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Fuel System

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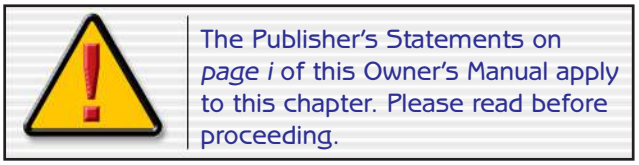


This chapter outlines fuel system components and how they integrate.

Major Topics:

Fuel System: Overview

Tanks and fuel lines

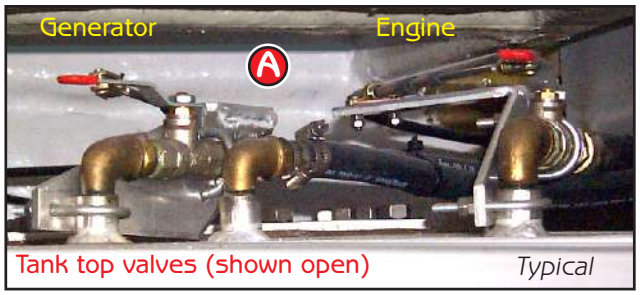
Fuel capacity is 790 gal U.S., held in four welded aluminum tanks in the engine room connected as port and starboard pairs. Each pair comprises a wing tank and a connected fwd bulkhead tank. Each pair (port and starboard) acts as a single tank because of a normally open balance pipe connection between them. There is no connection, however, between port and starboard sides. Tanks have internal baffles to add strength and reduce sloshing of fuel in a seaway.

Each side is filled separately (into the wing tank). And each side supplies one engine only. The starboard tank also supplies the generator.

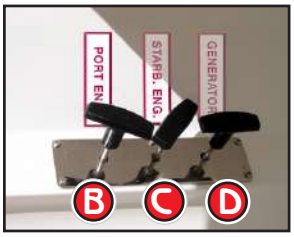
Pumps on the engines draw fuel from the tanks. More fuel is pumped to the engines than they can burn (to avoid fuel starvation). Unburned fuel returns to its tank of origin via the fuel return lines. The return fuel is warmed by its passage through the engine and thus it carries heat back to the main tanks which gradually get warmer and warmer.

This residual heat in the tanks, as it cools, can result in condensation on the tank walls which, combined with infiltrating oxygen from the vents, can promote bacterial growth. Use antibacterial additives, and keep tanks well filled. Monitor filters for water, dirt, and bacterial debris.

A vent from each tank allows air to escape or enter. If the tank is overfilled fuel will spill out the vent, particularly with boat motion, so do not overfill the tanks (see the section in this chapter on Refueling The Vessel).



Tank top valves (shown open) *Typical*



Remote fuel shut-offs

B – Port engine
C – Starboard engine
D – Generator

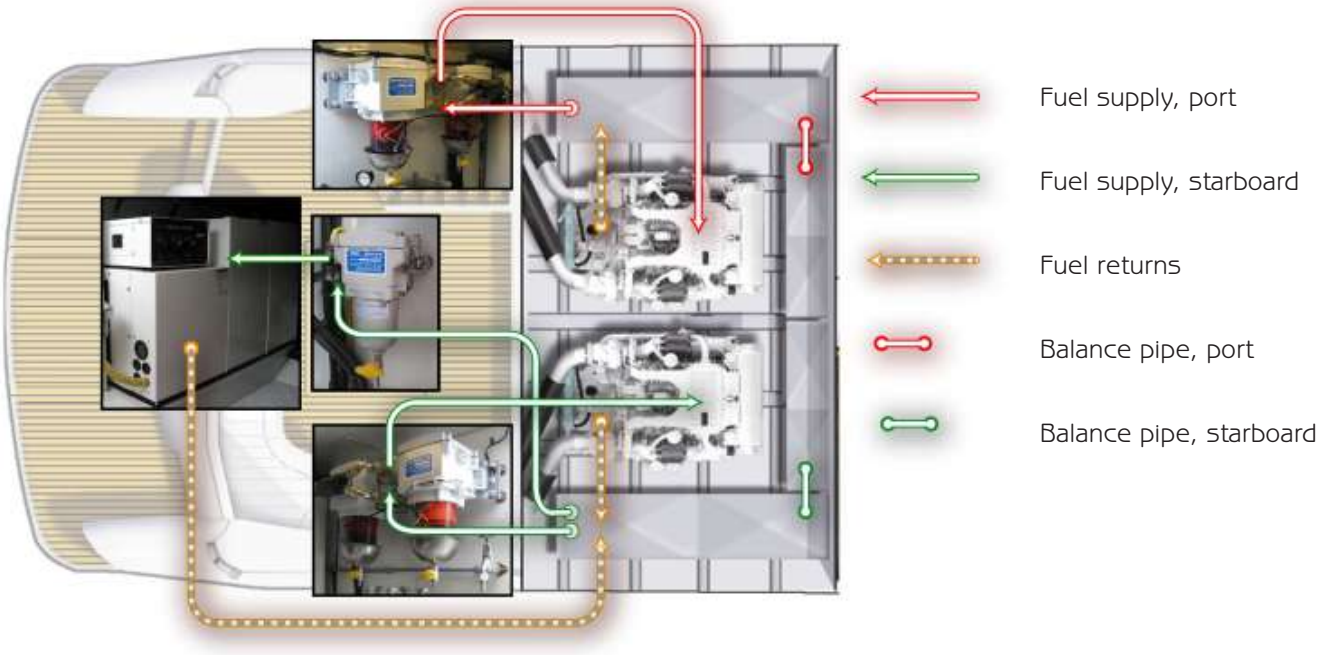
These are in the starboard cockpit service locker and operate the tank top valves.

Control valves

Remote fuel shut-offs, A, are installed on the top of both tanks. They are operated from the deck service locker, starboard side (shown in inset). The valves are for safety – they enable the fuel supply to be shut off for both engines and the generator.

If you close any of these valves you must ensure that the engines or generator cannot be started until the valve is opened again.

Leaking fuel is a fire hazard. Inspect system regularly and correct any leakage problems before operating the vessel.



Separ Fuel Filters

Fuel must be filtered to remove water droplets, rust, algae, asphaltines, varnishes and algae – all prevalent in diesel fuel today.

How they work

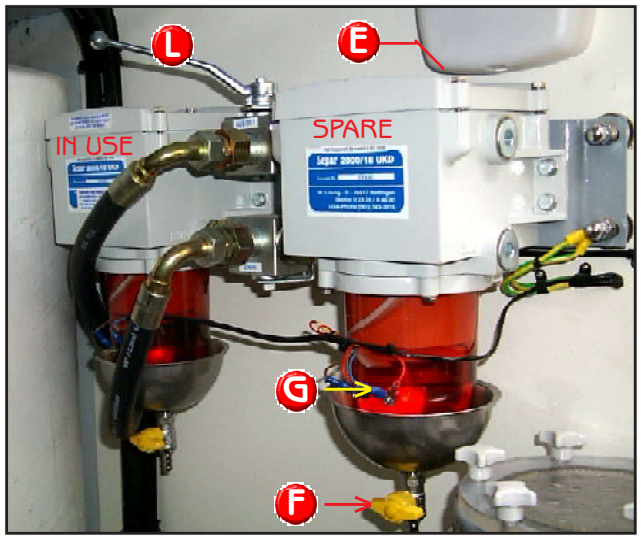
Fuel is sucked out of the tanks, into Separ 2000 fuel filters, a pair for each engine. Usually only one filter in a pair is selected, the other being spare. The raw fuel spins rapidly inside the bowl and the centrifugal action separates out large particles of dirt and water droplets (30 microns and larger) which are thrown into the centre of the bowl, and collect at the bottom. These you will see and can drain out.

The fuel continues to spin and enters the top filter element, which is usually 30 microns.

Sensors G trigger an alarm if water in the bowl rises to the sensor level. It must be drained as soon as possible. At high injector pressures water can turn to steam and damage the injectors.

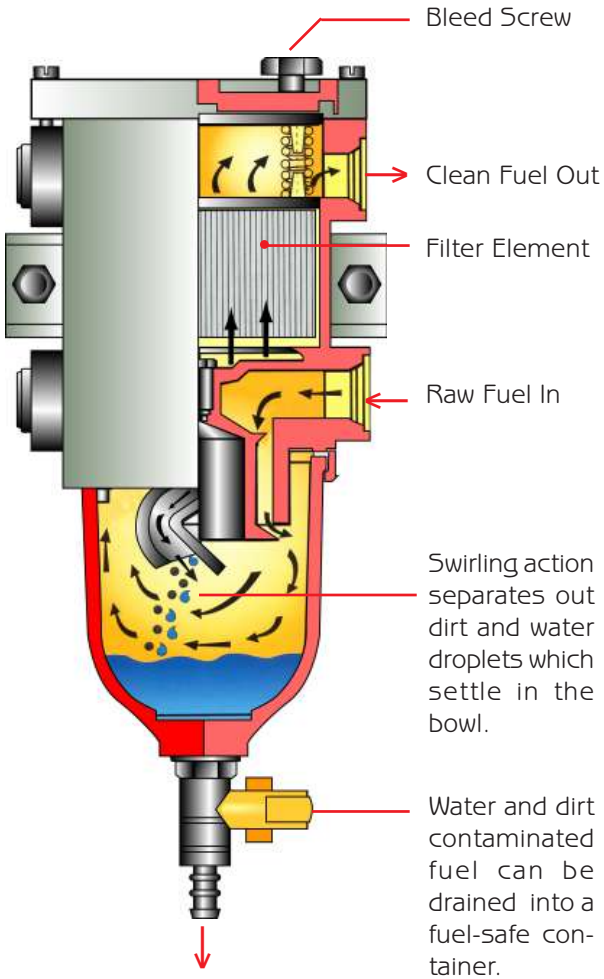
If the helm water-in-fuel alarm (icon inset) goes off you must take action. Most commonly, you will use selection lever L to close the contaminated filter and swith over to the spare.

However, the contamination must be dealt with before reactivating the unit – usually by "backflushing" the affected filter (see next section and your Separ manual.)



Separ 2000 filter pair - selection lever

Lever L selects which filter unit to use. In this photo the position of the lever shows the filter at left is in use. The bleed screw E is for backflushing, and valve F for draining the bowl. G is excessive water sensor.



Backflushing

If you suspect dirt and water are blocking the filter media and reducing fuel flow to the engines, the Separs can be partially cleared by backflushing. This can be while underway if *absolutely* necessary.

Move the selection lever fully to the spare filter (i.e., close the filter to be backflushed). Open bleed screw E at the top of the closed filter. Air will enter, and fuel will flow back through the filter. Assisted by gravity, contaminants will fall to the bottom of the glass bowl for draining.

To drain, push IN and TURN drain valve F; catch fuel in a suitable container until flow is clear. Close drain valve. Close bleed valve E. DO NOT OVER-TIGHTEN. Check for leaks.

Be very careful if backflushing a Separ while underway – you are close to a spinning shaft and any fuel that might spill is a fire hazard.

Fuel Filters, Separ Service

Filter restriction affecting fuel flow is indicated by surging at high revs, black smoke, or visible contaminants in the collection bowl. The restricted filter must be taken off line and serviced. You can likely run on the spare (assuming it's clean) until reaching harbor, but the pairing arrangement allows either filter element to be changed while underway if necessary. The procedure is described briefly here – but ***Read the Separ manual !***

Changing a Separ filter element

Turn off engine. Close fuel valve. Backflush the filter by opening bleed screw E at the top of the filter, Push in and turn drain valve F. Drain contents into a suitable container. Close drain valve F. Close bleed screw E.

Loosen lid screws and remove lid. Carefully lift out the spring frame B. Watch that the springs do not come out of their housings. Remove filter element A, and replace with a new one, 30 micron. Place spring frame B on top of filter element A. Fill filter with clean fuel. Check that gasket C is correctly seated. Align cover plate D, and gasket C. Screw lid down tightly.

Open system fuel valve. Use priming pump to ensure system is full of fuel. Start engine and check for leaks.

Secondary fuel filters

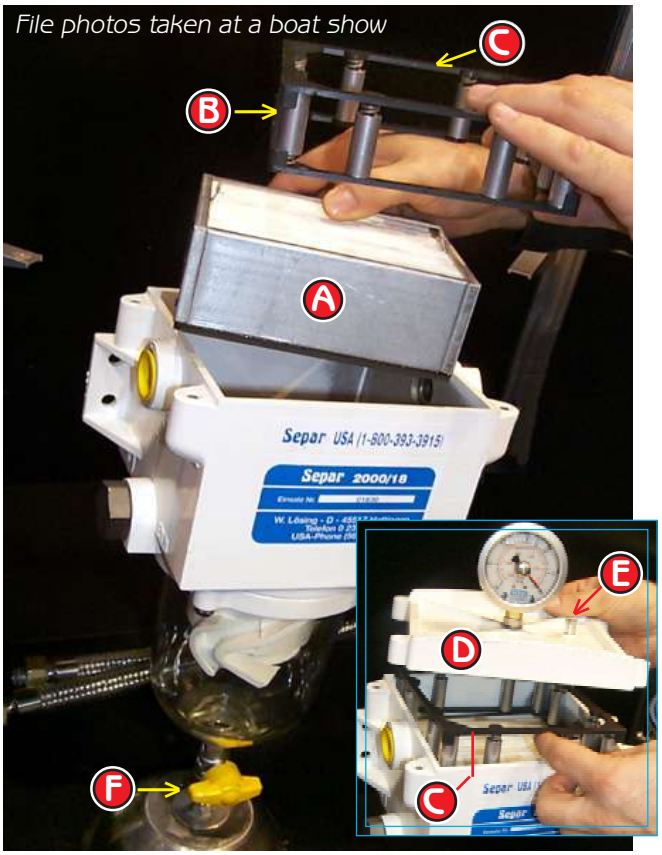
After leaving the Separ filter, fuel is pumped by the primary fuel pump into a pair of MAN secondary fuel filters (on the top of the engine beside the oil change pump). These are spin-on disposables – turn clockwise to remove. They must be replaced according to schedule: every 200 hours, or yearly. The fuel pre-cleaner, which is part of the fuel primer pump, requires the same service. Clogged filters make engines difficult to start and reduce performance considerably.

If you run out of fuel . . .

After refueling, you must use the priming pump beside the secondary filters to pressurize and vent the system. It may also be necessary to bleed air from the secondary fuel filters as well as the Separ. See your MAN instruction book.

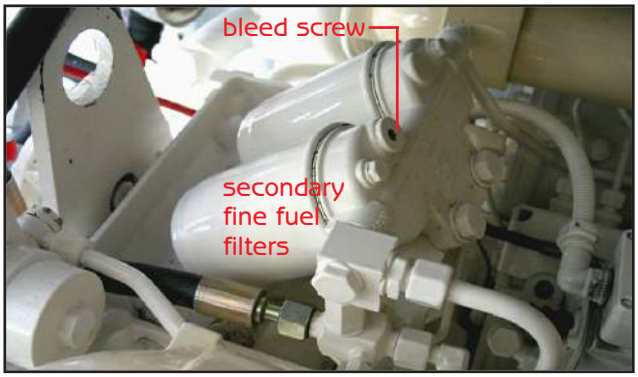
Bleeding the fuel system (of air)

If either the Separ or the secondary fine fuel filter elements are replaced, the fuel priming pump must be used to pressurize the fuel system. Pages 27-29 of the MAN instruction book show the procedure in detail. Note that the fuel primer pump is also a fuel pre-cleaner.



Optional vacuum gauge (inset)

The Separ cover plate can been modified to install a vacuum gauge. This gives a visual warning of filter clogging. Available at Separ Dealers.



Secondary fuel filters

Have a MAN diesel mechanic service these filters.

Generator fuel filter

The generator has its own fuel filter, Separ 2000/5M in the lazarette. The filter element should be replaced every 200 hours when servicing the engine, depending on the hours it has run.

Refueling the Vessel

Fuel quality:– Cut price fuel can contain water and other contaminants. Refuel only at a reputable dealer; it saves money in the long run. It is best to refuel late in the day to minimize fuel tank condensation.

Antibacterial additives:– In Florida, especially, fuel tanks become contaminated with microorganisms. Algae coats the outside of the filter element causing filters to easily plug up, particularly the primary fuel filter. If the engines are starved of fuel because of clogged filters engine power is reduced and the piston rings may be damaged. Be sure to always install a 30 micron element in the Separ Fuel Filter – anything smaller will clog up quickly, and there is no gain in it.

Antibacterial additives such as Biobor JF must be used to kill these contaminates. There are many brands on the market – use them liberally and all the time.

Procedure:– Refueling has to be from both sides. The fill caps are under deck plates A at the side deck steps and are clearly marked DIESEL. Fill both tanks to the same level.

During fueling the vessel must be securely tied up. All windows, doors and hatches closed. All electrical equipment switched off. Have a fire extinguisher handy.

All crew and passengers should be off the vessel. One person aboard to monitor the refueling. NO SMOKING.

The fuel gauges B are a very reliable magnetic type gauge, but no fuel gauge is 100% accurate. With experience, you will get to know about how much fuel you need and how accurate your own gauges are.

Allow for fuel expansion. DO NOT OVERFILL. Unless you require maximum range, when the gauge indicates full, stop there. If fuel comes out of the overboard vent stop at once.

Environmental laws prohibit fuel oil contamination of sea and lake water. Be responsible in disposing of discarded fuel. Always inspect for leaks when in the engine room.

After Fuelling:– Clean up any fuel spilled on the deck and dispose of rags ashore. Reinstall fuel deck plates and tighten down.

Open the windows and deck hatches. Check for diesel odor in cabins. Inspect engine room tanks for any fuel leakage. Switch on ignition (but don't start) to run engine room blowers for at least 5 minutes. As soon as possible after that start the engines and move away from the fuel dock area.

Water-in-fuel alarm

Warning light and alarm C indicates excessive water in the Separ fuel bowl. This must be drained off as soon as possible.

Importance of keeping tanks topped up

Fuel tanks should be kept topped up. In a heavy sea with low fuel the motion of the vessel could allow the fuel pickup to draw in air instead of fuel.

Tanks left half full of diesel oil are subject to condensation which promotes rapid growth of algae. When the fuel tanks are filled, the algae die and foul the fuel in the tank. Result: dirty fuel filters that must be cleaned.

Antibacterial additives such as Biobor JF or Technol 403 will help with this problem, but keeping the fuel tanks topped up will reduce algae growth.