Upgrading your fuel system

HOW TO SET UP YOUR BOAT PART 8

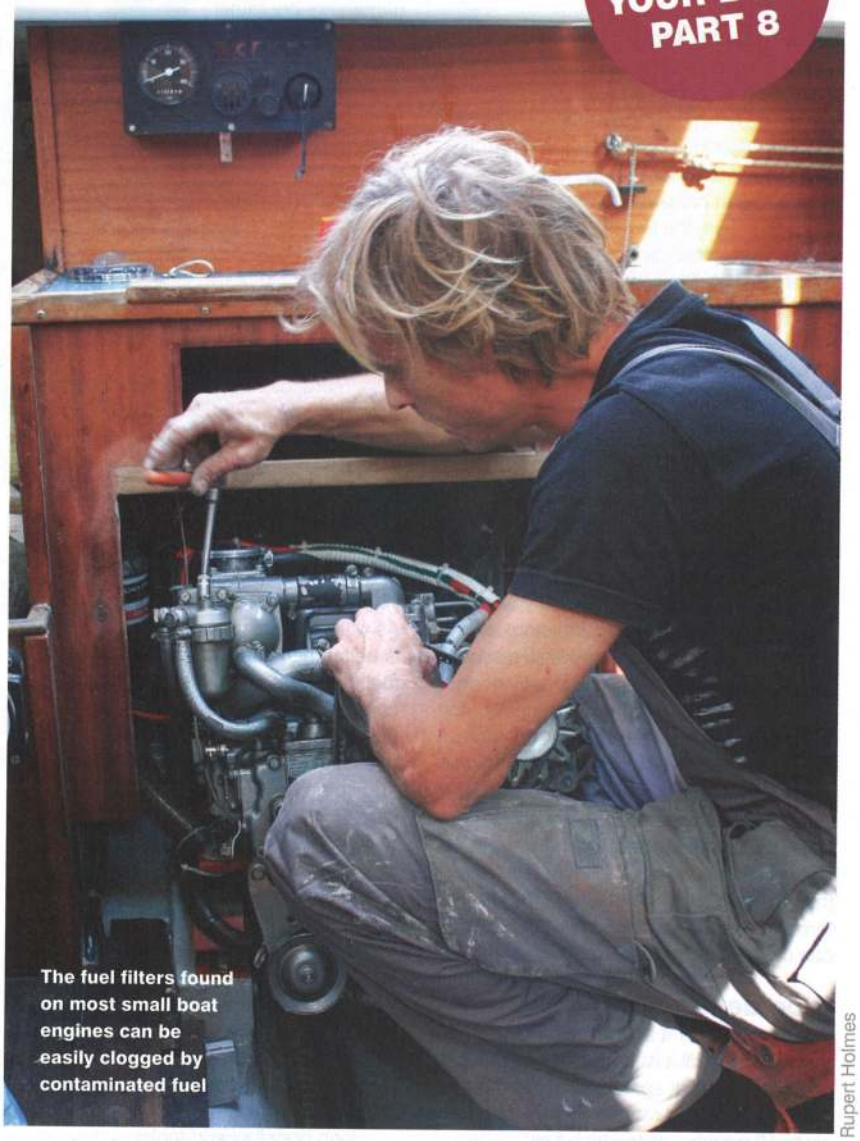
Rupert Holmes explains how to upgrade the primitive fuel system found on most small yachts

We've become accustomed to marine diesel engines being generally reliable, but they're still a long way from being infallible. With clogged fuel filters being a common source of engine failure, improving your boat's fuel filtering is an easy step towards better reliability.

Motor yachts tend to have systems that enable their engines to be restarted within seconds. This is achieved with a backup filter fitted in parallel that can be switched into service when necessary, or by using filters that are very quick to change. By contrast, typical fuel systems for the diesel engines below 40-50hp used by sailing boats tend to be very basic, with two in-line filters, plus a water separator. These filters generally have a small capacity, which means if there's an issue with crud in the fuel it's not long before they get blocked and the engine stops.

Engines are especially susceptible if diesel has been sitting in a tank for a long time. Crud and sludge builds up at the bottom of the tank, while condensation on the exposed wall of the tank can add water to the fuel, allowing bacteria to multiply (see 'Biodiesel and the bug', page 54). This problem most frequently comes to light after sailing in a rough sea, which mixes everything up in the tank. That's never a great time for engine failure.

"In any case, you don't want to be changing an element at sea," says Ashley Bradley of ASAP Supplies. "Typical CAV and other spin-on types have a number of O-rings throughout the system. So, to change the filter you need to juggle the element, the O-rings and so on all at the same time – it's not easy. The Racor systems are much better in that respect."



The fuel filters found on most small boat engines can be easily clogged by contaminated fuel

Rupert Holmes

Bradley advises customers to consider fitting a filter such as the Racor 500, purely because of how easy it is to service.

"Big advantages are you don't need any tools. To replace an element you simply undo the T-handle," he says.

"Then you remove the old paper insert, pop a new one in, and you can top it up with a bit of diesel so you don't have to prime the system. It's as simple as that – it's really quick," he adds. "With other systems you'd have to prime the system as well."

'Engines are especially susceptible if diesel has been sitting in a tank for a long time'

The only O-rings to replace are accessed from the top, which is part of what makes it so easy – you can see what's going on and gravity is working in your favour.

The 500 series are also centrifugal filters that are more efficient at removing water from fuel. They work in a two-stage process. Firstly centrifugal action spins water and up to one third of other contaminants out from the lighter liquid of the fuel. The remainder of the contamination is then picked up by the filter element.

However, while centrifugal fuel filters can be very effective, their function depends on a fast flow of fuel and they are only

Filters and thread sizes

If changing to a different type of fuel filter you may need adapters to suit different thread sizes in the pipework. These are available both for rubber hose and for copper pipe. Racor 500 series filters, for instance have ¾in UNF female connections, while the 120 range uses ¼in NPT. The more common CAV296 filters have ½in UNF threads.

Equipment and prices

- **Racor 500 filter from £212 – elements for turbine filters are considerably less, from as little as £10.46**
- **Racor 120 filter from £86; replacement elements from £26**
- **Twin fuel filter system with change-over valve and vacuum gauge from £904**
- **Vacuum gauge from £105**

ASAP Supplies

Duplex fuel filter with vacuum gauge

Racor 120 series fuel filter

ASAP Supplies

Fuel filter with heat shield for water separator bowl

Vacuum gauge

Expert tips from Ashley Bradley

1. When replacing a filter check all the connections, plugs, O-rings and so on. If they're not perfectly sealed and air gets into the system it can be hard to track down the source.
2. Use a fuel additive to prevent bacteria growing in the fuel tank. Easy to use test kits are available if you're unsure how clean the fuel in the tank is.
3. Fuel polishing kits are popular: these draw fuel from the tank, pull it through a filter and then put clean fuel back in the tank.
4. It's always worth keeping spare filters on board.

Top tip

Simply bleeding air out of the fuel system may get the engine going again quickly. This is because the increased vacuum pressure caused by a partially blocked filter can suck air into the fuel system. Bleeding this out is not a proper fix, and doesn't address the fundamental problem, but may provide a few minutes of engine running at low speed to get you out of a dangerous situation.

made in sizes to suit engines that are larger than those used by most sailing yachts under 40ft. For lower power units Bradley recommends the smaller Racor spin-on series, including the 120.

"Being a spin-on filter," he says, "these are not as easy to service as the 500 series, but it's still very simple in comparison to other systems." They are more akin in this sense to replacing the oil filter of a small engine, rather than the commonly used fuel filters where many elements must be held in place while tightening the central bolt that holds it all together.

Parallel filter systems work on a very simple premise – that the easiest action in the event of a blocked fuel filter is simply to switch that one out of the system and switch in another. If you're out at sea with a blocked fuel filter it's therefore really easy to get the engine going again and then replace the clogged element later on at a more convenient time.

Ready-made parallel filter systems are generally too large for smaller engines, but it would be fairly easy to rig one up using Racor 120 series filters and some switch-over valves.

Many parallel filter systems also include vacuum gauges that indicate when filters are getting close to becoming blocked. They work on the principle that the vacuum pressure in the fuel system increases as the filter becomes progressively more and more clogged.

After fitting a vacuum gauge you can figure out what the normal pressure is at different engine speeds and mark this on the gauge. If the needle then starts to climb above that level you know a problem is developing. It's a far better scenario that the typical one for most yachts, where the first you know of a developing issue is the engine losing power only a minute or two before it finally cuts out.

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The CAV296 type fuel filter that's typically used for smaller marine diesel engines

Other equipment

Built-in primer pumps offer a much easier and faster way to bleed air out of the fuel system than the manual lever fitted to the lift pump. Filter funnels are useful when refuelling, especially if the fuel is from an untrusted source. These will filter out any contaminants, with some products even able to remove water from fuel before it reaches the diesel tank.

It's also worth considering adding a sensor with an alarm for the water separator bowl, to warn you before the water level exceeds the separator's capacity. It's an important safeguard that will protect the injector pump, which relies on the lubricating properties of diesel fuel. It's therefore at risk of being wrecked if water reaches it – a prospect that's both inconvenient and potentially very expensive.

Typically for the smaller engines used on sea-going sailing boats water separator bowls are the standard CAV glass type that fit below the fuel filter. Note they're not suitable for boats used on inland waterways that must conform to the Boat Safety Scheme. Instead these vessels need a metal bowl that is fireproof, or a heat deflecting shield for a clear bowl. PBO