provided exact positioning of the vibration mounts and the driveshaft and did not require the shop crane to move around. The mockup was invaluable, as it exposed the fact that the engine bed had to be lowered by 31/4". As it turns out, the old engine mounts were not on the plane of the crankshaft, but rather were vertically offset to lower the engine. I had missed this detail when specifying the engine.

This proved to be a blessing, as when I cut the top few inches off the old fiberglass bed, it became apparent just how flimsy it was. While the cross section of the bed was upwards of 1/2" thick at the top, where I cut was closer to 1/4" thick. I would not depend on that to properly support the engine.

For the new bed, I used 3/8" thick angle iron, onto which I welded angles to abut the lateral beams of the engine compartment. The new bed was bolted with 3/8" bolts through the beams and to the old engine bed in six places on each side. To ease the engine installation, holes were predrilled and tapped for the vibration mounts. Where the mounting hole was over a beam, a stud was installed and welded into the tapped hole.

FIDDLING ABOUT IN THE SHOP

The last bit of pre-installation engineering was to figure out how to mount the engine-driven refrigeration compressor. Beta Marine had never installed this model of compressor on an engine, but they gladly provided engineering drawings of other compressor installations. In the end, I fabricated an over-engineered mount, which I welded directly onto one of the engine mounts. A little more fiddling about in the metal shop produced the brackets and tensioning rod to complete the installation. This also required remote mounting of the oil filter, which I would have done anyway, but in this case I had to use a right-angle filter adapter, which I secured from a mail-order hot rod supply. A local industrial supply was able to provide the swivel fitting 1/2" high-pressure/high-temperature hoses, which I knew I could rely upon.

Clearly not everyone is set up, willing or capable of fabricating their own engine bed and compressor mount. If you are depending on a boat yard to do this work for you, ask for references from clients who have had re-power work done by them. If possible, check out the quality of the work and discuss the costs and level of satisfaction with the boat owners. Custom work makes the job complete and proper, but it can also create the budget overruns.

A SINCERE RECOMMENDATION

A fresh engine deserves fresh hoses. In fact, it may demand them. Exhaust hose of the new engine is 2", while the old engine had 1 7/8" exhaust hose and accordingly a smaller lift muffler (which itself was grossly undersized) and exhaust thru-hull. The water hose to the exhaust elbow was also 1/8" larger than that on the old Westerbeke W58. This required a hard to find 7/8" vented loop. Of course, Beta Marine stocked the vented loop.

In retrospect, I can provide one sincere recommendation: ask your

SHOPPING LIST

Extras needed to complete the engine installation:

- Hose—exhaust, hot water heater, seawater, fuel
- Clamps and clips to secure the hoses
- Wire, terminals, connectors, labels, heat shrink tubing, wire ties
- Exhaust thru-hull, vented loop, lift muffler
- Nuts and bolts for securing engine to engine bed
- Oil, transmission fluid, antifreeze

engine dealer what else customers have needed from them when installing their engines. This would have saved me a few extra orders for items such as the vented loop and alternator brush kit to accommodate my external regulator.

Stanley Feigenbaum of Beta Marine suggested I have a welder further raise my high-rise exhaust elbow and rotate the output so that it pointed aft on my reverse-mounted engine. Brilliant! This little adjustment saved several feet of exhaust hose and assured a continuous downhill slope to the lift muffler. Since this required TIG welding, I contracted it out to a local dragster fuel tank welder.

CLAMPS AND CLIPS

Along with hoses come clamps and securing clips. For the exhaust hose, only heavy-duty t-bolt clamps are strong enough to stand up to the necessary clamping pressure. On lighter hoses, standard hose clamps are fine. I only use stainless 316 clamps with at least 304 hardware or Titan-brand titanium clamps. For a little more money, the peace of mind is cheap—I have removed far too many "stainless" clamps that crumbled as soon as their screws were turned, each representing a potential flood. To keep the hoses from rubbing on the engine or other points, rubber-lined stainless steel clips were used liberally to secure the hoses to and from the water heater (uh, calorifier), as well as to and from the vented loop in the exhaust cooling circuit.

On the appointed afternoon, our highly-engineered, tractor-mounted crane boom was pressed back into service. (The boom would never break, as the rear wheels of the tractor lift off the ground first. And without a massive counterweight, we found they did just that when we first tried to remove the heavier old engine.)

A temporary bed of 4x4 timbers was placed in the boat forward of the engine bed to receive the engine, which had to be lowered at an almost vertical angle to pass through the companionway. A wooden guard was fashioned to protect the stainless and teak below the drop board slot, which left one less thing to watch while lowering the engine. A chain hoist provided minute and safe control over the lowering of the engine. Once the engine was level on its temporary bed, the refrigeration compressor was attached to its mount and the engine was raised again, this time at its proper angle of just under 15 degrees from horizontal. With just a little bit of push and jiggle, the vibration mounts slid easily over the three studs in the engine bed and the remaining five bolts were then a breeze to align.

It all was going just a little too well when I realized that the front lateral fiberglass of the engine bed was touching the engine. A little lift with the chain hoist and a quick trim with the trusty Sawzall opened up the necessary clearance. Cold drinks were enjoyed by all.

Over the next few weeks, all the correct hoses and wires were ordered and installed and the area around the engine got some buff and polish in the form of new Formica and woodwork. With the heavy lifting over, we'll cover the itchy fiberglass fuel tank and fuel system and the dusty remodeling of the aft cabin in upcoming articles. ≈

Pete Dubler has crewed offshore deliveries since 1999 and is an ASA-certified instructor. Experience on many boats led to his purchase of a one-owner Pearson 424 in June of 2004, re-named Regina Oceani. *Worldwide cruising plans delayed by Ponzi losses, Pete and his wife Jill moved their boat to their home in Colorado—which Pete points out is strategically located between two oceans—for a complete do-it-yourself refit and restoration while they rebuild the cruising kitty.*