Fuel system

⚠️ IMPORTANT! Remember that all fuel, wrongly handled, is flammable.

Ensure good ventilation during all work on the fuel system.

The main components in the fuel system are the fine filter, feed pump with hand pump, the injection pump, supply pipes and injectors. In many installations, a pre-filter with water trap is also installed.

The fuel is sucked up from the fuel tank by the supply pump and is then pressed through the fine filter before it reaches the injection pump. In the injection pump, the pressure is considerably raised before it is forced out to the injectors.

1. Feed pump
2. Fine filter
3. Injection pump
4. Supply pipe
5. Injector
6. Return pipe, surplus fuel.
7. Prefilter

Since the injection pump supplies more fuel than the engine needs, there is a system of return pipes to take the surplus fuel back to the tank.

Changing the fine filter

The fine filter must be changed at least once per season.

To avoid getting fuel spilled inside the boat, a plastic bag can be put round the filter before it is removed. Be prepared to find that the filter is full of fuel. Unscrew the filter and take care of the fuel left inside the filter.

Hand the old filter in to a re-cycling station.

Check that the mating surface for the filter is absolutely clean. Wipe a smear of oil on the filter seal. Tighten the oil filter by hand (1) until it contacts the mating surface. Then tighten the filter by hand (2) a further ½ turn, not more!

If an extra fuel filter is installed, it is a good idea as regards air bleeding, if you clean this filter as well and drain any water off.

The fuel system must be bled after a filter change. Please refer to the separate chapter on bleeding, on page 22.
Changing the extra fuel filter

If an extra fuel filter with water separator is installed, the filter should be changed and any water should be drained off at the same time as the fine filter on the engine is changed.

Start off by closing the fuel tap by the fuel tank.

The following advice refers to Volvo Penta fuel filters.

Put a tin can underneath the filter and drain the fuel and any water off through the tap on the base of the filter. Take care of the water/fuel drained off, and hand it in to a recycling station later on.

To avoid fuel spillage, you should pull a plastic bag up round the filter before it is removed.

Undo the centre screw so that the filter can be taken to pieces. Clean the bottom bowl and change the filter insert.

Put the filter together. Be careful with assembly, to avoid leakage. Tighten the tap on the bottom. If an extra fuel filter of another make is installed, the instructions for the filter should be followed.

Open the fuel tap. The fuel system must be bled after a filter change.

Injectors, injection pump

The injector should be overhauled after 400 hours of operation.

Get an authorised workshop to do this job plus any other work needed on the fuel system, since these workshops have both the equipment needed and experienced personnel.

Parts of the fuel system can be sealed. These seals may only be broken and replaced by personnel at authorised workshops. The engine is set to give the smallest possible environmental impact.
Removing the injectors

If the injectors have to be removed to be handed in for checking, start off by cleaning round the injectors.

Cleanliness is very important in all work on the fuel system.

Undo the fuel supply pipes and the oil leakage pipes from the injectors. Protect the unions from dirt entry by means of plastic plugs.

Unscrew the injectors, using the lowest hexagon. Remove the copper gaskets beneath the injectors. Do not strip the injector! Hand the injectors over to an authorised workshop for inspection and adjustment.

NOTE! Use a spanner on the second hexagon up "underneathlear of pipe" to prevent injectors loosening instead of pipe causing pipe fractures.

When replacing, new copper gaskets should be used beneath the injectors.

Tightening torque:

MD 2010, 2020, 2040: 60 - 70 Nm (44.2 - 95 ft.lbs)
MD 2030: 80 - 85 Nm (108 - 115 ft.lbs)

Install the pipes and bleed the system. Open the air bleed screw (1) and then pump with the hand pump (2) until fuel which is free of air bubbles flows out. If the pump has no action turn the engine over slightly using start button and try again. Shut the air bleed nipple whilst fuel is flowing out.

Setting the idle

The maximum speed of the engine is set at the factory and has been sealed. Adjustments may only be done by an authorised Volvo Penta service workshop.

⚠️ WARNING! Working or coming close to a running engine is a safety risk. Watch out for rotating machinery and hot surfaces.

The idling speed should be 850 ± 25 rpm. If necessary, the idling speed can be adjusted. Adjustment should be done when the engine is hot, as follows:

1. Put the engine control into neutral. Check that the gap (1) is approximately 3 mm.
Adjustment: Undo locknut (2) and adjust by means of screw (3) until the correct gap is found. Tighten the locknut.

2. Start the engine and let it idle with engine control in neutral.


Do not adjust the idling speed to a higher value than specified, since the reversing gear or S-drive would be subjected to unnecessarily high stresses during direction changes.

* This item does not apply to boats with dual control.
Fuel tanks

If the boat is laid up for a longer period of time, e.g. winter lay-up, it is important to drain any water from the fuel tank.

To avoid getting condensation in the fuel tank, it is a good idea to have it filled during the lay-up period. Check before you fill up that there are no special rules applicable to the site where the boat is laid up, about the quantity of fuel aboard.

Fuel hoses

The fuel hoses should be checked regularly for wear, ageing and clamping.

It is important that the fuel pipes are securely clamped so that they do not vibrate. Pipe ruptures can occur, since vibration in some materials causes hardening, and consequent brittleness.

Fuel hoses made of rubber or synthetic material can age with time, and crack or lose their elasticity.

Check that all pipe and hose couplings are fully tightened, to avoid leakage and air entry into the fuel system.

⚠️ IMPORTANT! Remember that all fuel, wrongly handled, is flammable.

Ensure good ventilation during all work on the fuel system.

Bleeding the fuel system

The fuel system must always be bled after filter changes, if the fuel tank runs dry, during all service in which the fuel pipes have been undone, replaced or after long-term stoppages etc.

The process of bleeding is messy, since fuel leaks out. Remember the fire risk. Always have clean rags available to wipe the fuel up immediately, so that it can not run down below the engine and cause a bad smell in the boat.

1 Air bleed screw, filter
2 Hand pump on feed pump.
How to bleed the fuel system

The fine filter on the engine has an air bleed screw above the lid. Wind rags round the filter or put a plastic bag round the filter, to catch up the fuel which will run out.

Undo the air bleed screw a couple of turns.

Pump with the hand pump until clean fuel comes out, with no air bubbles. Keep pumping at the same time as you tighten the air bleed screw. Carefully remove the rags or plastic bag, to ensure that no fuel gets spilled.

If the pump action is poor, turn the crankshaft to another angle to put the pump cam into another position.

In normal cases, the air bleed procedure described above is enough. If it is found that more air bleeding needs to be done, the fuel supply pipe unions on the injectors can be undone a couple of turns, after which the engine should be turned by means of the start motor until fuel with no air bubbles comes out.

NOTE! Use a spanner on the second hexagon up on the injector "underneath the lever off pipe" to prevent injector loosening instead of pipe causing pipe fractures.

Electrical system

As standard, the "A" versions of the MD 2010 - 2040 are equipped with a 2-pole electrical system. The "B" versions of the MD 2010 - 2040 are equipped with a 1-pole electrical system, i.e. a positive pole, using the engine block as the earth return. All versions of the engine have 12 Volt system voltage.

The flywheel housing and transmission in the B version are electrically insulated from the engine and must not be earthed to the engine block or negative side of battery. Earthing of these components can cause serious damage because of galvanic corrosion.

The batteries are charged by an alternator.

The electrical systems on the "A" versions of the MD 2010 - 2040 are equipped with 2 fuse blocks, one for the + side and one for the - side. The "B" versions of the MD 2010 - 2040 have fuses on the + side.
The main components in the electrical system are as follows:

Start motor, alternator, distribution box, fuse block or circuit breaker, oil pressure monitor and oil pressure sensor, coolant temperature monitor and coolant temperature sensor.

If there are any abnormal values, the monitors in the system send an impulse to the alarm which is then sounded. The sensors are connected to the gauges.

⚠️ IMPORTANT!

1. Never break the circuit between the alternator and the battery when the engine is running and never turn the main switch off before the engine has stopped. There is otherwise a risk that the alternator could be damaged.

2. Never switch over the positive and negative leads from the battery.

3. During any repairs to the alternator or other electrical equipment on the boat, remove both cables from the battery. The same thing applies if the batteries are being quick charged.

4. Regularly check the cables, tightening of terminals and clamping of cables. Cables which are not used should be isolated.

5. Batteries can be stored on board for the winter, on condition that they are fully charged. Poorly charged batteries can freeze and split.

6. No auxiliary equipment may be connected to the standard cables for the engine, unless Volvo Penta's installation instructions expressly permit it. The cables are dimensioned for the power consumption of each circuit.

7. If electric welding is done afloat, the battery cables and all cables connected to the alternator must be detached and isolated. The earth clamp of the welder must be located in such a way that the welding current does not pass through a bearing.

Location of the electrical components on the engine:

1. Start motor
2. Earthing relay ("A" version)
3. Glow plugs
4. Alternator
5. Start relay
6. Glow plug relay
7. Fuses (4 no.)
   max 15 A (+)
8. Fuses (4 no.)
   Max 15A (-)
9. Oil pressure monitor
10. Oil pressure sensor (not standard)
11. Coolant temperature monitor
12. Coolant temperature sensor (not standard)
Inspection and replacement of the drive belt

The alternator drive belt is subjected to wear and stretching. The belt tension should be checked often, including between the regular service intervals. If slippage occurs, this can cause poor charging and high engine temperatures in the drive belt, it will also shorten the belt life.

The easiest way to check the tension of the drive belt is to press it down between the pulleys. If you can press the drive belt down 5 mm (3/16") with normal thumb pressure, the tension is about right. Do the check after running the engine for a while, so that the belt is warm and supple. If the belt is hard, shiny, cracked or even frayed, it must be replaced.

When you change drive belts, it is important to clean the pulley grooves before fitting the new belt.

If a new belt is fitted, check and adjust the belt tension after a couple of hours operation.

How to change the belt

MD 2010 - 2020. Undo the upper fastening screws for the alternator a couple of turns. Undo both bolts on the tensioner strap a couple of turns. Press the alternator towards the block and work the belt off. Clean the pulley grooves. Put the new belt in place. Move the alternator out to tension the belt and lock the alternator in that position with the screws on the alternator tensioner strap. Check the belt tension.

MD 2030 - 2040. Undo the fastening screws for the alternator tensioner strap a couple of turns, then the lower fastening screws a couple of turns. Press the alternator towards the block and work the belt off. Clean the pulley grooves. Put the new belt in place. Move the alternator out to tension the belt and lock the alternator in that position with the screws on the alternator tensioner strap. Then tighten the other fastening screws. Check the belt tension.
Conservation

Boats which are taken out of service for a while, during the winter for example, must be prepared for the lay-up by means of what is generally referred to as conservation.

If the boat will be subjected to such low temperatures that there is a risk of frost, the boat must be laid up ashore during this period.

During the winter lay-up, the boat and its equipment are subjected to stresses in the form of large temperature differences and damp, salty air. A lot of the equipment is normally taken home, but the equipment left behind should be protected to retain its function.

When the time for the lay-up approaches, it could be a good idea to do a condition check. Book a date with an authorised workshop in good time. If any work needs to be done by the workshop, book a time while you are there, so that the workshop can do the work during the winter when they are normally more able to plan their work.

Before the boat is lifted out of the water, the fuel tank should be filled, if the laying-up site permits the boat to have its tank full.

Oil change, engine

Warm the engine up, so that the oil becomes more fluid. Stop the engine and pump the engine oil out.

⚠️ WARNING! Hot oil can cause burns.

The oil volume to be pumped out is app:

- MD 2010 = 1.8 litre (1.9 US quarts)
- MD 2020 = 3.4 litre (3.6 US quarts)
- MD 2030 = 4.3 litre (4.5 US quarts)
- MD 2040 = 7.3 litre (7.7 US quarts)
Top up with oil according to the recommendations in "Oils..." (Page 51). It is a good idea to use Volvo Penta engine oil, since this has a formula which counteracts corrosion.

Change the oil filter as well. For further information, please refer to the "Lubrication system" chapter.

Start the engine, check the oil pressure and also check that there is no oil leakage round the oil filter.

NOTE! Never spray in oil through the induction system while the engine is running.

Start the engine and fill up with oil to the correct level, since it will have fallen a bit when the oil filter was filled.

If Volvo Penta oil was used, the engine is ready to put into service in the spring, after checking the oil level.

Special conservation oil can of course be used but this is mainly recommended for long lay-ups, e.g. when the boat will not be used at all during the season. In this case, the oil must be changed again just before launching.

Oil change, reversing gear, S-drive

When the engine oil is changed, it is a good idea to change the oil in the reversing gear or S-drive at the same time.

If the boat is equipped with a sailboat drive, S-drive, the oil can not be changed until the boat has been taken up.

When the oil in the reversing gear is to be changed, the dipstick should be removed first. The oil is then sucked up by means of a mechanical or electric drain pump.

⚠️ Warning! Hot oil can cause burns.
Insert the suction hose through the dipstick pipe. Make sure that the hose reaches the base of the reversing gear housing, and then suck the oil out. The volume is about 0.8 litre (0.84 US quarts).

The oil in the S-drive can then be drained once the drain plug in the base of the drive has been unscrewed and the dipstick has been removed. The oil volume is about 2.8 litre (3.0 US quarts).
Check the drain plug seal and fit the plug.

Put new oil in. The oil level should be within the markings. The oil level should be adjusted once the engine has been run for a few minutes after launching.

The same grade of oil is used for the reversing gear and S-drive as is used for the engine.

Check the oil level with the dipstick. Note that the dipstick should not be screwed in during measurement. Never have the oil level too high or too low.

Lifting the boat out of the water is the next phase in conservation. The rest of the conservation work can now be done ashore, with the boat resting on blocks.
The fresh water system

After the boat has been taken up and put on its blocks, it is time to start conserving the fresh water system of the engine. Conservation can be done in two ways:

Alt. 1. If the cooling system is filled with a corrosion-protecting mixture of water and ethylene glycol, check the anti-freeze and top up if necessary. Every second year, the mixture should be changed and the system should be flushed clean.

Volvo Penta anti-freeze type 90 is intended for use in fresh water systems. It contains anti-corrosion agents and gives full frost protection when mixed 50/50 with water.

Alt. 2. If the system only contains water with anti-corrosion additives, this must be drained off, since there is no frost protection. Drain the water off through the drain points.

It is important that the water should run out if the system is to be empty during the laid-up period. Close all the drain points.

To protect the ducts from corrosion, the system should be temporarily filled with a mixture of anti-freeze which is drained before launching, and could be saved for the following year.

Check that the anti-freeze gives sufficient protection.
The sea water system

It is essential to idle the engine to carry out conservation of the sea water system.

Arrange a collection vessel beneath the exhaust pipe outlet, to collect up the coolant.

Connect a hose to the intake side of the reversing gear, i.e. the side which is connected to the hull fitting, or if the engine is equipped with an S-drive, directly to the suction side of the sea water pump.

Connection diameter is 19 mm.

The hose should be so long that it reaches the collection vessel, to permit anti-freeze to circulate round.

If this is not possible, put a vessel beside the engine, with a short hose from the pump/reversing gear to the vessel. This is a more cumbersome procedure, since the anti-freeze collected up must be poured into the vessel inside the boat.

⚠️ IMPORTANT! The pump must never run dry.

Alt. 1. Coolant with anti-freeze

Fill the vessel with a 50/50 mixture of corrosion-protecting ethylene glycol and water. It is a good idea to use Volvo Penta anti-freeze 90, mixed with water.

⚠️ WARNING! Anti-freeze is highly poisonous. Read the warning text on the bottle and be especially careful if there are any children nearby.
Start the engine and let it idle. If the engine is connected to let the mixture re-circulate, it is a good idea to let the engine run until it gets warm. Be on your guard to ensure that the pump never runs dry. If the pump runs dry, the impeller will be destroyed almost at once.

When conservation of the sea-water system is finished, the mixture can remain in place, since it gives full frost protection.

**The mixture must be drained off before launching.**

For environmental reasons, it must not be dumped into the sea water or spilled on the ground.

Alt. 2. Conservation without anti-freeze

Can be used when there is no risk of freezing.

The cooling ducts can be conserved with a mixture of emulsifying oil and water. Water re-circulation as in Alt. 1 is recommended. Check that the impeller does not run dry.

This method does not give any frost protection, so the mixture must be drained off as soon as conservation is completed.

Since the drain taps can block as time passes, it is important to check carefully that the mixture really does run out, to avoid frost damage.

In this case, the sea water system is left empty. Shut all drain taps when the mixture has run out.

⚠️ This mixture must not be allowed to contaminate the environment!
Conservation, general

Remove the lid from the sea water pump. A small amount of water may now run out. Pull the impeller out from the pump housing carefully, using a pair of water pump pliers.

Inspect the impeller and, if it is in good condition, put it into a plastic bag for winter storage.

Inspect the sides of the pump housing and clean as necessary, before replacing the lid temporarily.

If a vacuum valve is fitted to the cooling system, it must be taken to pieces for cleaning. Remove the valve from the hose connections.
Unscrew the hexagonal lid. There is a diaphragm and a gasket in the lid. Clean all the components, turn the lid upside down and put in a diaphragm and a gasket, in that order.

To prevent the components from falling out or being damaged, the valve housing must also be held upside down during assembly.

Do not tighten the lid too hard (0.2 kpm / 1.4 ft. lbs). The valve could stop working otherwise.

Re-install the valve in the boat. Connect the hoses to the valve and tighten the hose clamps.

If a water heater is installed, it must be drained of all water. Follow the instructions for the water heater.

If a silencer is fitted, it must be be drained of all water, if conservation is carried out as in Alt. 2. Undo the hose clamps and let the water run out.

Empty the exhaust pipe from water.

⚠️ IMPORTANT! Do not forget to tighten the exhaust hose before launching.
Electrical system

The cables for the electrical system of the engine have a large number of connections, where damp can enter and cause electrical problems because of corrosion.

The rest of the electrical system on the boat is also exposed to this corrosive environment and must be protected.

The locations which are especially exposed are the underneath of the instrument panel, the electrical distribution box, the electrical distribution box on the engine and the start motor and alternator terminals.

A damp-repellent spray can be used as a protection.

Never make holes in cable sheaths to use a sharp probe for making electrical measurements. In a corrosive environment such as found on a boat, it takes 2 years for small dimension cables to corrode through where the hole is. If you have to make holes in insulation, seal them with a suitable adhesive.

The boat batteries can remain on board if they are fully charged, since a fully charged battery will not freeze. If there is any doubt about the condition of the battery, it should be taken for trickle charging and stored as cool as possible. If the boat will be laid-up in a warm climate, the battery should be trickle-charged every second month. This has to be done since the batteries lose their charge much faster in a warm environment than in a cold one.
Fuel system

There is a fine filter on the engine, which has to be changed, and there is often an extra fuel filter further along the fuel pipe, which is a combined filter and water trap.

Be prepared for fuel spillage when the filter is unscrewed. If the filter is very tight, it can be removed by means of a filter spanner. Never throw away the used filter with ordinary rubbish, since it contains fuel. Show consideration for the environment and take it to a service station for processing.

Always use original filters to ensure good filtering.

Start by wiping a smear of oil on the rubber seal on the filter. Clean the mating surface on the engine.

Screw the filter on by hand until it just touches the mating surface. Then tighten the filter a further half turn by hand, not more. Filter changing is finished.

After the filter change, the fuel system must be bled. Please refer to the separate section on bleeding the fuel system (page 22).
**Engine bay, equipment**

Clean the engine bay and beneath the engine, to remove the reasons for unpleasant smells and unnecessary damp. Check the finish of the engine and the equipment. Chafed points should be cleaned and touched up with paint to avoid corrosion. Use original paint and varnish from Volvo Penta.

If the engine has a reversing gear, and has a rubber propeller shaft seal, it is a good idea to press in about 1 ml of water-resistant grease into the seal.

The rubber propeller shaft seal should be replaced after 500 hours of operation or about 5 years, depending on which is reached first.

The engine controls have a number of moving parts beneath the housing, which need lubrication. Lift the control housing off and wipe grease on the arm bearings and on the control cable connections.

On most controls, there is a friction screw for the control lever, which is accessible once the cover has been removed. If the friction in the lever needs to be adjusted, tighten the screw to increase friction and unscrew it to reduce friction.

Put the cover back.
Removal of conservation products, launching

Before launching.

If the engine has been filled with Volvo Penta oil, or oil which meets the CD and VDS requirements, all that is needed is to top the oil up. If special conservation oil has been used, this must be replaced by Volvo Penta oil or equivalent, and the oil filter must be changed.

Check the oil level in the reversing gear or S-drive. If the level is not high enough, top up through the dipstick hole, if the level is too high, drain off to the correct level.

If the fresh water system has been filled, check the level. If it has been empty, top it up to the correct level, using a mixture of 50/50 ethylene glycol and water, or with a mixture of corrosion inhibitors and water. It is a good idea to use Volvo Penta anti-freeze type 90 or Volvo Penta corrosion inhibitor.

**NOTE!** Volvo Penta anti-freeze type 90 and Volvo Penta corrosion inhibitor must never be mixed since this would lead to foaming and reduced cooling performance.

Check all the hoses in the cooling system for cracks and other damage which could affect the buoyancy of the craft. After this, check the tightness of all hose clamps and inspect them for corrosion. Be careful to adjust any hoses which could be exposed to chafing.

Check that all drain taps are closed.
Lubricate the inside of the pump housing with a thin layer of water-resistant grease.

NOTE! Do not use ordinary mineral grease, since this could attack the impeller.

Install the impeller. Turn the wings so that they correspond to the direction of rotation of the pump, which is clockwise.
Install the lid, using a new gasket.

Check the condition of the exhaust hose and silencer. Look out for chafing damage. Check the tightness of all hose clamps at the same time as you check them for corrosion.
Checking valve clearance

Check and adjust the valve clearance at least once every second season.

Note! The valve clearance must never be checked when the engine is running, this must be done with the engine cold and stationary.

The correct clearance for both inlet and exhaust valves is 0.20 mm (0.008").

Remove the valve cover. Turn the engine over in the normal direction of rotation until both valves for cylinder no. 1 are closed (compression stroke), “the notch on the front pulley should be lined up with the top dead centre mark on the front cover”. Check/adjust both valves on no. 1 cylinder.

Valve adjustment is carried out as follows.

Using a 0.20 (0.008") feeler gauge, check the valve clearance by sliding the feeler gauge between the valve stem and the rocker arm. There should be slight friction felt as you slide the gauge through the gap. Take care, to large a gap causes noise from the rockers and will lead to mechanical damage, too small a gap will cause valves to be burnt out and mechanical damage. If you need to adjust the clearance undo the locknut on the rocker adjustment screw slightly and using a screwdriver adjust the clearance until slight friction is felt on the gauge as you slide it backwards and forwards, then tighten the locknut while holding the adjuster screw in position with the screwdriver, do not overtighten. Always recheck clearance after tightening as it is quite common for the clearance to change during the tightening process.

MD 2010 only (two cylinder). Once the valve clearances have been checked for cylinder no. 1 turn the engine over half a revolution 180° “in the normal direction of rotation” (clockwise viewed from the front of engine) “No. 2 cylinder is now on the compression stroke”, now adjust both the valve clearances for cylinder no. 2.

The arrow in the figure shows the forward direction of the engine.