Fuel Filters: Choose Well and Prosper

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Arguably the most important piece of safety equipment on a boat is a good set of fuel filters. The water and dirt that occur in all fuel will quickly stop a diesel engine, and cause expensive damage over time. Most engines come with one or more fuel filters attached, but these are only the final line of defense against fuel contamination—a backup for the primary filter or filters.

Depending on engine make and model, the final filter, mounted on the engine just before the injection pump, will have a single-pass retention (pore size) rating of 2 to 10 microns (a micron is a thousandth of a millimeter). This is the size that most engine manufacturers figure will protect injector pumps and nozzle tips from damage. Two microns is pretty small stuff; and because water can quickly saturate and clog the paper of a 2-micron filter, it is important to remove all the water and most of the sludge and particulates upstream of the final filter. Final filters are typically difficult to change quickly, are expensive, and often require bleeding air from the fuel line before the engine can be run again.

The standard approach is to put turbine-type water-separator primary filters with larger pores (typically 5 to 30 microns) on a bulkhead between the fuel tanks and the engine's fuel lift pump. Some vessels have a dedicated mechanical centrifuge for a passive centrifugal water-separating device like the RCI Fuel Purifier, in line ahead of the primaries. Some operators stick with 2-micron filters even in their primaries. The choice depends on the difficulty of changing both primaries and finals, and the nature and amount of contamination in the fuel. Ten microns is standard for gasoline fuel filters.

How to know the pore size of the filter elements you have been using? It's not always easy to find out since marine and automotive supply dealers often don't know, and each company codes its filters differently. For example, your Racor element will have a code number (2010, 2020) followed by a letter or letters: PM is for primary, which is 30 microns; SM is for secondary, which is 2 microns; and TM is 10 microns. If you suspect that excessively small (or large) pores are part of your fuel filter problem, demand that your dealer check with the manufacturer for the pore size code.

You have no doubt noticed that the filter elements cheerfully provided by your engine dealer at a hefty price appear—except for the company-colors paint job—identical to the less expensive house brands of your local auto parts store. That's because they probably are. Most of the filter elements on the market are made by just a few companies, including Wix, Baldwin, Fram, AC, and Racor. These manufacturers make elements for many engine and auto parts companies, and even for each other. These "private label" filters generally contain the same filter medium (paper) as the name brands and do the job just as well. But there are two caveats here. First, "generally" means there are some cases where the name-brand units use proprietary materials not specified for the house brands.

The other consideration is warranties. Engine companies usually will not warranty damage claims resulting from failure of a substitute component, even a filter that was made on the same assembly line as the OEM (original equipment manufacturer) item. This could be a sobering realization when thinking about saving a couple of bucks on a filter for an engine that cost tens of thousands of dollars. But remember: damage caused by fuel filter failure is pretty rare.

Selecting the right fuel filter element is just half the battle. Filter units are sized by flow rate, expressed in gallons per minute or hour. Since a four-cycle diesel returns two to four times as much fuel as it burns and two-cycles return five or six times, a handy rule of thumb is to multiply peak engine fuel consumption by 3.5 or 4, then divide by 60 to get the fuel flow rate in gallons per minute for a four-cycle diesel. Another is horsepower $\times$ 0.18 = gallons per hour.

If you're not in the habit of going to the engine room and checking your filter bowls regularly you may want a unit with a water sensor that alerts you when the settling bowl starts to fill with water. Paper with pores of five microns or less will trap water; but even if pore size is larger, water, being heavier than fuel, will settle out in the bottom. A diesel's lift pump, however, is powerful enough to suck the water right through the filter if the water level gets up that high, which can cause serious harm to injection pump and tips. The other option offered on some filters is a heater, which is used where fuel comes from high-paraffin petroleum, and where ambient temperatures are low enough to cause paraffin "clouding" or crystallization. Normally, fuel in boats that are floating is warm enough that a fuel heater isn't necessary, but fuel clouding can occur at temperatures as high as 45°F.

Primary filters should be set up with two units in parallel, valved so that you can quickly switch from one to the other. Run on one, and you can quickly switch to the other to change the first while underway without getting air into the lines. Normally, filters have to be mounted higher than the bottom of the tanks, which means that you can't reprime them after changing elements by gravity flow after the fuel level in the tanks drops below the level of the tops of the filters. An electric or hand priming pump can be plumbed into the system—also with bypass valves—downstream of the filters, so that once the new element is installed and the unit sealed, the pump will draw fuel into the filter. The disadvantage of this setup is that it also sucks air into the line from the filter, so you have to bleed it at the next filter down the line.

How to know when it's time to change a filter element? A vacuum gauge teed into the line between the primaries and the lift pump will show suction as the filter element starts to become clogged. When you are drawing five pounds of vacuum, it's time to change elements. ✦