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# Marine Fuel Polishing Solves Problems

By Paul Esterle

In an ideal world, diesel fuel would be pristine from the time it leaves the refinery to the time your injectors force it into your cylinders. Unfortunately, this isn't an ideal world. Fuel is beset by all manner of dangers.

Your primary fuel filter will catch many of these culprits, but it may require frequent changing, especially if you happen to take on a load of badly contaminated fuel. A more elegant solution – and one that is catching on fast – is fuel polishing, which actively cleans your fuel of debris and returns it to the tank in pristine condition.

Diesel fuel is plagued by dirt, rust and asphaltenes, which are soft, tar-like particles (usually less than 2 microns in diameter) that naturally occur in diesel fuel and can settle on the walls of your tanks, fuel lines and filters. Another common problem is water in the tank, which impacts the precision machinery of your fuel pumps and injectors.

In fact, things can grow when fuel and water interact. This growth is often called algae, but it really isn't. Algae requires sunlight to grow, and there is obviously no sunlight in your fuel tanks. The growth is actually a microbe that lives in the water and feeds on the diesel fuel. These microbes form colonies that can grow rapidly in warm temperatures. Bits of the colony die or break off, then make their way through your fuel system. They can clog your primary filters and even shut down the engine by starving it of fuel.

Polishing your fuel can eliminate all of these conditions and the problems they cause, and there are several ways to do it. One option is to call in a professional fuel-polishing company. Technicians will show up at your boat, pump out the fuel, circulate it through filters and return it to your tanks. This works well in extreme cases, but if you would like to be more proactive – and more independent – then you may want to consider installing an onboard fuel-polishing system.

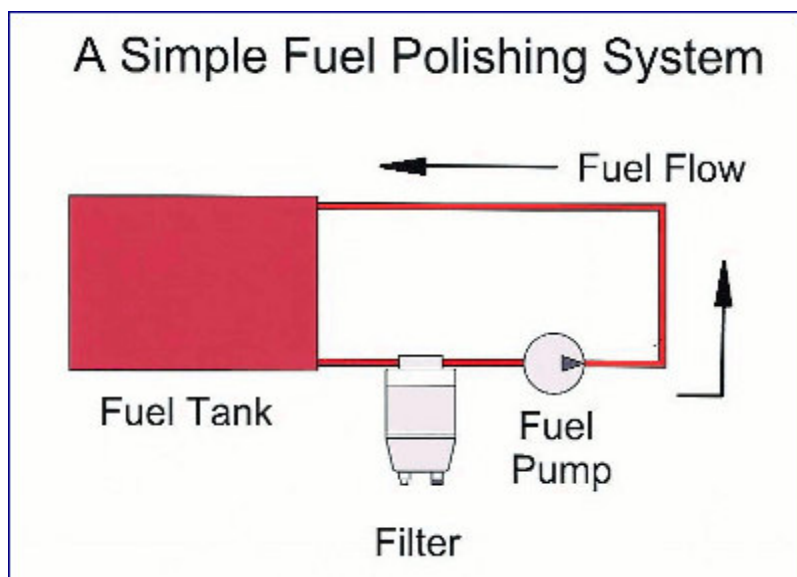
## THINK TANKAGE

The concept behind onboard fuel polishing is quite simple. An auxiliary fuel pump takes fuel from your tank, circulates it through a fuel filter and then returns it to your tank much cleaner.

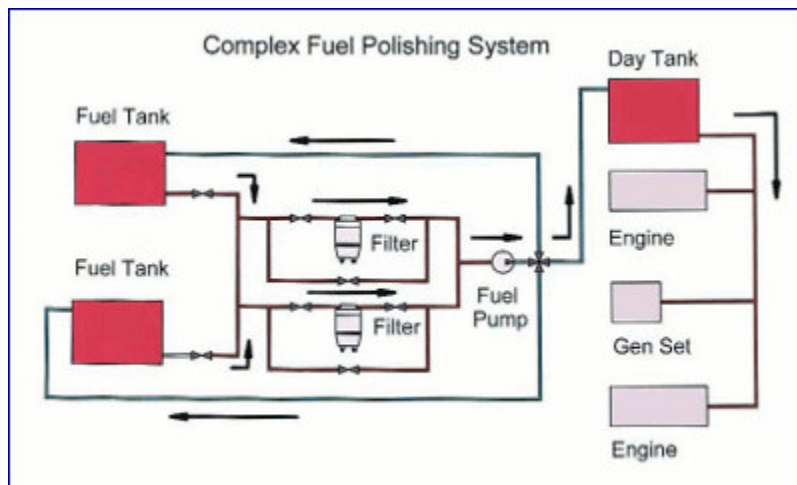
Many production boats are starting to offer fuel polishing as standard equipment, and it has become a popular do-it-yourself addition. While cutting into the fuel system is not a job for amateurs, it is a project that many experienced boat owners can do, with careful planning and attention to detail. Remember that, like almost all boat projects, the details can complicate things.

One of the factors to consider in putting together your system is your boat's tankage. Some boats have only a single tank, while others have a series of them, including a day tank to distribute fuel to various engines, generators and diesel-fed accessories.

A good fuel-polishing system has to take into account the number of tanks and allow fuel to transfer from all tanks to the polishing components and back. One advantage of having a flexible system with multiple tanks is that you can segregate fuel as it is taken onboard and polish it before it feeds your engines.



Fuel-polishing systems can be relatively straightforward (above) or even pretty detailed (below).



## INSTALLATION OPTIONS

There are several choices when it comes to installing a fuel-polishing system. Some are available as pre-fabricated systems, pre-plumbed and ready to install, and some come as kits with all the materials, but you must assemble them. You can also buy components and put together your own setup.

Gulf Coast Filters, for example, can provide kits or pre-assembled units for boats with fuel capacities up to 1,000 gallons. One example is its FPS Deluxe Magnum unit. This is a high-end installation featuring filtration to less than 1 micron using a huge filter that can hold up to a pound of contaminant. It uses a high-capacity Oberdorfer Bronze Gear Pump and comes with a water-detection sensor, vacuum gauge and a 12-hour timer. The unit comes pre-assembled on a ¾-inch polymer backboard. This little beauty will polish 120 gallons per hour! Take out a bank loan, however, as it will set you back \$3,995.

Gulf Coast Filters also supplies a variety of other sizes as well as kits. The kits typically include all the valves and fittings required for installation. For example, one popular kit is the GCF-FPS-Deluxe-Kit, recommended for boats with 300 to 500 gallons of fuel tankage. It is rated at 120 gallons per hour and is priced at \$2,884, which includes all fittings, filter, gauges, sensors and even the fuel hose. You supply the mounting board and assembly. A smaller kit, designed for vessels with 100 to 300 gallons of diesel tankage, is the GFC-FPS-Kit, priced at \$1,661. This, too, is a complete kit, lacking only the mounting board and assembly effort.

While pre-fabricated systems and kits make the job easier, they are definitely not cheap, and it is the cost that drives many boaters to build their own system.

## SYSTEM COMPONENTS

Whatever route you choose, the components in most systems are the same, starting with the filter itself. Some system suppliers use standard marine filters, such as Racor, Sierra, Gulf Coast or the like, while others opt for filters used in farm or construction applications.

In either case, you will have to make a decision on size and filter rating. Most filters used for fuel polishing are 10, 20 or 30 micron. The smaller the micron rating, the sooner it will clog – but it will also do a better job of cleaning the fuel. Decent-sized filters in the 10-micron range are most common.

Smaller filters use a replaceable metal filter canister similar to oil filters. Larger-capacity filters utilize a drop-in style filter element. Some filters come equipped with a see-through bowl, allowing you to check for water in the fuel. However, these don't belong in an engine room unless they are equipped with a metal bowl guard and are rated for use in engine spaces. Some filters can be equipped with electronic water sensors to alert you when they've collected excessive water.



WALBRO

**The Walbro FRA fuel pump is a new choice.**

systems for these more complicated systems should be designed so that fuel removed from one tank and polished is then returned to that same tank. Any other option could overfill a tank and cause a fuel spill.

Some diesel engines are equipped with a fuel-return line to return excess diesel, under pressure, back to the tank. Don't be tempted to direct this fuel through a filter and back to the tank as a quick-and-dirty polishing system. You risk overloading and damaging the engine fuel pump. The other problem is that this return fuel flow is simply too small to effectively circulate the content of even relatively small main fuel tanks.

The other key component in a fuel-polishing system is the pump. The pump should be certified for use with diesel fuel, be able to run continuously and have a low amp draw. The pumps are 12 volt D.C., so that the system can be operated while away from the dock. There are also 120-volt A.C. transfer pumps, but they are seldom used.

While one of the most common fuel pumps in the past was the Walbro 6000 series pump, Walbro recently discontinued it in favor of a new FR series of pumps. These pumps are available in a variety of capacities and configurations. They draw less than 2 amps at 12 volts, are reverse-polarity protected and can run dry for up to four hours. They are U.S. Coast Guard approved and can pump fuel continuously. Walbro can provide a variety of fuel-delivery volumes and pressures by configuring a core set of components. That means you can choose a pump more closely suited to your desired flow rates and pressures.

Other components required are two- or three-way valves, fuel-line parts and electrical parts. The valves need to be rated for use with diesel fuel. The fuel line also needs to carry Coast Guard certification for that purpose. In addition to the wiring and fuse or breaker for power, some systems utilize a timer to run the system periodically. Other systems run when the engine is on and have a simple manual on/off switch.

## SYSTEM DESIGN CONSIDERATIONS

The simplest systems, used on single-tank installations, take the fuel from the bottom of the tank, pump it through the filter and return it to the tank. Boats with multiple fuel tanks require a bit more hardware to accomplish the task. Sometimes, a manifold is used to direct the fuel. Polishing

Draw out your proposed fuel-polishing system on paper before buying components and cutting hose. The old saying that a picture is worth a thousand words holds true in this instance. Accompanying this story are two diagrams of systems, from simple to complex. Study them, and then start designing a setup configured for your boat.

Make sure you have accounted for all fuel-distribution scenarios by tracing out the fuel-flow paths. Do the math to determine the size of the pump you will need and how long it will take your system to clean the fuel on your boat. Be sure to account for the power needed to run the polishing system, too. Perfecting the design at this stage saves you money and possible embarrassment. It also never hurts to consult a pro, or someone else who has installed such a system. Online forums like TheHullTruth.com are full of postings by boaters who have assembled and installed their own systems.

Next decide where you can install your system. It needs to be convenient to the fuel lines and tanks, to minimize hose runs and plumbing. It needs to be accessible so you can reach and easily change all the valve settings and replace filter elements. If it will go in the engine room, the filters need to have metal bowls or bowl guards to be legal. Fuel filters and valves need to be firmly mounted to withstand vibration and the stresses of opening and closing those valves.

In addition, rubber fuel lines need to be properly supported to eliminate chafing, rubbing or vibration that might loosen fittings and clamps. Consider mounting all the components on a piece of  $\frac{3}{4}$ -inch StarBoard polymer. Provide permanent labels for each valve, fuel line and filter. Also consider making a flow diagram part of the installation; future owners and surveyors will thank you.

Wiring should also be installed using American Boat and Yacht Council standards. That includes using yellow wire for the D.C. ground and providing a fuse or breaker in the power lines. Wiring should also be supported at least every 18 inches to avoid chafing. You can control the system with a timer, but consider sizing the system to allow continuous operation whenever the main engine is running. For example, a boat equipped with a 200-gallon diesel tank and a 20-gph, continuously rated fuel-polishing pump will turn over the contents of a full fuel tank every 10 hours. Aim for at least a couple of turns of the fuel per week, especially in the warm months, when microbes can explode. If you don't use your boat often, consider a higher-capacity polishing pump, or plan on running your system at the dock. At the current price of fuel, you don't want to risk losing a tank of diesel.

*Paul Esterle is Technical Editor for Small Craft Advisor magazine, and his freelance work has appeared in Sail, BoatWorks, Voyaging and Good Old Boat magazines. He has produced a series of boating videos and lectures widely. He also works at West Marine and has written product reviews for the company.*

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**Racor 500 series filters are stocked by suppliers.**