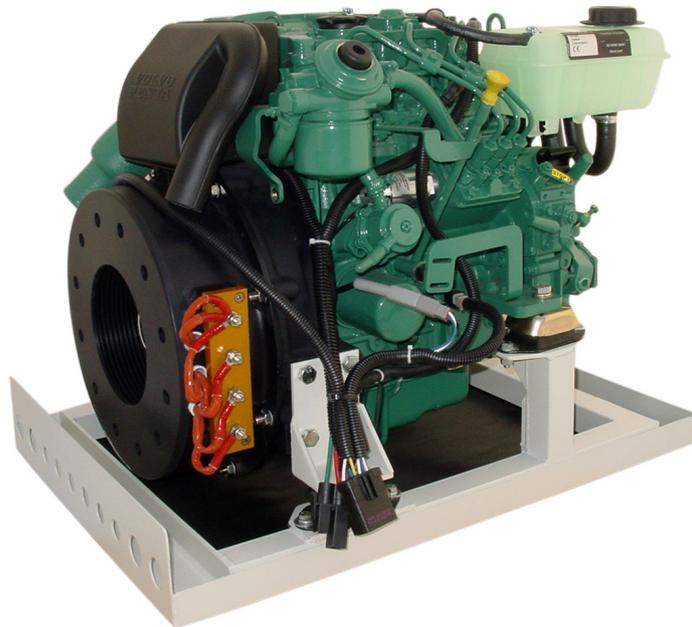




Operators Manual

Volvo Penta - Engine



Welcome Aboard

Polar DC Generators and Volvo Penta marine engines are used all over the world today. They are used in all possible operating conditions for professional as well as leisure purposes.

Polar DC Marine is becoming a symbol of reliability, technical innovation, performance and long service life. We also believe that this is what you demand and expect of your Polar DC Marine generator .

Please read this operator's manual thoroughly and consider the advice we provide on operation and maintenance before you cast off on your voyage so that you will be ensured of fulfilling your expectations.

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Safety Information

Read this chapter carefully. It concerns your safety. This chapter describes how safety information is presented in the Operator's Manual and on the engine itself. It also gives a general account of basic safety precautions to be taken when operating the boat and maintaining the engine.

Check that you have the correct Operator's Manual before you read on. If this is not the case please contact your Volvo Penta dealer.



If operations are performed incorrectly this could result in personal injury, or damage to property or the engine. Read the Operator's Manual carefully before operating or servicing the engine. If anything is unclear please contact your Volvo Penta dealer for assistance.

⚠ This symbol is used in the book and on the engine to make you aware of safety information. Always read these safety precautions very carefully.

In the Operator's Manual warning texts have the following priority:

⚠ WARNING! If these instructions are not followed there is a danger of personal injury, extensive damage to the product or serious mechanical malfunction.

⚠ IMPORTANT! Used to draw your attention to something that can cause damage, product malfunction or damage to property.

NOTE! Used to draw your attention to important information that will facilitate work or operations.



This symbol is used in certain cases on our products and refers to important information in the Operator's Manual. Ensure that warning and information symbols on the engine and transmission are always visible and legible. Replace symbols that have been damaged or painted over.

Safety precautions to be taken when operating the boat

Your new boat

Read Operator's Manuals and other information supplied with your new boat. Learn to operate the engine, controls and other equipment safely and correctly.

If this is your first boat, or is a boat type with which you are not familiar, we recommend that you practice controlling the boat in peace and quiet. Learn how the boat behaves at different speeds, weather conditions and loads before casting off for your "real" maiden voyage.

Remember that the person driving a boat is legally required to know and follow the current rules regarding traffic and safety at sea. Make sure you know the rules that apply to you and the waters you are sailing in by contacting the relevant authorities or organization.

A good piece of advice is to take a course in seamanship. We recommend that you contact your local boating organization to find a suitable course.

Accidents

Statistics show that poor maintenance of boats and engines and a lack of safety equipment are often the cause of accidents at sea.

Ensure that your boat is maintained in accordance with the relevant Operator's Manual and that the necessary safety equipment is on-board and is serviceable.

Daily checklist

Make a habit of checking the engine and engine compartment visually before operating the boat (**before the engine is started**) and after operating the boat (**after the engine has been stopped**). This will help you to quickly detect fuel, coolant and oil leaks and spot anything else unusual that has, or is about to happen.

Maneuvering

Avoid violent and unexpected changes in course and gear engagement. This could cause someone on the boat to lose their balance and fall over or overboard.

A rotating propeller can cause serious injury. Check that nobody is in the water before engaging ahead or astern. Never drive near bathers or in areas where people could be in the water.

Avoid trimming an outboard drive too much, as steering will be severely reduced.

Refueling

When refueling there is always a danger of fire and explosion. Smoking is forbidden and the engine must be switched off.

Never overfill the tank. Close the fuel tank filler cap properly.

Only use the fuel recommended in the Operator's Manual. The wrong grade of fuel can cause operating problems or cause the engine to stop. On a diesel engine poor quality fuel can cause the control rod to seize and the engine to overrev with a resultant risk of damage to the engine and personal injury.

Do not start the engine

Do not start or run the engine with a suspected fuel or LPG leak in the boat, when you are close to or in a discharge of explosive media, etc. There is a risk for fire and/or explosion in explosive surroundings.

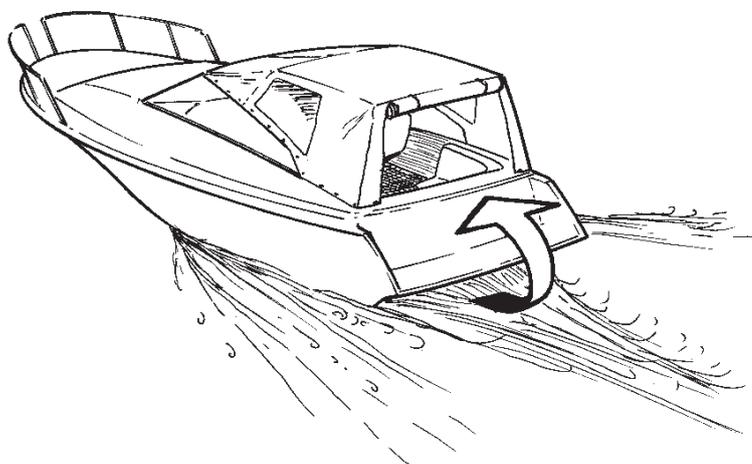
⚠ Carbon monoxide poisoning

When a boat is moving forward backwash is caused behind the boat. Sometimes this backwash can be so powerful that exhaust gases can be sucked into the cabin or seating well on the boat with the resulting risk of carbon monoxide poisoning for those on board.

The backwash problem is greatest with high, broad boats with a squared stern. But other types of boat can also have backwash problems under certain conditions, for example when running with an awning rigged. Among other factors that can increase the backwash effect are wind conditions, load distribu-

tion, the sea running, trim, open hatches and valves.

Most modern boats are designed in such a way that problems with backwash are extremely unusual. Should a backwash problem occur do not open hatches or valves in the forward part of the boat. This will only increase backwash. Try changing speed, trim or load distribution in the boat instead. In addition take down, open or change the rigging of the awning in some other way if an awning is rigged. Contact the dealer where the boat was purchased to get more information on how to solve this problem should it occur on your boat.



⚠ Checklist

- | Safety equipment: Life jackets for all passengers, communication equipment, emergency rockets, approved fire extinguisher, first-aid equipment, life belt, anchor, paddle, torch etc.
- | Replacement parts and tools: impeller, fuel filters, fuses, tape, hose clamps, engine oil, propeller and tools for any repairs that might have to be carried out.
- | Get out your charts and go over the planned route. Calculate distance and fuel consumption. Listen to the weather reports
- | Make sure that relations or contact persons are informed when planning a longer voyage. Remember to inform them if your plans have changed or been delayed.
- | Tell your passengers and crew where the safety equipment is stored and how to operate it. Make sure you are not the only person on board who knows how to start the boat and operate it safely.

The list should be supplemented because the requirement for safety equipment varies depending on the boat type and how it is used etc. We recommend that you contact a local boating or maritime safety organization for more detailed marine safety information.

Safety precautions for maintenance and service operations

Preparations

Knowledge

The Operator's Manual contains instructions on how to carry out general maintenance and service operations safely and correctly. Read the instructions carefully before starting work.

Service literature covering more complicated operations is available from your Volvo Penta dealer.

Never carry out any work on the engine if you are unsure of how it should be done, contact your Volvo Penta dealer who will be glad to offer assistance.

Stop the engine

Stop the engine before opening or removing engine hatches. Unless otherwise specified all maintenance and service must be carried out with the engine stopped.

To prevent accidental start of the boat engine remove the ignition key, turn off the power supply to the engine at the main switch and lock it in the OFF position before starting work. Put up a warning sign in the control position that work on the engine is being carried out.

Approaching or working on an engine that is running is a safety risk. Loose clothing, hair, fingers or a dropped tool can be caught in the rotating parts of the engine and cause serious personal injury. Volvo Penta recommend that all servicing with the engine running be undertaken by an authorized Volvo Penta workshop.

Lifting the engine

When lifting the engine use the lifting eyes installed on the engine (reverse gear where installed). Always check that lifting equipment is in good condition and is strong enough for the lift (engine weight with any extra equipment). For safety's sake lift the engine using an adjustable lifting beam. All chains and cables should run parallel to each other and as perpendicular as possible in relation to the top of the engine. Bear in mind that extra equipment installed on the engine may alter its center of gravity. Special lifting equipment may then be required in order to maintain the correct balance and make the engine safe to handle. Never carry out work on an engine suspended on a hoist.

Before starting the engine

Reinstall all guards removed during service operations before starting the engine. Check that no tools or other items have been left on the engine.

Never start a turbocharger engine without installing the air cleaner (ACL). The rotating compressor in the turbocharger can cause serious personal injury. Foreign objects can also be sucked in and cause mechanical damage to the unit.

Fire and explosion

Fuel and lubrication oil

All fuel, most lubricants and many chemicals are inflammable. Read and follow the instructions on the packaging.

When carrying out work on the fuel system make sure the engine is cold. A fuel spill onto a hot surface or electrical components can cause a fire.

Store fuel soaked rags and other flammable material so that there is no danger of them catching fire. In certain conditions oil-soaked rags can spontaneously ignite.

Do not smoke when filling fuel, oil or in proximity of a filling station or in the engine room.

Non-original components

Components used in the fuel and ignition system (gasoline engines) and electrical systems on Volvo Penta products are designed and constructed to minimize the risk of fire and explosion.

Using non-original Volvo Penta parts can result in fire or explosion on board.

Batteries

The batteries contain and give off oxyhydrogen gas, especially during charging. This gas is easily ignited and highly flammable.

Do not under any circumstances smoke or use naked flame or allow sparks in the vicinity of the batteries or battery compartment.

Incorrectly connecting a battery terminal cable or jump-start cable can cause a spark which in turn can be sufficient to cause an explosion.

Start spray

Never use start spray or similar agents to start an engine equipped with air pre-heating (glow plugs/starter element). The starter element may cause an explosion in the inlet manifold. Danger of personal injury.

Hot surfaces and fluids

There is always a risk of burns when working with a hot engine. Beware of hot surfaces. For example: the exhaust pipe, turbocharger (TC), oil pan, charge air pipe, starter element, hot coolant and hot oil in oil lines and hoses.

Carbon monoxide poisoning

Start the engine only in a well-ventilated area. If operating the engine in an enclosed space, ensure that there is proper ventilation in order to remove exhaust gases and crankcase ventilation emissions from the working area.

Chemicals

Most chemicals such as anti-freeze, rustproofing agent, inhibiting oil, degreasing agent etc. are hazardous to health. Read and follow the instructions on the packaging.

Some chemicals such as inhibiting oil are inflammable and dangerous if breathed in as well. Ensure good ventilation and use a protective mask when spraying. Read and follow the instructions on the packaging.

Store chemicals and other hazardous materials out of the reach of children. To protect the environment please dispose of used or leftover chemicals at a properly designated disposal site for destruction.

Cooling system

There is a risk of water penetration when working on the seawater system. Turn off the engine and close the sea cock before starting work on the system.

Avoid opening the coolant filler cap when the engine is hot. Steam or hot coolant can spray out and cause burns.

If work must be carried out with the engine at operating temperature and the coolant filler cap or a cock open or a coolant hose disconnected, open the coolant filler cap carefully and slowly to release pressure before removing the cap completely. Note that the coolant may still be hot and can cause burns.

Lubrication system

Hot oil can cause burns. Avoid skin contact with hot oil. Ensure that the lubrication system is not under pressure before commencing work on it. Never start or operate the engine with the oil filler cap removed, oil can spray out.

Fuel system

Always use protective gloves when tracing leaks. Liquids ejected under pressure can penetrate body tissue and cause serious injury. There is a danger of blood poisoning.

Always cover the generator if it is located under the fuel filter. The generator can be damaged by spilled fuel.

Electrical system

Cutting off power

Always stop the engine and break the current using the main switches before working on the electrical system. Isolate shore current to the engine block heater, battery charger, or accessories mounted on the engine.

Batteries

The batteries contain an extremely corrosive electrolyte. Protect your skin and clothes when charging or handling batteries. Always use protective goggles and gloves.

If battery electrolyte comes into contact with unprotected skin wash off immediately using plenty of water and soap. If battery acid comes into contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.

Introduction

This Operator's Manual has been compiled to help you get the most from your Volvo Penta engine. It contains all the information you need in order to operate and maintain your engine safely and correctly. Please read the Operator's Manual carefully and learn how to operate the engine, controls and other equipment safely.

Always have the Operator's Manual available. Keep it in a safe place and do not forget to give it to the new owner if you sell your boat.

Care of the environment

We would all like to live in a clean and healthy environment. Somewhere where we can breathe clean air, see healthy trees, have clean water in our lakes and oceans, and are able to enjoy the sunshine without being worried about our health. Unfortunately, this cannot be taken for granted nowadays but is something we must work together to achieve.

As a manufacturer of marine engines, Volvo Penta has a special responsibility, why care of the environment is a core value in our product development. Today, Volvo Penta has a broad range of engines where progress has been made in reducing exhaust emissions, fuel consumption, engine noise, etc.

We hope you will take care in preserving these qualities. Always follow any advice given in the Operator's Manual concerning fuel grades, operation and maintenance and you will avoid causing unnecessary interference to the environment. Get in touch with your Volvo Penta dealer if you notice any changes such as increased fuel consumption exhaust smoke.

Adapt speed and distance to avoid wash and noise disturbing or injuring animal life, moored boats, jetties, etc. Leave islands and harbours in the same condition as you want to find them. Remember to always leave hazardous waste such as waste oil, coolant, paint and wash residue, flat batteries, etc., for disposal at a destruction plant.

Our joint efforts will make a valuable contribution to our environment.

Running-in

The engine must be run in for its first 10 operating hours as follows:

Operate the engine normally. Do not operate it at full load except for short periods. Never run the engine at a constant engine speed for long periods during the running-in period.

The engine can be expected to use more engine oil during the running-in period than would otherwise be normal. Check the oil level more often than is normally recommended.

The prescribed warranty inspection "First Service Inspection" must be carried out during this first period of operation. For more information: See the Warranty and Service Book.

Fuel and oils

Only use the fuel and oils recommended in the chapter Technical Data. Other grades of fuel and oil can cause operating problems, increased fuel consumption and, in the long-term, a shorter engine service life.

Always change oil, oil filters and fuel filters at the recommended intervals.

Service and replacement parts

Volvo Penta marine engines are designed for high operational reliability and long service life. They are constructed to withstand the marine environment while also affecting it as little as possible. Through regular service and the use of Volvo Penta original spare parts, these qualities will be retained.

The Volvo Penta worldwide network of authorized dealers are at your service. They are specialists in Volvo Penta products and have accessories and the original replacement parts, test equipment and special tools necessary for high quality service and repair work.

Always follow the maintenance intervals contained in the Operator's Manual. Remember to state the engine/transmission identification number when ordering service and replacement parts.

Certified engines

It is important to be aware of the following information if you own or run an engine that is exhaust emission certified:

Certification means that an engine type is inspected and approved by the authorities. The engine manufacturer guarantees that all engines manufactured of that type correspond to the certified engine.

This places special requirements for maintenance and service as follows:

- | The maintenance and service intervals recommended by Volvo Penta must be observed.
- | Only genuine Volvo Penta replacement parts may be used.
- | The service of injection pumps and injectors or pump settings must always be carried out by an authorized Volvo Penta workshop.

- | The engine must not be modified in any way except with accessories and service kits approved by Volvo Penta.
- | No modifications to the exhaust pipes and air supply ducts for the engine may be undertaken.
- | Seals may only be broken by authorized personnel.

Otherwise the general instructions contained in the Operator's Manual concerning operation, service and maintenance must be followed.

⚠ IMPORTANT! Late or inadequate maintenance/ service or the use of spare parts not approved by Volvo Penta will invalidate AB Volvo Penta's responsibility for the engine specification being in accordance with the certificated variant.

Volvo Penta accepts no responsibility or liability for any damage or costs arising due to the above.



Warranty

Your new Volvo Penta marine engine is covered by a limited warranty according to the conditions and instructions contained in the Warranty and Service book.

Note that AB Volvo Penta's liability is limited to that contained in the Warranty and Service Book. Read this book as soon as you take delivery of the engine. It contains important information about warranty cards, service and maintenance which you, the owner, must be aware of, check and carry out. Liability covered in the warranty may otherwise be refused by AB Volvo Penta.

Contact your Volvo Penta dealer if you have not received a Warranty and Service Book and a customer copy of the warranty card.

VOLVO PENTA

Declaration of Conformity for Recreational Craft Propulsion Engines with the exhaust emission requirements of Directive 94/25/EC as amended by 2003/44/EC

D1-13, D1-20, D1-30, D2-40

Engine manufacturer: _

AB Volvo Penta
Gropegårdsgatan
405 08 Göteborg
Sweden_____

NKIP
Nipkowweg 9
Postbus 65
8500AB Joure
Netherlands
ID Number: 0613

Body for exhaust emission assessment:

Modules used for exhaust emission assessment B + F
Other Community Directives applied EMC 89/336/EEC

Description of engine(s) and essential requirements

Engine Type 4 stroke diesel engine

Engine model(s) covered by this declaration

EC Type certificate number

D1-13..... CE-RCD-540
D1-20..... CE-RCD-540
D1-30..... CE-RCD-541
D2-40..... CE-RCD-541

Essential requirements	Standards Used	Other normative document used
Annex I.B – Exhaust Emissions		
Engine identification	Volvo Penta std	Annex 1.B.1
Exhaust emission requirements	EN ISO 8178-2:1998 EN ISO 8178-4:1996	Annex 1.B.2
Durability	Volvo Penta std	Annex 1.B.3
Operator's manual	ISO 10240:2004	Annex 1.B.4
EMC Directive	EN 61000-3-2, EN 61000-3-3, CISPR 25	

This declaration of conformity is issued under the sole responsibility of the manufacturer. I declare on behalf of the engine manufacturer that the engine(s) will meet the requirements of above mentioned directives when installed in a recreational craft, in accordance with the engine manufacturer's supplied instructions and that this (these) engine(s) must not be put into service until the recreational craft into which it is (they are) to be installed has been declared in conformity with the relevant provisions of the above mentioned Directives.

Name and function: Sam Behrmann, Product Liability
(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title:
(or an equivalent marking)

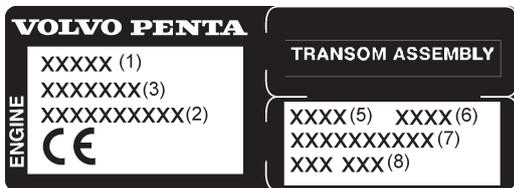
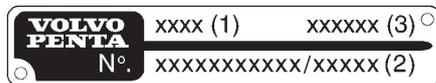
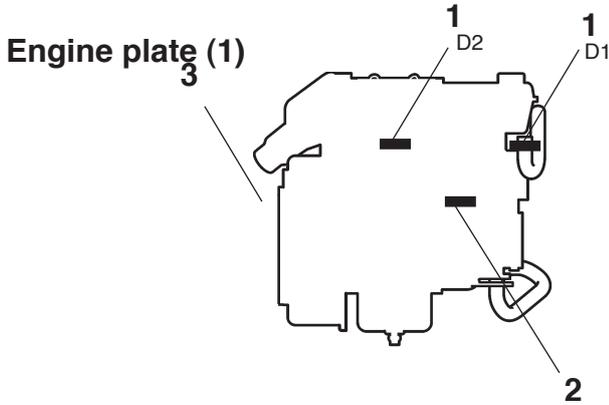
Date and place of issue: (yr/month/day) 2006/04/27 Göteborg



Identification number

Your engine and transmission has identification plates with identification numbers. This information should always be quoted when ordering service and replacement parts. Make a note of the details below, make a copy of the page and keep it so that you have a copy should the boat be stolen.

The appearance and location of identification plates is shown below. The figures in brackets refer to the location of the identification numbers on the identification plate.



Product designation (1)

Serial number (2).....

Product number (3)

Certification number (4).....

Engine and transmission decal (2)

Product designation (1)

Serial number (2).....

Product number (3)

Product designation (5)

Gear ratio (6)

Serial number (7).....

Product number (8).....

S-drive/Reverse gear (3)

Product designation (5)

Gear ratio (6)

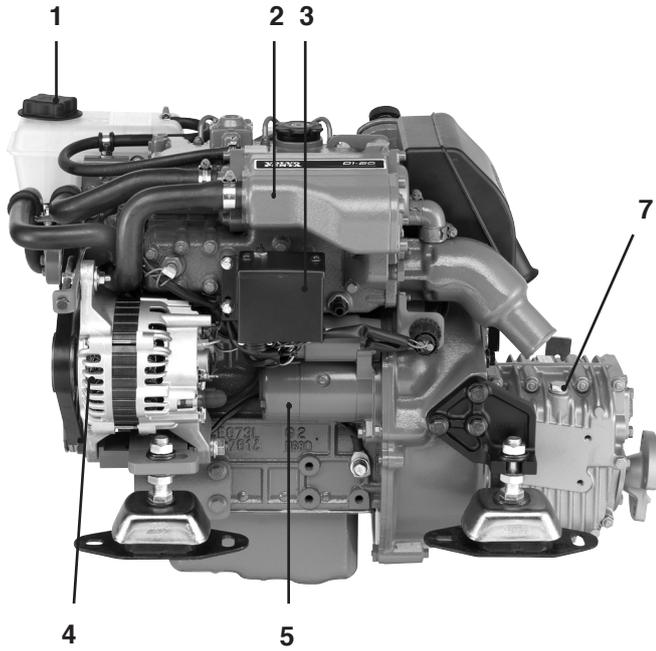
Serial number (7).....

Product number (8).....

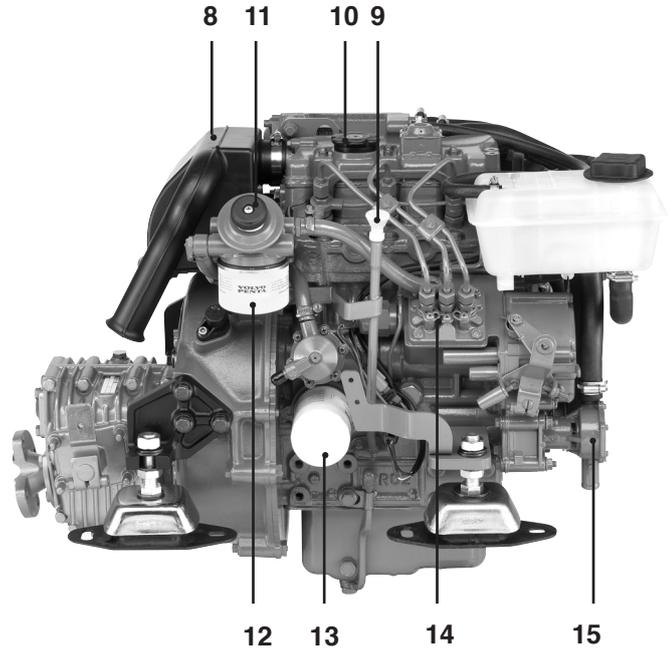
Propeller designation.....

.....

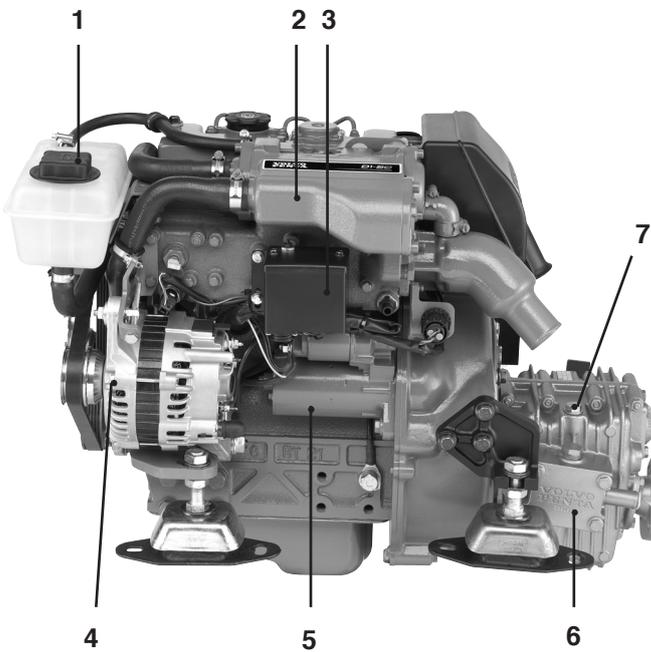
Presentation



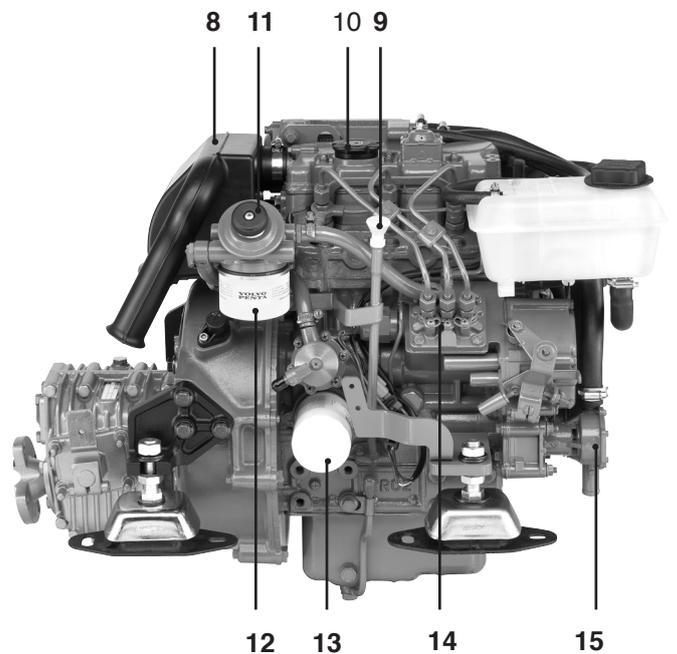
D1-20 with reverse gear MS10A



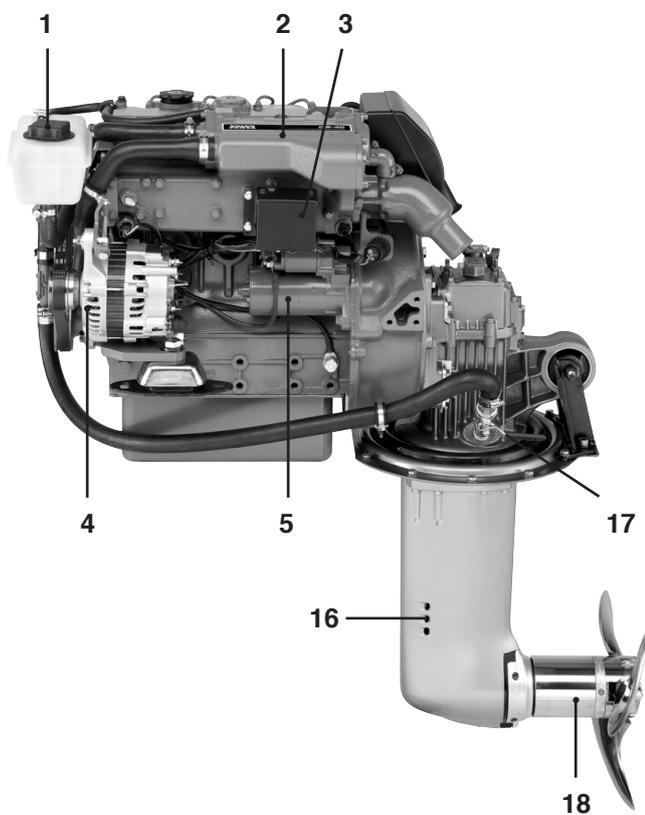
D1-20 with reverse gear MS10A



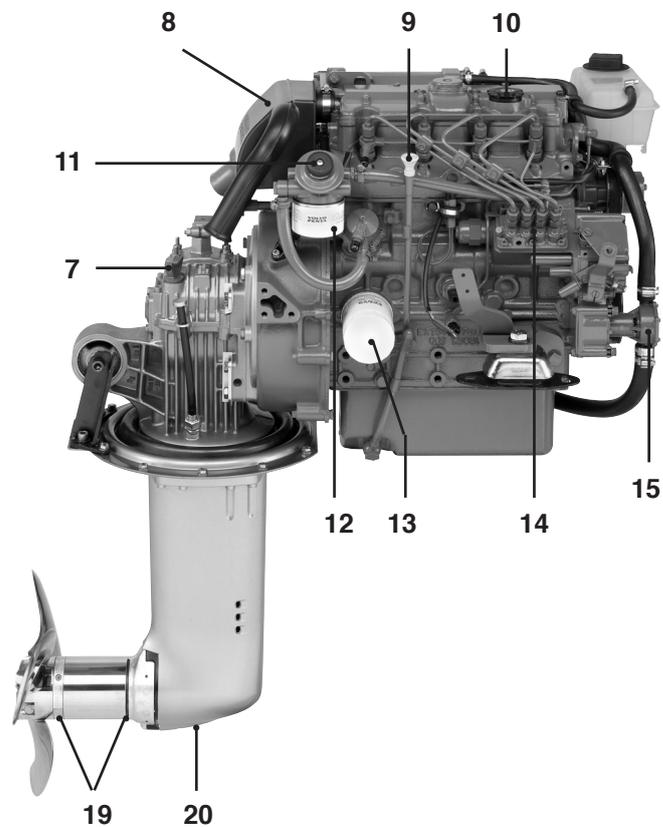
D1-30 with reverse gear MS15A



D1-30 with reverse gear MS15A



D2-40 with sailing boat drive 130S



D2-40 with sailing boat drive 130S

- 1. Coolant filler cap
- 2. Heat exchanger
- 3. Relay box
- 4. Generator
- 5. Starter motor
- 6. Oil cooler, reverse gear
- 7. Dipstick, reverse gear/S-drive

- 8. Air cleaner (ACL)/Air intake
- 9. Dipstick, engine
- 10. Oil filler cap, engine
- 11. Fuel pump
- 12. Fuel filter
- 13. Oil filter
- 14. Injection pump

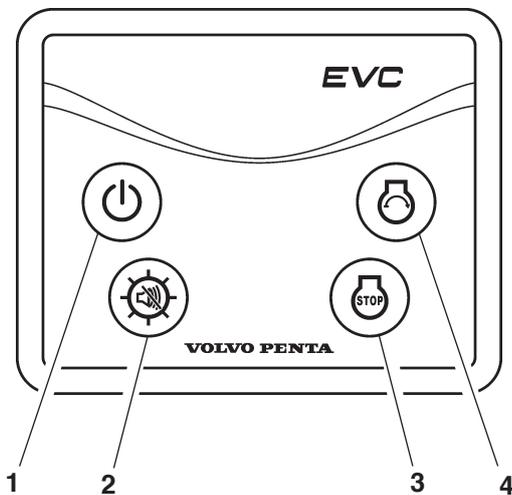
- 15. Seawater pump
- 16. Cooling water intake, S-drive
- 17. Sea cock, S-drive
- 18. Folding propeller
- 19. Sacrificial anodes
- 20. Oil drain plug, S-drive

Instrumentation

This section describes the instrument panels available as standard alternatives for your engine from Volvo Penta, for Volvo Penta optional extra instruments see next section. Note that in certain boats instruments, alarm panels, key switches etc. may be installed separately without the instrument panels shown here.

If you want to install additional instrumentation, or your boat is equipped with instruments not described here, please contact your Volvo Penta dealer.

The system does not have an ignition switch. To stop unauthorized persons starting the engine the wheelhouse should have a lock or a lockable main switch should be used.



Control panel

On/Off button (1). Press this button to engage or turn off the system.

NOTE! The control panel can not be turned off while the engine is running.

Start button (4), when this button is pressed the glow function is activated and the starter motor is engaged.

Multifunction button (2).

- Alarm acknowledgment. If there is an alarm the LCD screen on the tachometer will show a flashing alarm warning and the alarm buzzer sound.

The alarm is acknowledged by pressing the multifunction button. The alarm buzzer stops and the alarm warning continues to show in a steady light until the malfunction is corrected.

- Background lighting. Used to light up and extinguish background lighting of the tachometer LCD screen. Press the button 1-5 seconds to light or extinguish background lighting.

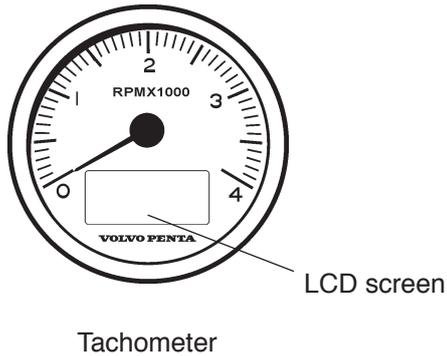
Background lighting can be adjusted in five stages by pressing the multi function button less than 1 second.

- Contrast adjustment of the tachometer LCD screen, press the button for more than 5 seconds to adjust contrast.

Stop button (3). The engine stop running when this button is pressed.

⚠ IMPORTANT! Read the starting instructions in the “Starting the engine ” chapter.

Tachometer/LCD Gauge



The tachometer provides you with the engine RPM on the dial gauge. Multiply this value by 1000 for revolutions per minute.

The LCD screen on the tachometer shows engine operating time in hours and tenths of an hour and also symbols for operating information.

If a fault occurs the associated symbol will light up on the LCD screen to provide you with a visual warning and the alarm buzzer sound.

Symbols for operating information



Preheat

The "Preheat" symbol will show when the glow function is activated.



Crank

The "Crank" symbol will show when the starter motor is engaged.



Stop

The "Stop" symbol will show when the stop button is pressed.



Fuel level

The "Fuel level" symbol will show when 20% or less of usable fuel remains in the tank.

NOTE! The engine has to run at least one minute before this function is activated.



System failure

The "System failure" symbol will show at short circuit or a broken wire.

AUX

Extra alarm for optional switch function.



Coolant temperature

Coolant temperature

The coolant temperature symbol shows when the coolant temperature is too high.

- Stop the engine if this lamp lights up during operation.

⚠ WARNING! Continued operation when the coolant temperature is too high can cause serious engine damage.

- Check the coolant level. Please refer to “Maintenance: Freshwater system”.

⚠ WARNING! Do not open the coolant filler cap when the engine is warm this could cause serious engine and personal damage. Steam or hot fluid could spray out.

- Check that the sea water filter, if installed, is not blocked. Please refer to “Maintenance: Sea water system”
- Check the impeller in the sea water pump. Please refer to “Maintenance: Sea water system”.



Oil pressure

Oil pressure

If the oil pressure shows during operation, the oil pressure in the engine is too low.

- Stop the engine at once.

⚠ WARNING! Continued operation when the oil pressure is too low can cause serious engine damage.

- Check the oil level in the engine. Please refer to “Maintenance: Lubrication system” to check and top the oil up.
- Also check that the oil filter is not blocked. Please refer to “Maintenance: Lubrication system”



Voltage

Voltage

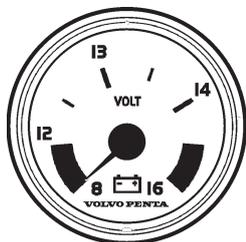
The battery lamp shows if the alternator is not charging or voltage is too high, this can be due to a fault in the electrical system or because the alternator drive belt is slack.

- Stop the engine
- Check the alternator drive belt.

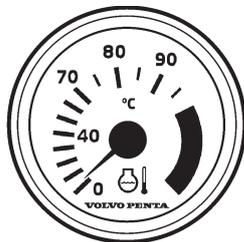
⚠ WARNING! Do not continue operation if there is any problem with the alternator drive belts. This could cause serious engine damage.

- Check that there is no poor contact/broken wires.

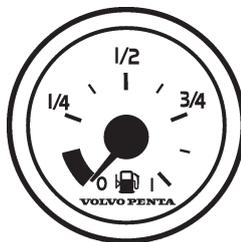
This section describes the instrument and control panels sold by Volvo Penta as optional extras for your engine.



Voltmeter



Coolant temperature



Fuel level



Alarm display

Voltmeter

The operating charge voltage is approx. 14 V. When the engine is stopped battery voltage is approx. 12 V.

Coolant temperature

Normal operating temperature is between 75–95°C. The acoustic alarm will automatically go off if the engine coolant temperature is too high.

⚠ IMPORTANT! If the alarm sounds: Reduce engine speed to idle (neutral). Stop the engine if the temperature does not drop. Investigate and correct the malfunction.

Alarm display

The alarm display provides you with a visual warning, if and when an alarm occurs, to notify you of an existing malfunction.

The warning lamps light up, in sequence, when the engine is started. Check that all lamps function and that they go out once the engine is started.

If a fault occurs the associated lamp on the alarm display will light up, the Tachometer LCD screen will show an alarm warning and the alarm buzzer sound.

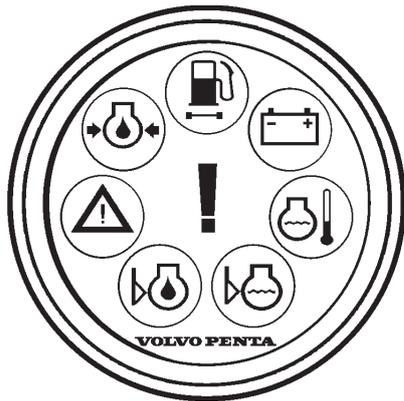
NOTE! Warning lamps should never light up during operation.



System Failure (red indication)

The "System Failure lamp" will light up at short circuit, broken wire and AUX failure.

Red: for faults requiring immediate action or attention by the operator. The buzzer will sound constantly.



Oil pressure (red indication)

If the oil pressure lamp lights up during operation, the oil pressure in the engine is too low.

- Stop the engine at once.



WARNING! Continued operation when the oil pressure is too low can cause serious engine damage.

- Check the oil level in the engine. Please refer to "Maintenance: Lubrication system" to check and top the oil up.
- Also check that the oil filter is not blocked. Please refer to "Maintenance: Lubrication system"



Fuel level (orange indication)

The "Fuel level" symbol will show when 20% or less of usable fuel remains in the tank.

NOTE! The engine has to run at least one minute before this function is activated



Battery (orange indication)

The battery lamp lights up if the voltage is too high (>15 V) or the alternator is not charging, this can be due to a fault in the electrical system, or because the alternator drive belt is slack.

- Stop the engine
- Check the alternator drive belt.



WARNING! Do not continue operation if there is any problem with the alternator drive belts. This could cause serious engine damage.

- Check that there is no poor contact/broken wires.



Coolant temperature (red indication)

The coolant temperature lamp lights up when the coolant temperature is too high.

- Stop the engine if this lamp lights up during operation.



WARNING! Continued operation when the coolant temperature is too high can cause serious engine damage.

- Check the coolant level. Please refer to “Maintenance: Freshwater system”.



WARNING! Do not open the coolant filler cap when the engine is warm could cause serious engine and personal damage. Steam or hot fluid could spray out.

- Check that the sea water filter, if installed, is not blocked. Please refer to “Maintenance: Sea water system”
- Check the impeller in the sea water pump. Please refer to “Maintenance: Sea water system”.



Coolant level

This indicator is not activated for the engine.



Oil level

This indicator is not activated for the engine.

Display EVC System

Introduction

The Volvo Penta EVC System Display is an instrument that displays the engine's operating information and allows communication with the engine electrical system.

NOTE! The display is preset for engines larger than D2 and therefore, before the display can be used with D1/D2 engines, engine series D1/D2 must be selected in the configuration menu SETTINGS/ENGINE SERIES (refer to the configuration menu section).

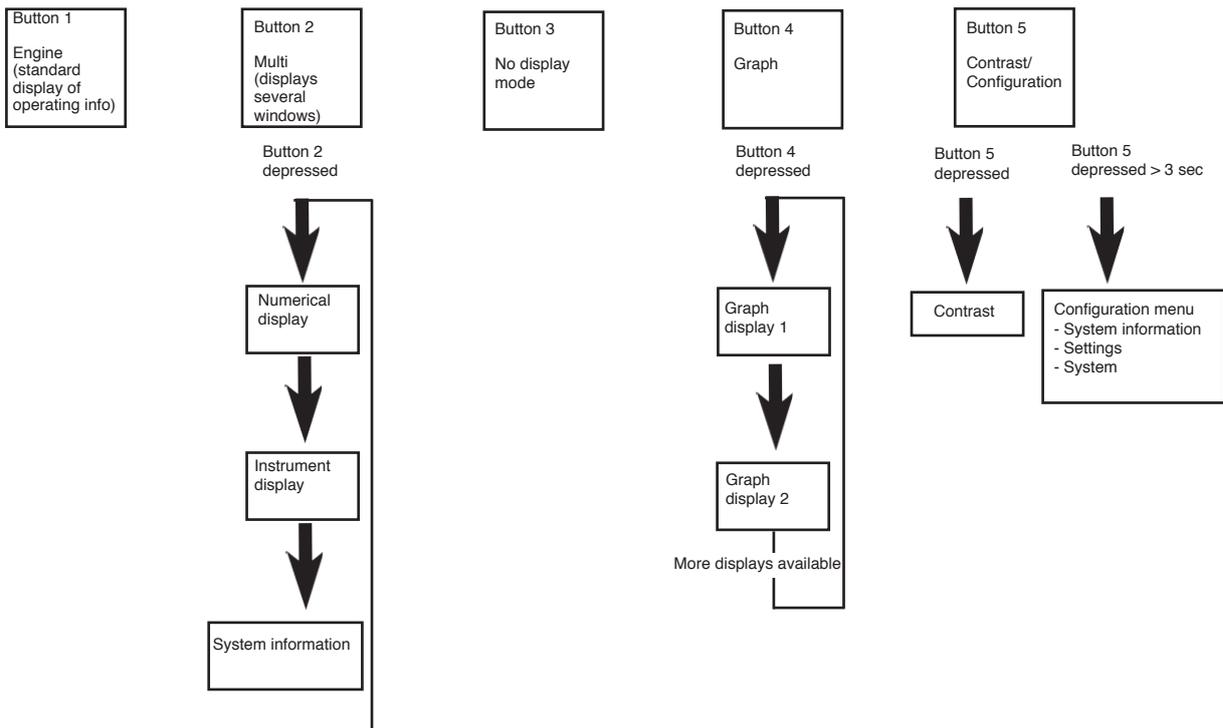
Operating information is shown on an LCD display. The driver can select the display mode with the five buttons at the front of the instrument.

Three of the four buttons to the left show operating information in different ways. The button at the far right (5) is used to adjust the display contrast and to access the configuration menu. It can be used to make display settings, amongst other things. The configuration menu can also show display mode SYSTEM INFORMATION (which is also available via button 2, see diagram below). The display mode functions in the same way as the EVC System Tachometer.

Before using the display, certain display settings must be made. To see which settings can be made, refer to the configuration menu section.



Structure for the main menus in the display





Start image

This is the starting image that is shown on the display for a brief period after starting.

If the display emits a high pitched sound continuously after starting, the self-test has failed. The display may still function but may act erratically.

Symbols for operating information



Oil pressure



Coolant temperature



Voltage



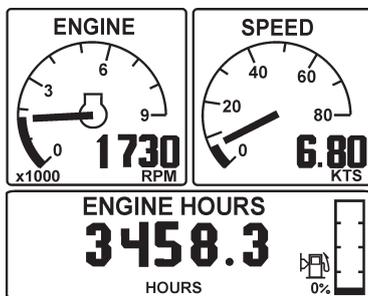
System failure



Fuel level

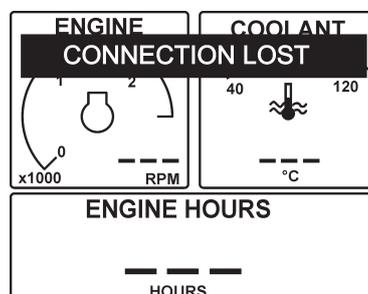
AUX

Extra alarm for optional function



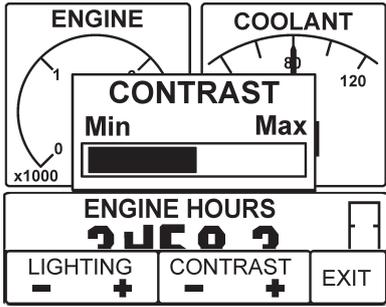
Display after starting screen

The ENGINE display mode (button 1) is always shown after the starting screen when the display is first started up (more information about this display mode can be found in the instructions below). Once the display has been used, it will always show the display mode that was selected when the display was last switched off, next time it starts up.



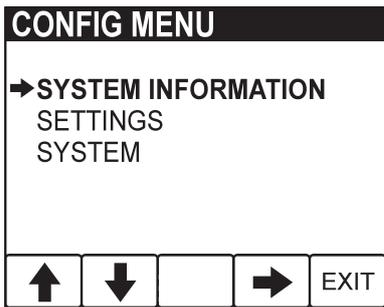
Transfer fault

If the display does not register the transfer of operating information from the electrical system, the pop-up window CONNECTION LOST flashes. When operating information has been registered/reset, the pop-up window disappears.



Set display contrast

Press button 5 (far right) to set display contrast. Then press the appropriate buttons to adjust the levels and save the settings by pressing EXIT. The display unit has 5 contrast settings.



Configuration menu (button 5)

(depressed for longer than 3 s)

The configuration menu is used to:

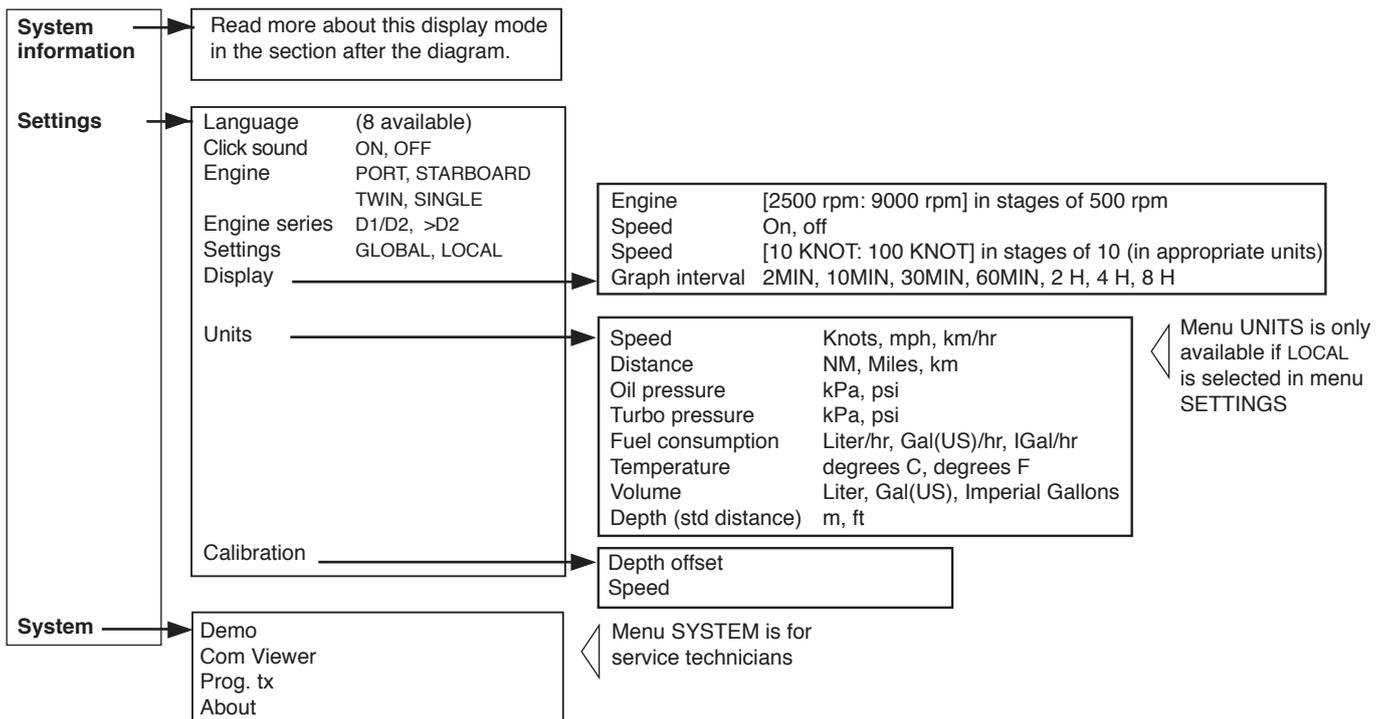
- reach display mode SYSTEM INFORMATION
- make certain settings for the display
- calibrate depth offset and speed
- reach information and functions for display service

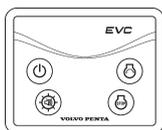
Please refer to the configuration menu structure below and read the following section, which explains each section in the menu.

⚠ Important! Before the display can be used with D1/D2 engines, engine series D1/D2 must be selected in the configuration menu SETTINGS/ENGINE SERIES (see diagram below).

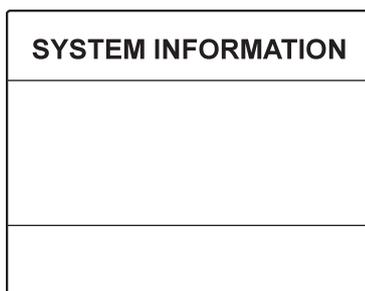
NOTE! The engine must have the system switched on when you change the display settings or calibrate functions.

Configuration menu structure

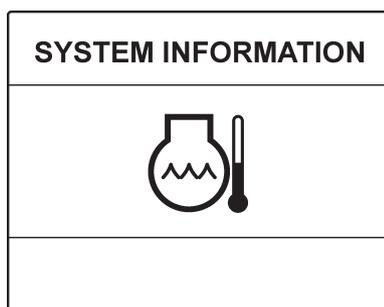




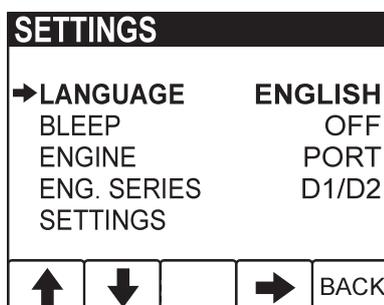
Control panel



"System information" display mode



Alarm example



Display mode System Information

SYSTEM INFORMATION is a display mode that functions in the same way as the EVC System Tachometer.

Instructions about how the display in the tachometer functions can be found in the section concerning the tachometer in this instruction book.

Alarm

The display automatically switches to display mode SYSTEM INFORMATION when an alarm is to be displayed. Instructions about how the alarm should be handled can be found in the chapter "Operation". To exit the system, press button 5.

Settings

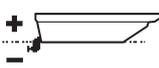
The menu SETTINGS is used for making various settings on the display.

- **Language:** This is where you select the display language (8 different languages are available).
- **Bleep:** This is where you select whether a bleep should be heard when a button is pressed. (ON/OFF)
- **Engine:** This is where you select the engine for which operating data will be displayed. (SINGLE, PORT, STARBOARD or TWIN.) Choose SINGLE.
- **Engine series:** This is where you select the engine for which the display has been installed. (D1/D2, >D2) For D1/D2, this setting must be made before the display can be used.
- **Settings:** (LOC, GLOB) Choose LOC.
- **Display:** This is where you set the measurement intervals of the speedometers and tachometers.
 - Rpm engine: [2500 rpm: 9000 rpm] in steps of 500 rpm. Set to 4000 rpm
 - Speed: Change speed display (on/off)
 - Speed: [10 KNOT: 100 KNOT] in steps of 10 (in current measurement unit for speed)
 - Graph interval: 2 MIN, 10 MIN, 30 MIN, 60 MIN, 2 H, 4 H, 8 H

UNITS	
SPEED	KM/H
→DISTANCE	KM
OIL PRESSURE	kPa
TURBO PRESSURE	kPa
FUEL RATE	L/H
↑	↓
→	BACK

- **Calibration:** This is where depth offset and speed calibration are made. See calibration procedure below.
- **Units:** (This menu is displayed only if LOCAL is selected in menu SETTINGS.) This is where you select the measurement units to be used to display operating information. For D1/D2, LOCAL shall always be selected and the measurement units set as desired.
 - Speed: KNOT, MPH, KM/H
 - The distance is adjusted to suit the speed unit: NM, MILE, KM
 - Oil or Turbo pressure: kPa, psi
 - Volume: LITER, GAL, Imperial GAL
 - Fuel consumption / time: is adjusted to suit the volume unit: L/H, GAL/H, IGAL/H
 - Temperature: °C (CELSIUS), °F (Fahrenheit)

CALIBRATION	
→DEPTH	
SPEED	
↑	↓
→	BACK

DEPTH OFFSET	
	
DEPTH DATA	6.6M
OFFSET	-0.6M
DISPLAY	<u>6.0M</u>
↑	↓
→	BACK

Depth offset calibration

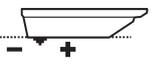
Note! The engine must have the system switched on when functions are calibrated.

The depth sounder can be placed somewhere on the hull that it gives another depth than the desired depth. You can then add or subtract a distance so that the display shows the depth from, for example, the lowest point on the boat, or from the surface.

OFFSET can be adjusted upwards (+) or downwards (-) in steps of 0.1 units.

The adjusted value is stored when you press button BACK.

CALIBRATION	
DEPTH	
→SPEED	
↑	↓
→	BACK

SPEED CALIBRATION	
	
SPEED DATA	6.6 kts
CALIBRATION	x0.90
DISPLAY	<u>6.0 kts</u>
-	+
→	BACK

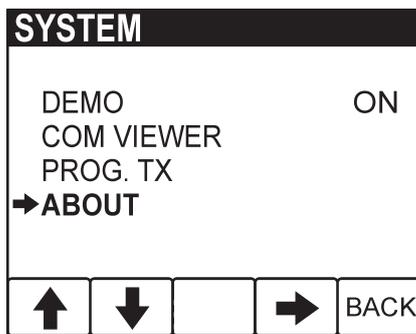
Speed calibration

Note! The engine must have the system switched on when functions are calibrated.

Perform speed calibration when the boat is moving. Compare the sensors speed value SPEED DATA with the GPS speed value (or another boat with the same speed) and adjust the calibration value CALIBRATION so that the correct speed value is shown on the DISPLAY.

Calibration value CALIBRATION for the boat's speed sensor can be adjusted upwards (+) or downwards (-) in steps of 0.01 unit (+ or - 1%).

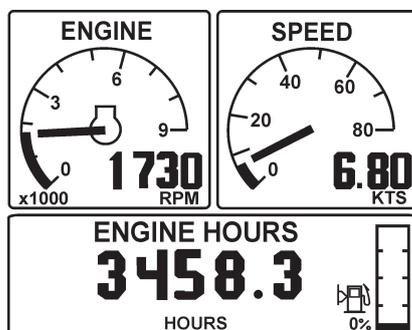
The adjusted value is stored when you press button BACK.



System

The SYSTEM menu is to give necessary functions and information to service technicians.

- **Demo:** Switch between demo mode ON/OFF. The display is in normal operating mode when demo is OFF.
- **Com Viewer:** Shows the latest messages received on the communication inputs
- **Prog tx:** Transfers the content of the application program on flash memory to other CANtrak-units on the same CANbus-link
- **About:** Shows the following information:
 - ID-no:** Display serial number
 - Eeprom:** No. of writes to the EEPROM
 - Vers:** Software version number
 - Chk:** Flash memory checksum
 - Part no:** Volvo's part number for the software
 - Source:** Shows the source of the received data
 - Label:** Label allocated on the bus. Each unit on the same bus must have its own unique label



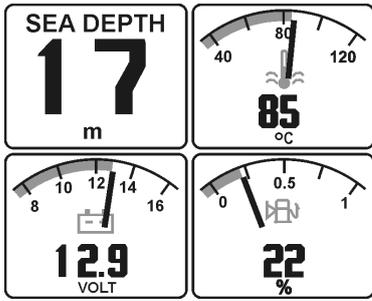
Display mode Engine (Button 1)

This display mode shows the engine speed and boat speed in the form of standard instruments. Operation time is shown in the lower window. The fuel level gauge is only displayed if there is a tank sender.

The scale values for maximum engine speed and maximum speed can be set in the configuration menu.

Only metric values are displayed, but other units can be displayed if they have been chosen in the configuration menu.

If information about boat speed is not available, the display shows coolant temperature instead.



Example of display in several windows

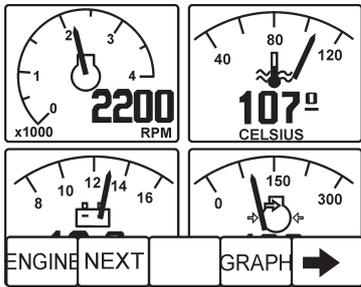
Display mode Multi (button 2)

This display mode shows operating information in four different windows (see below). The user can choose which operating information is to be shown in which window.

The information can be displayed as figures or as a standard instrument. The display switches between different modes when button 2 is pressed repeatedly.

If an item of operating information is not available, the unit displays "—" and the analog gauge needle is not shown.

From display mode MULTI one can also reach SYSTEM INFORMATION, the display mode that functions in the same way as the small display in the tachometer. Read more about display mode SYSTEM INFORMATION in the configuration menu section.



Press button 5 to choose setting mode

Set the appearance of display mode Multi

Display mode MULTI has a mode for setting which operating information should be displayed in which window.

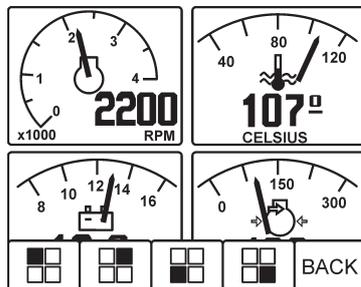
The setting mode is reached by pressing button 5 (far right), when you are in the display mode MULTI. Please refer to the illustrations below.

Note! The type of operating information available depends on the electrical system in the boat and the sensors that the boat is equipped with. Optional sensors include depth sounder, water temperature and speed.

Note! The following applies for standard instrument display:

The maximum engine speed range can be set on the configuration menu.

The voltage range can be [8V: 16V] and is changed automatically, depending on the latest data value.



Buttons 1 to 4 are used to adjust the corresponding window (refer to the black markings)

Display mode Graph (button 4)

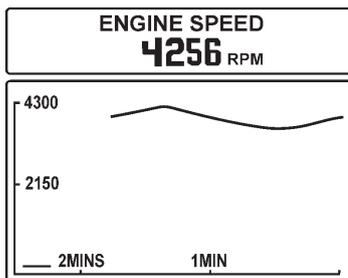
This display mode shows operating information in the form of a histogram. Press button 4 repeatedly to show different operating information.

If an item of operating information is not available, that window cannot be chosen.

If contact with the relevant information is lost during display, the curve will no longer be drawn, but the line will continue to scroll across the window.

The maximum time interval can be set to one of the following values in the configuration menu: 2 min, 10 min, 30 min, 1 h, 2 h, 4 h, 8 h.

The interval on the Y-axis is set automatically for the best view.

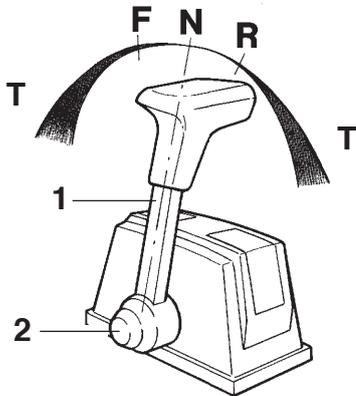


(shows engine speed)

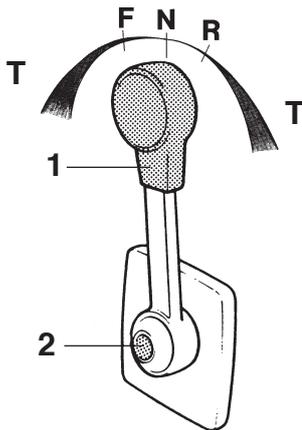
Controls

The shift function and engine speed control are combined in one lever. If necessary the shift function can be easily disengaged so that only the engine speed (rpm) is affected by the lever. The control lever has an adjustable friction brake.

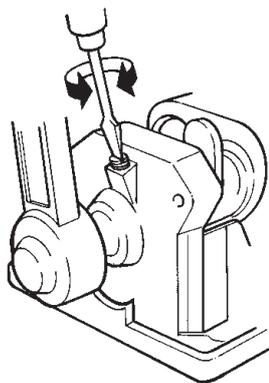
NOTE! A neutral position switch is available as an accessory, this will only permit the engine to be started with the drive/reverse gear disengaged.



For top-mounted controls



For side-mounted controls



Maneuvering

Shifting and engine speed are controlled with the same lever (1).

N = Neutral position. Drive/reverse gear disengaged.

F = Drive/reverse gear engaged for movement ahead.

R = Drive/reverse gear engaged for movement astern.

T = Engine speed control

Disengaging the shift function

- 1 Move lever (1) to the neutral position (N).
- 1 Press in button (2), move the lever slightly forward and release the button.

The shift function is now disengaged and the lever affects only engine speed. When the lever is moved back to the neutral position it will automatically re-engage.

⚠ IMPORTANT! Take care not to engage the drive/reverse gear by mistake.

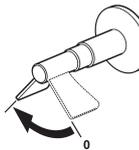
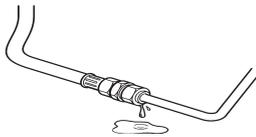
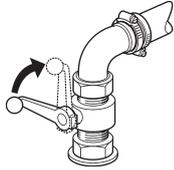
Adjusting the friction brake

The friction brake only affects the engine speed control movements.

- 1 Lift the cover over the control. For side-mounted controls the lever must first be removed.
- 1 Set the lever to the half-open throttle/reverse position.
- 1 Adjust the friction brake. Turning the screw clockwise (+) makes the lever movement stiffer, while turning counterclockwise (-) makes it easier to move the lever.
- 1 Reinstall the cover and lever.

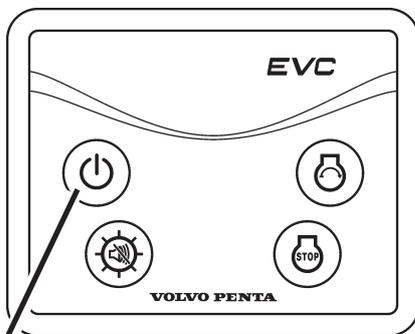
Starting the engine

Make a habit of checking the engine and engine compartment visually before operating the boat. This will help you to quickly detect anything unusual that has or is about to happen. Also check that instruments and the warning display are indicating normal values when you have started the engine.



Before starting

- | Open the cooling water intake sea cock.
- | Open fuel valve.
- | Carry out the actions in the “Daily before the first start-up” section in the maintenance schedule
- | Switch on the main switch.
 - ⚠ **IMPORTANT!** Never break the circuit with the main switch while the engine is running. This could damage the generator.
- | Start the engine compartment fan if one is fitted and let it run for at least four minutes.
- | Check that there is sufficient fuel.



1

Starting method

Press the on/off button (1) to activate the control panel. The Volvo Penta logo will show in the LCD screen and two beeps indicate the system is ready.





Check the warning lamps and LEDs

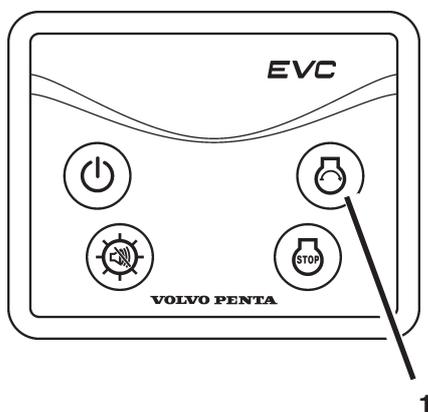
Each time the system is activated all bulbs and LEDs are illuminated on the alarm display (optional extra). Check that all bulbs and LEDs function!

Start the engine

To start the engine press the start button (1) until the engine starts. The pre-heat symbol shortly shows on the LCD screen. The pre-heat process runs for 20 seconds after the button is pressed.

NOTE! If the preheat button is pressed briefly and not until the engine starts the preheat process will be running for 20 seconds. The preheat symbol will show on the LCD screen.

The pre-heat process will only run if the engine temperature is less than 50°C.



Read the instruments and warm the engine up

Allow the engine to idle for the first ten seconds, and check that instruments and warning displays show normal values. Check that no warning lamps flash on the alarm display.

Then warm the engine up at low speed and low load, so that reaches normal operating temperature before full power is used.

⚠ IMPORTANT! Never race the engine when it is cold.

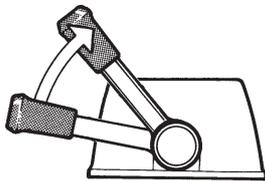
Operation

Avoid violent and unexpected changes in course and gear engagement. There is a risk that someone aboard will fall over or overboard.

⚠ WARNING! A rotating propeller can cause serious injury. Check that nobody is in the water before engaging ahead or astern. Never drive near bathers or in areas where people could be in the water.

Checking instruments

Check the instruments and warning display directly after starting the engine and then at regular intervals while driving the boat. Stop the engine if there is an abnormal reading or any warning lamp comes on and the alarm sounds.



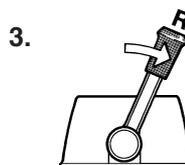
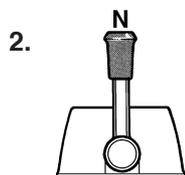
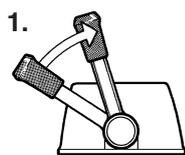
Cruising speed

Operating the engine at full speed should be avoided since it is both uneconomical and uncomfortable. Volvo Penta recommends a cruising speed in the range 500–1000 rpm lower than maximum rpm at full speed. Depending on hull type, choice of propeller, load and conditions etc. the maximum engine speed at top speed can vary, but it should be within the full speed range.

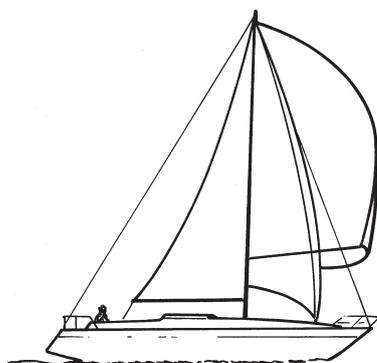
Full speed range:..... 2,800–3,200 rpm

Maneuvering

All shifting between ahead and astern must be done at engine idle speed. Shifting at higher speeds may damage the drive or reverse gear and will also be uncomfortable for those on board.

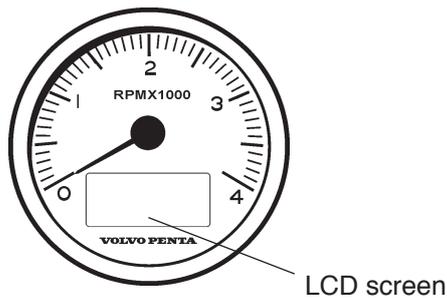


1. Reduce engine speed to idling and, if possible, let the boat lose most of its speed.
2. Move the reverse gear control lever quickly and firmly into the neutral position. Wait for a moment.
3. Move the gear control lever quickly and firmly into astern, then increase the speed.

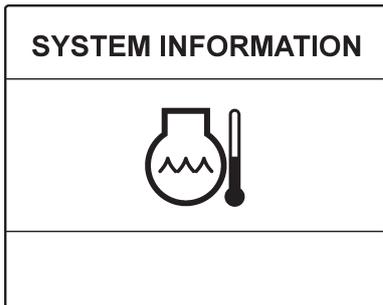


When sailing

When sailing the control lever should be in the reverse position if a folding propeller is used and in neutral position if a fixed propeller is used.



Tachometer



Alarm example

Alarm

If there is an alarm the tachometer LCD screen will show a flashing warning icon and the alarm buzzer sound.

If the boat is equipped with an alarm display (optional extra) the relevant lamp will start to flash.

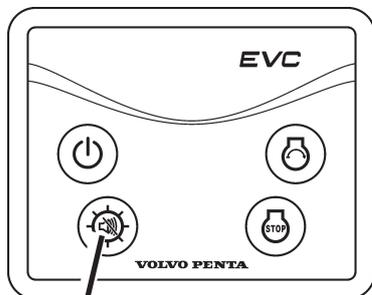
Please refer to chapter "Instruments" for more information about the warning icons and the alarm display indicator lights.

1. Reduce engine speed to idling.
2. Acknowledged the alarm by pressing the multi-function button (1). The alarm buzzer stops and the warning icon continues to show in a steady light until the malfunction is corrected.

Please refer to the "Instrumentation" chapter where you will find information about the alarm symbols.



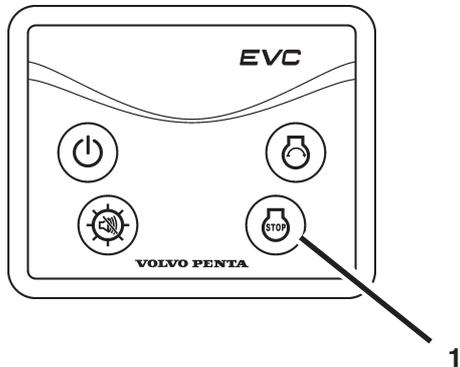
Alarm display (optional extra)



1

Stopping the engine

The engine should be run for a few minutes at idle (in neutral) before turning it off. This will avoid boiling and even out the temperature. This is especially important if the engine has been operated at high engine speeds and loads.

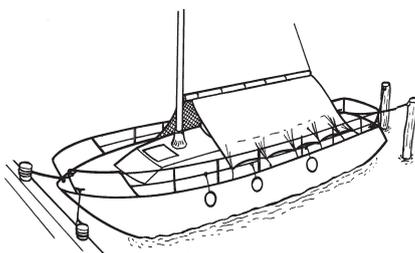
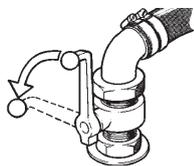
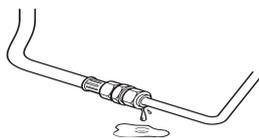


Stopping

Press the Stop button (1) until the engine stops running.

After stopping the engine

- | Inspect the engine and engine compartment for any leaks.
- | Close the fuel cock and sea cock for the cooling water intake.
- ⚠ **IMPORTANT!** Do not forget to open the cocks before the engine is started again.
- | Read off the hours counter and do preventive maintenance as in the maintenance schedule.
- | Switch off the main switch if the boat is not to be used for some time.
- ⚠ **IMPORTANT!** Never break the circuit with the main switches while the engine is running. This could damage the generator.



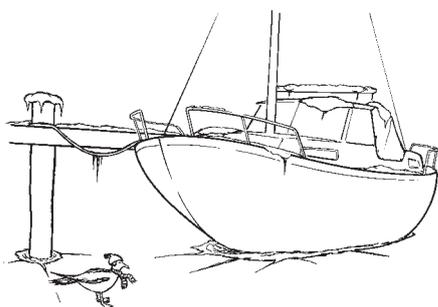
Laying up

If the boat is not going to be used for some time but is being left in the water, the engine must be run to operating temperature at least once every 14 days. This prevents corrosion in the engine. If the boat will not be used for more than two months then inhibiting should be carried out: See chapter "Laying up/ Launching".

Cold weather precautions

To prevent freezing damage, the seawater system must be drained and the freshwater system coolant must have sufficient antifreeze protection. See chapter Maintenance "Cooling systems".

- ⚠ **IMPORTANT!** A poorly charged battery may burst as a result of freezing.



Maintenance schedule

Your Volvo Penta engine and associated equipment is designed to provide high operational reliability and long service life. They are constructed to withstand the marine environment while also affecting it as little as possible. Preventive maintenance in accordance with the maintenance schedule will ensure that it retains these qualities and avoid unnecessary operational disturbances.

Warranty inspection

The prescribed warranty inspection “First Service Inspection” must be carried out at an authorised Volvo Penta workshop during this first period of operation. Directions for when and how this is to be carried out can be found in the **Warranty and Service Book**.

Extended Protection

Volvo Penta offers an Extended Protection for your marine diesel engine, including transmission, if used for pleasure use only. To be valid a Extended Protection service has to be performed at the owners cost and expense by an authorized Volvo Penta distributor, dealer or workshop before the expiry of the 12 months Warranty Period. Further directions can be found in the **Warranty and Service Book**.

MAINTENANCE SCHEDULE

 **WARNING!** Read the chapter “Maintenance” thoroughly before starting any maintenance work. It contains directions for performing maintenance in a safe and correct manner.

 **IMPORTANT!** When both operating time and calendar time is given, the one occurring first is to apply. Maintenance points marked with are to be carried out at an authorised Volvo Penta workshop.

Daily before starting for first time

- I Engine and engine room. General inspection page 36
- I Engine oil. Checking level page 39
- I Coolant. Checking level..... page 40

Every 14 days

- I Fuel pre-filter. Drain water page 49
- I Drive belt. Check page 37
- I Seawater filter. Cleaning page 45
- I Battery. Check electrolyte level page 51
- I Reverse gear. Check oil level..... page 57
- I S-drive. Check oil level..... page 56

Every 200 operating hours or at least once a year, included in Extended Protection

- I D1-13, D1-20, D1-30. Engine oil. Replace page 39
- I D1-13, D1-20, D1-30. Oil filter. Replace page 39
- I Reverse gear. Oil change page 57
- I Reverse gear. Lubricate propeller shaft seal page 80
- I S-drive. Oil change page 56
- I S-drive/Reverse gear. Checking corrosion protection page 58

Every 500 operating hours or at least once a year, included in Extended Protection

- I D2-40. Engine oil. Replace page 39
- I D2-40. Oil filter. Replace page 39
- I Fuel filter. Replace page 49
- I Fuel pre-filter. Replace page 49
- I Idling speed. Check page 38
- I Seawater pump. Check impeller page 44
- I Vacuum valve. Cleaning page 45

Least once a year, included in Extended Protection

- I Folding propeller. Cleaning page 58
- I S-drive. Check rubber seal (hull/drive) page 80

Every 500 operating hours or at least once every two years

- I Air Cleaner (ACL). Replace page 38
- I Coolant. Replace page 43
- I Heat exchanger. Cleaning page 43
- Injectors. Test pressure not shown
- Valve clearance. Adjustment not shown

Every 500 operating hours or at least every fifth year

- Reverse gear. Replacing propeller shaft seal not shown

Every seventh year

- S-drive. Replacing rubber seal between drive and hull not shown

Maintenance

This chapter contains instructions regarding how the above maintenance points should be carried out together with general technical information. Read the instructions carefully before starting work. Maintenance intervals are contained in the chapter above. Maintenance schedule

⚠ WARNING! Read the safety precautions for maintenance and service in the chapter: Safety Precautions, before starting work.

⚠ WARNING! Unless otherwise specified all maintenance and service must be carried out with the engine stopped. Stop the engine before opening or removing engine hatches. Immobilize the engine by removing the ignition key, turning off the power supply with the main switch.

Engine, general



General inspection

Make a habit of “visually” inspecting the engine and engine room **before starting the engine and after stopping** when the engine has been turned off. This will help you to quickly detect abnormalities that have occurred or are about to occur.

Look especially carefully for oil, fuel and coolant leaks, loose bolts, worn or slack drive belts, loose connections, damaged hoses and electric cables. This inspection takes only a few minutes but can prevent serious operating disturbances and costly repairs.

⚠ WARNING! Accumulations of fuel, oil and grease on the engine or in the engine room is a fire hazard and must be removed immediately they are detected.

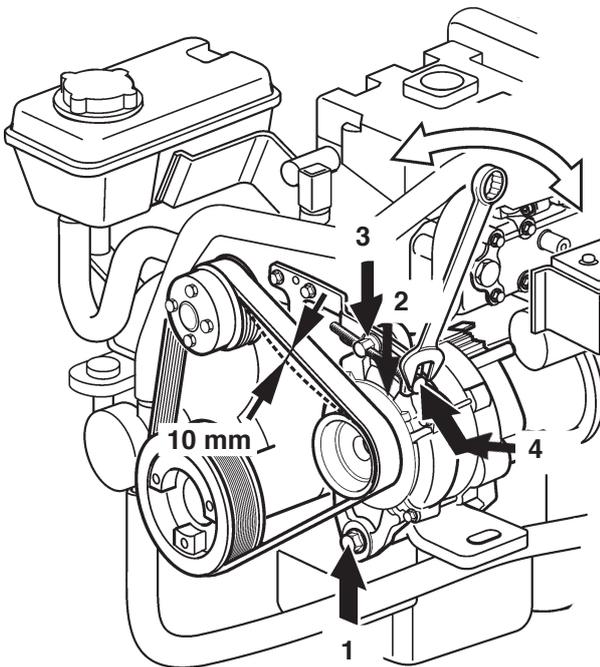
⚠ IMPORTANT! If an oil, fuel or coolant leak is detected, the cause must be investigated and the fault rectified before the engine is started.

⚠ IMPORTANT! Never point high-pressure water jets directly at seals, rubber hoses or electrical components. Never use the high-pressure function when washing the engine.

Drive belt. Check

The belt drives both the circulation pump and the generator. A belt that is too loose can result in slippage, poor cooling and poor charging. A belt that is too tight can damage the bearings in the circulation pump and damage the generator.

Check the tension of the belt regularly. Adjust as required. Check that the belt is not cracked or damaged. Replace a worn belt. Keep a spare belt on-board.



Drive belt. Adjusting and replacing

⚠ WARNING! Always turn the engine off before starting maintenance work.

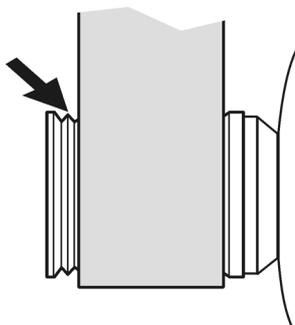
⚠ IMPORTANT! Tighten screw (1) to 50 Nm.

Check and adjust as necessary after operating the engine when the belts are warm. It should be possible to depress a belt at the correct tension approx. 10 mm between the pulleys using normal thumb pressure.

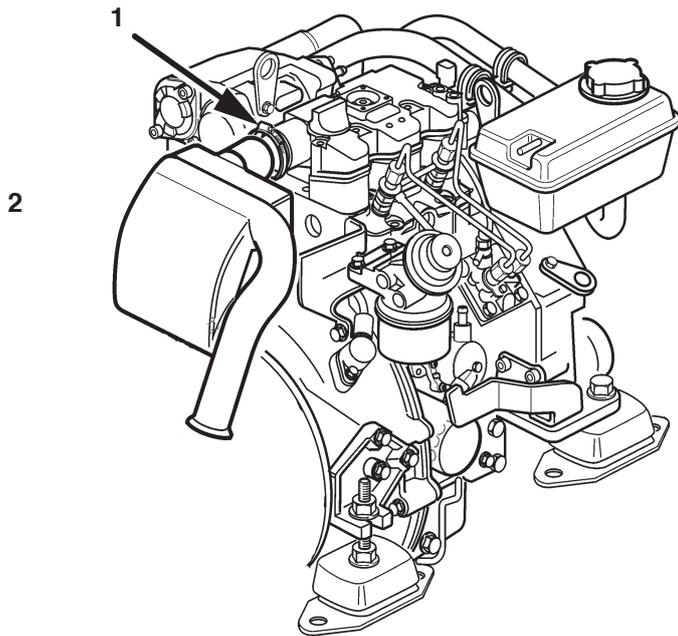
Loosen the alternator fixing screws (1-3). Tension the belt with the adjustment screw (4), to the correct tension. Tighten the screws (1-3). Check the tension.

To replace the belt slacken off screws (1 and 2). Press the generator in towards the cylinder block so that the belt can be removed. Clean off the pulley grooves. Install the new belt. Adjust as above. Check belt tension again after a few hours' operation.

⚠ IMPORTANT! D1-30 and D2-40: make sure the drive belt is positioned in the track closest to the alternator.



D1-30, D2-40

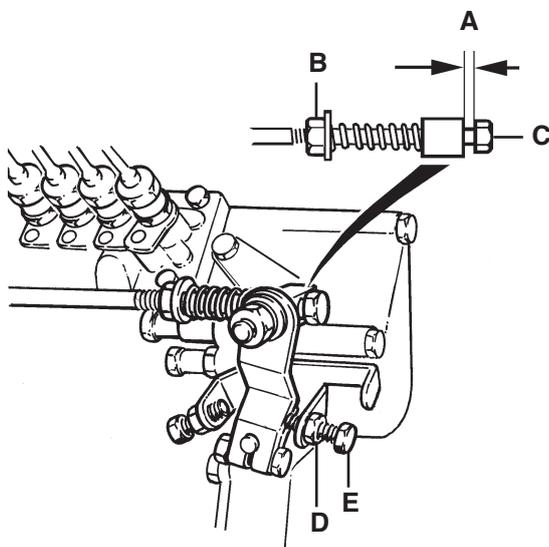


Air Cleaner (ACL). Changing

Loosen the hose clamp (1) and screw (2) to remove the old filter.

Fit the new filter and tighten the hose clamp.

⚠ IMPORTANT! Take care that no contaminants enter the engine.



Idling. Adjustment

For engine idling speed: Please refer to the Technical Data chapter. A lower engine speed can cause the engine to stall and a higher engine speeds can cause extra stresses to the drive/reverse when shifting.

Adjust with the engine at operating temperature as follows:

1* Set the control lever in the neutral position. Check that gap (A) is approx. 3 mm. Adjustment: Slacken off the locknut (B) and adjust until the correct gap is obtained with screw (C). Tighten the locknut.

*This point does not apply to boats with double control positions.

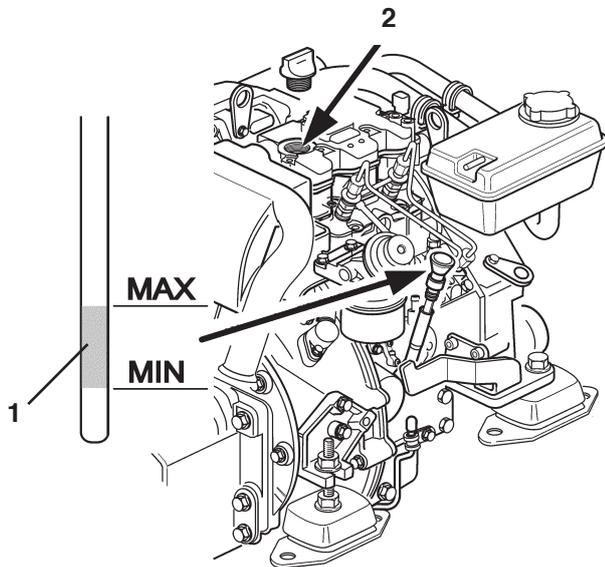
2 Start engine and allow to idle with gear selector in neutral.

⚠ WARNING! Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.

3 Slacken off locknut (D). Adjust engine speed with adjustment screw (E). Tighten the locknut. Repeat step 1.

Lubrication system

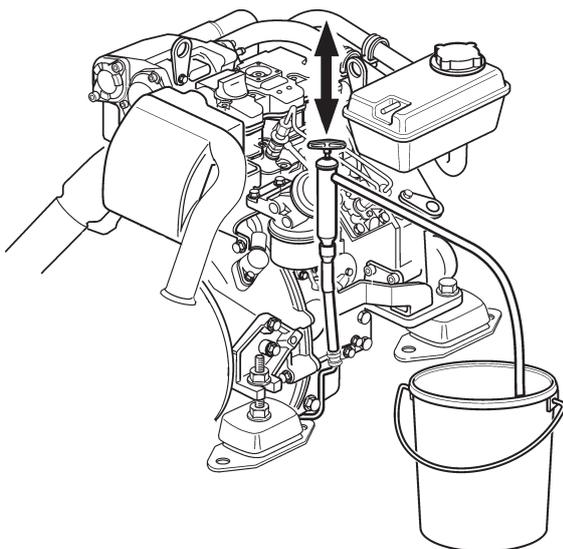
⚠ IMPORTANT! With a new or reconditioned engine, the oil and oil filters must be changed after 20-50 hours of operation. After that they should be changed every 500 operating hours or at least once a year. Use only the recommended grades of oil: See the chapter "Technical Data".



Oil level. Checking and topping up

The oil level should be within the marked area on the dipstick (1). It should be checked every day before the engine is started. Topping up is done through the valve cover (2). Top up oil slowly. Wait a few minutes before checking the oil level again to give the oil time to run down to the oil pan. Then check the level again. Use only the recommended grades of oil: See the chapter "Technical Data".

⚠ IMPORTANT! Do not fill the oil above the MAX level.



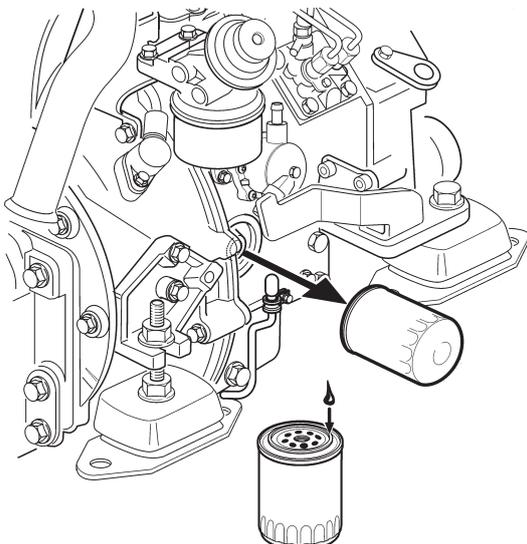
Oil and oil filters. Changing

1. Run the engine to operating temperature so that the oil is easier to suck out. Stop the engine.
2. Suck out the oil using an oil drain pump through oil drain pipe.

⚠ WARNING! Hot oil and hot surfaces can cause burns.

3. Unscrew the old filter. (To avoid oil spills put a plastic bag over the filter before it is unscrewed).
4. Check that the engine mating surface is clean.
5. Moisten the filter rubber gasket with a little oil. Screw on the new filter by hand until it is in contact with the mating surface. And then a further half turn **but no more!**
6. Top up oil to correct level. Start the engine and let it idle. Check that the warning lamp for low oil pressure goes out.
7. Stop the engine. Wait for approx. 10 minutes before checking the oil level. Top up if required. Check that there are no leaks round the oil filter.

NOTE! Collect up the old oil and filter for deposit at a proper disposal site.



Freshwater system

The fresh water system is the engines' internal cooling system, which ensures that the engine operates at the correct temperature. It is a closed circuit system and must always be filled with a mixture of at least 40 % concentrated coolant and 60 % water to protect against internal corrosion, cavitation and damage caused by freezing.

We recommend that you use “**Volvo Penta Coolant, Ready Mixed**”, alternatively “**Volvo Penta Coolant**” (concentrated) mixed with **pure** water according to spec, see “Coolant. Mixture”. Only coolant of this quality is suited too and approved by Volvo Penta.

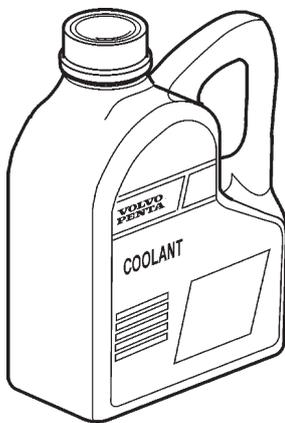
The coolant should contain ethylene glycol of a good quality with a suitable chemical consistency for an adequate protection of the engine. Using anti-corrosion additive exclusively is not permitted in Volvo Penta's engines. Never use water by itself as coolant.

⚠ IMPORTANT! Coolant must be used all year round. This applies even if there is never any risk for frost , to ensure that the engine has an adequate protection against corrosion.

Future warranty claims on the engine and additional equipment may be rejected if an unsuitable coolant has been used or if the instructions concerning coolant mixing have not been followed.

NOTE: The anti-corrosive agents become less effective after a time, which means that the coolant must be replaced, see “Service schematic”. The cooling system should be flushed out at the same time as the coolant is

replaced, see “Cooling system. Flushing”.



“**Volvo Penta Coolant**” is a concentrated coolant that is to be mixed with water. It has been developed to function optimally with Volvo Penta's engines and provides excellent protection against corrosion, cavitation and frost damage.

“**Volvo Penta Coolant, Ready Mixed**” is a ready-mixed coolant, 40% “Volvo Penta Coolant” and 60% water. This concentration protects the engine against corrosion, cavitation damage and freezing conditions down to -28 °C (18°F).

Coolant. Mixture

⚠ WARNING! All glycol is hazardous and harmful to the environment. Do not consume!
Glycol is flammable.

⚠ IMPORTANT! Ethylene glycol must not be mixed with other types of glycol.

**Mix: 40 % “Volvo Penta Coolant” (conc. coolant)
60 % water**

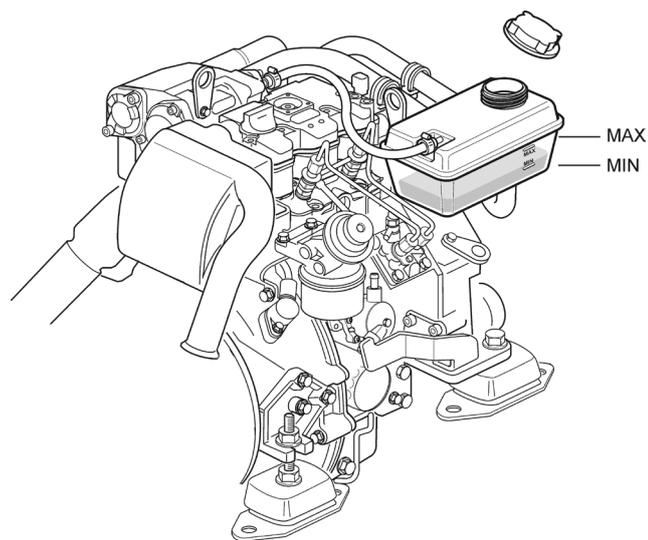
This mixture protects the engine against internal corrosion, cavitation and frost damage down to $-28\text{ }^{\circ}\text{C}$ (18°F). (Using 60 % glycol lowers the freezing point to $-54\text{ }^{\circ}\text{C}$ (65°F)). Never mix more than 60 % concentrate (Volvo Penta Coolant) in the cooling liquid, this will give reduced cooling effect and increase the risk of overheating, and will give reduced freezing protection.

⚠ IMPORTANT! Coolant must be mixed with **pure** water, use **distilled - de-ionized water**. The water must fulfill the requirements specified by Volvo Penta, see “Water quality”.

⚠ IMPORTANT! It is extremely important that the correct concentration of coolant is added to the system. Mix in a separate, clean vessel before adding into the cooling system. Ensure that the liquids mix properly.

**Water quality****ASTM D4985:**

Total solid particles	< 340 ppm
Total hardness:	< 9.5° dH
Chloride	< 40 ppm
Sulfate.....	< 100 ppm
pH value.....	5,5–9
Silica (acc. ASTM D859).....	< 20 mg SiO ₂ /l
Iron (acc. ASTM D1068)	< 0.10 ppm
Manganese (acc. ASTM D858).....	< 0.05 ppm
Conductivity (acc. ASTM D1125)	< 500 μS/cm
Organic content, COD _{Mn} (acc. ISO8467)	< 15 mg KMnO ₄ /l

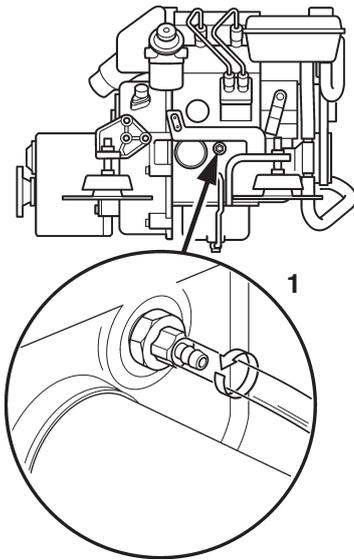


Coolant level. Checking and topping up

⚠ WARNING! Stop the engine and allow it to cool before opening the filler cap. Steam or hot coolant may spurt out. Hot coolant and hot surfaces can cause burns.

Turn the filler cap slowly counter clockwise and let any pressure escape from the system before removing the cap. The coolant level should be between the MAX and MIN marking on the expansion tank, when the engine is cold. Top up coolant if necessary. Reinstall the filler cap.

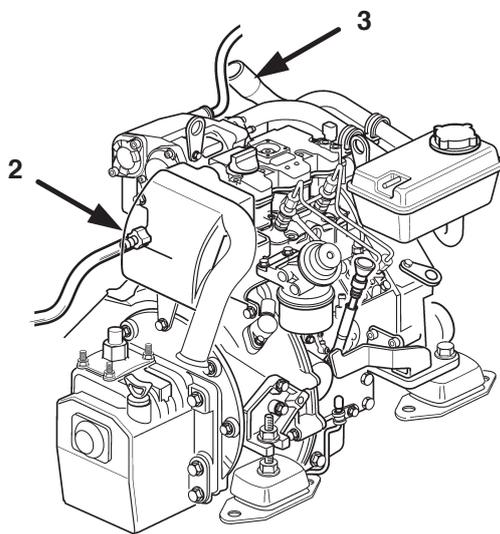
⚠ IMPORTANT! When filling a completely drained system the coolant level must be checked after an hours use because the system is self bleeding. Top up if required.



Coolant. Draining

Connect a hose to the engine drain cock (1) and another to the heat exchanger drain tap (2) and lower these into a vessel. Remove the filler cap on the heat exchanger to let the coolant run out faster. Open the drain cock (1) and the drain tap (2) and drain off all coolant. Before new coolant is put in, clean the heat exchanger as in the following paragraphs.

NOTE! Deposit old coolant at a properly designated disposal site.

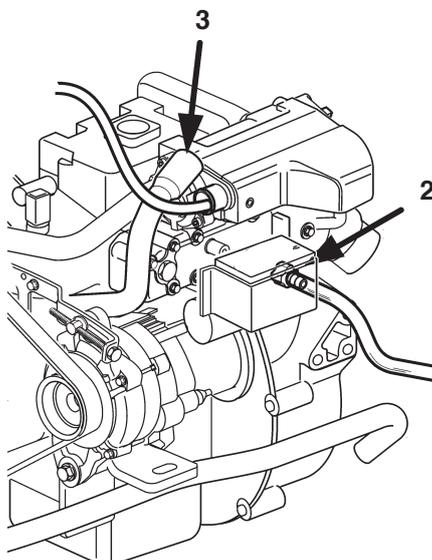


D1-13

Heat exchanger. Cleaning

Cooling performance is reduced by scaling in the heat exchanger. It should therefore be flushed when the coolant is changed.

1. Drain the coolant as above.
2. Insert a hose into the filling pipe (3) on the heat exchanger. Rinse with fresh water until the water which runs out of the drain tap and the engine block is clean. Let all the water run out.
3. Close the drain tap and the drain plug. Fill up with coolant to the correct level. Put the filler cap back.



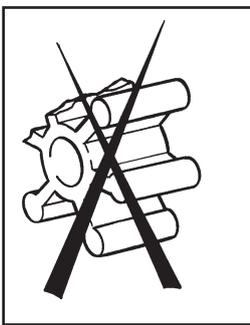
D1-20, D1-30 & D2-40

Seawater system

The sea water system is the external cooling system of the engine. On engines with a sail drive, the sea water pump sucks in water via the drive, after which the water passes the sea water filter (optional extra) before it is pumped through the heat exchanger. Finally, the water is pumped out into the exhaust elbow pipe, where it is mixed with the exhaust gases.

On engines with a reverse gear, the sea water pump suck in water via the sea water inlet, after which the water passes the sea water filter (optional extra) and the reverse gear oil cooler before it is pumped through the heat exchanger. Finally, the water is pumped out into the exhaust bend, where it is mixed with the exhaust gases.

⚠ WARNING! There is a risk that water will enter while working on the seawater system (if the boat is in the water). Water may flow into the boat if a hose, plug or similar object located below the waterline is removed. So always close the seawater cock. If the boat does not have a seawater cock, the flow of water must be stopped in a safe manner. The boat must be brought up on land if this is not possible.



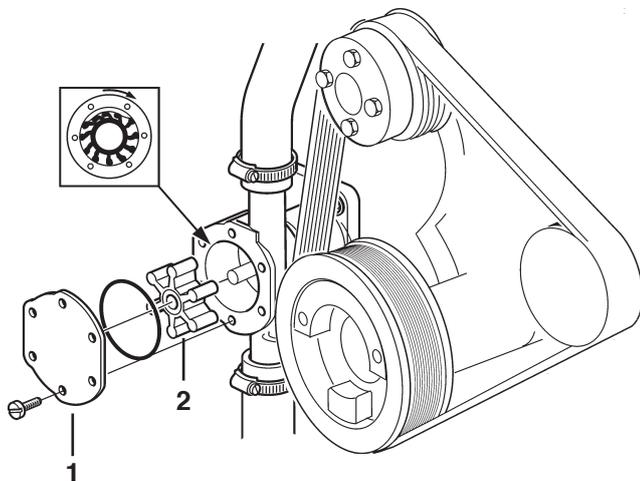
Impeller. Checking/Replacing

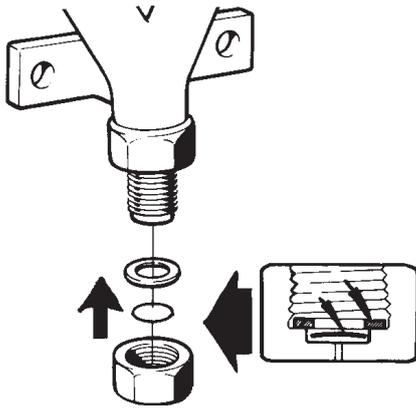
⚠ WARNING! Risk for water penetration. Close the sea cock.

Close the sea cock. Remove cover (1) on the sea-water pump. Remove impeller (2). If there are cracks or other defects the impeller must be replaced. Lubricate the pump housing and the inside of the cover with a little glycerin. Reinstall the impeller using a clockwise rotating movement. Install the cover together with a new gasket. Open the sea cock.

⚠ IMPORTANT! The impeller will be damaged if other types of lubricant than glycerin are used.

⚠ IMPORTANT! Always carry a spare impeller on board.





Vacuum valve. Cleaning

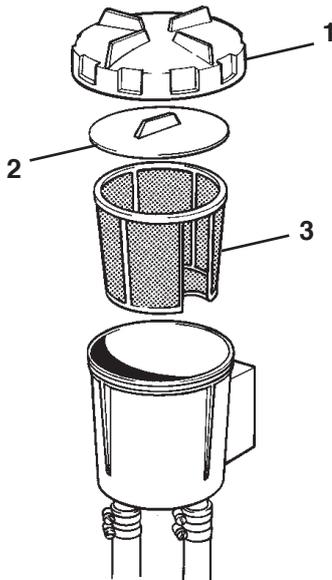
Some engines have a vacuum valve installed in the seawater piping.

⚠ WARNING! Risk for water penetration. Close the sea cock.

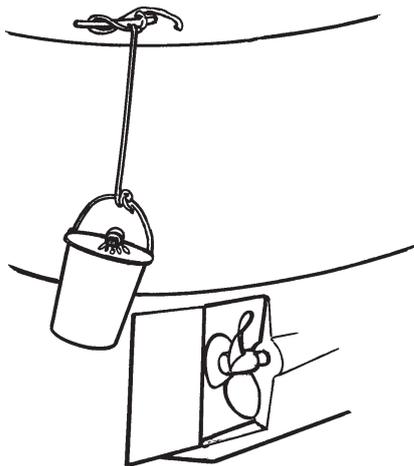
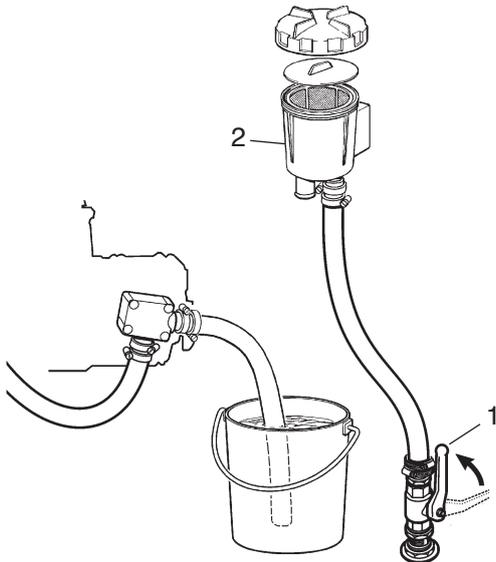
Close the sea cock. Disassemble the valve. Unscrew the hexagonal cover. In the cover there is a membrane and a gasket. Clean all the parts. Turn the cover upside down. Install the membrane first and then the gasket. Turn the valve housing upside down as well. Screw the cover into position, but not too hard (0.2 kpm), or the valve may stop working.

Seawater filter. Cleaning

The seawater filter is an accessory. Screw off cover (1) and remove seal plate (2). Lift out and clean the insert (3).



⚠ IMPORTANT! If the boat is used in water that has a lot of contaminants, seaweed etc. the filter must be checked more frequently than indicated in the maintenance schedule. Otherwise there is a risk the filter will clog and the engine will overheat.



Seawatersystem. Flushcleaningandcorrosion inhibition

When laying up during winter (or out of season), the seawater system must be flushed clean of all deposits and salt crystals. It must also be treated to protect against internal corrosion.

⚠ WARNING! Risk of water penetration. This work must be carried out with the boat on dry land.

Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.

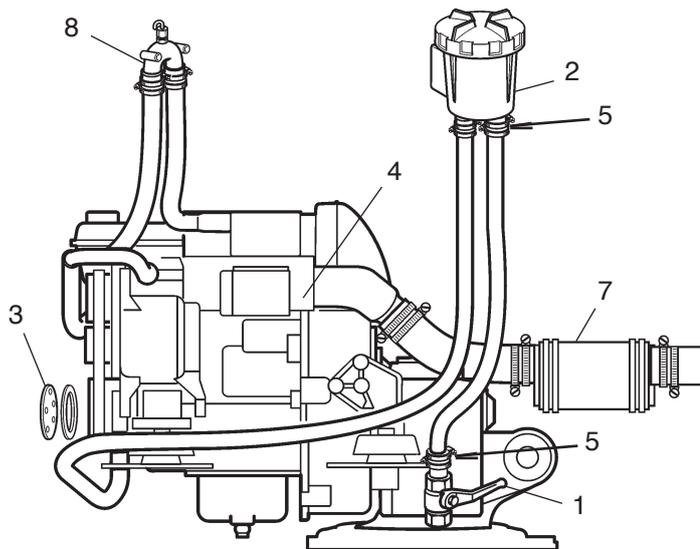
Glycol is harmful to health (dangerous if ingested). Collect used and drained glycol and take it to a proper disposal site.

1. Open the seawater cock (1).
2. Disconnect the hose at the seawater cock (1) or on the outlet side of the sea water filter (2) (if the engine is equipped with such a filter).
3. Place the free end of the hose in a bucket of fresh water. Fill the system.

⚠ IMPORTANT! The impeller will be damaged if it runs dry.

4. Check that there is nobody close to the propeller and there is nothing that will get splashed behind the exhaust outlet.
5. Set the control lever to neutral. Start the engine. Let the engine run at fast idle for a few minutes. Stop the engine.
6. Fill the bucket with an anti-freeze mixture (50% Volvo Penta glycol and 50% fresh water). Collect the mixture from the system in a suitable container.
7. Start the engine and let it idle. Stop the engine just before the mixture is finished.
Repeat as necessary until the entire system has been flushed with the mixture.
8. Reconnect the hose.

This mixture prevents corrosion and protects against freezing. It must be left in the seawater system throughout the laying-up period. Drain the mixture just before the boat is launched.



130S

Seawater system. Draining

If it is not possible to keep the engine compartment free of frost, the seawater system must be drained to prevent freezing damage.

Note that all the seawater must be drained. The type of drainage must be adapted to the way in which the engine is installed and any additional equipment that is connected, for example sea water filter (2), vacuum valve (8), exhaust riser with drain cock (9), silencer (7) etc.

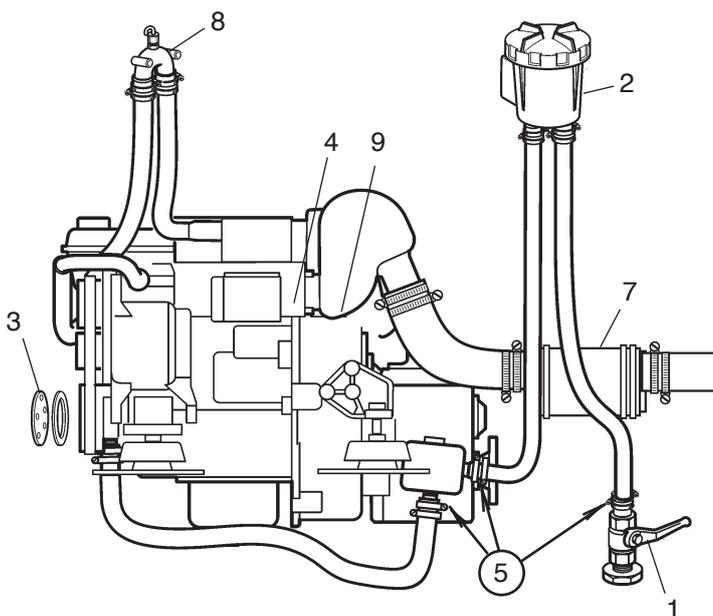
⚠ WARNING! Risk of water penetration. Close the sea cock before starting work.

⚠ IMPORTANT! If the boat is laid-up for winter or the off season, the seawater system must be instead flushed clean and protect against corrosion according to the instructions in the previous section.

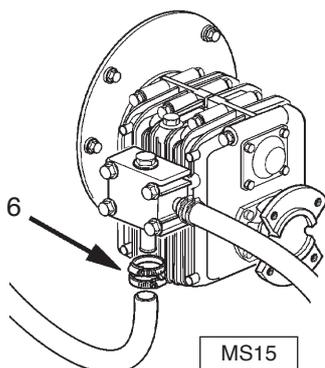
Draining:

1. Close the seawater cock (1).
2. Remove the cover and sealing plate on the sea water filter (2).
3. Remove the cover (3) from the seawater pump. Let the water run out.
4. Open the drain cock (4) on the rear end of the heat exchanger and drain the water off.
5. Disconnect the hoses where indicated by the arrows (5). Drain the hoses.
6. Connect a hose to the drain cock on the heat exhaust riser (9) and lower into a vessel. Open the drain cock and drain the water. Close the drain cock.
7. Disconnect the hose (6) on the reverse gear oil cooler and drain the water off.
8. Drain the silencer (7), the exhaust system and any other additional equipment connected to the seawater and exhaust systems.
9. Reinstall all hoses, the cover on the seawater pump and the cover and sealing plate on the seawater filter. Close the drain cock on the heat exchanger.
10. Opened the seawater cock the next time the boat is used.

⚠ WARNING! Check that there is no leakage in the seawater system.



MS10 / MS15

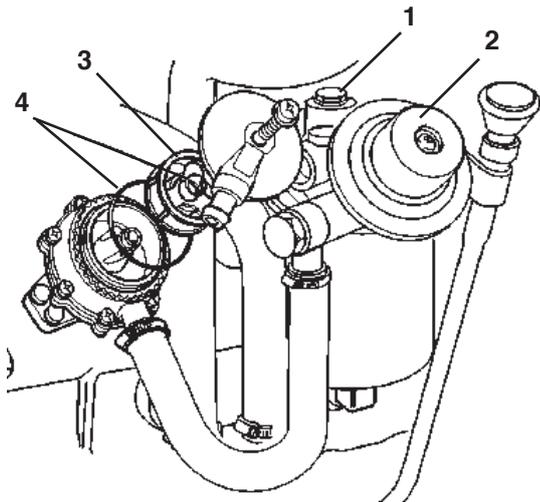


MS15

Fuel system

All work on the engine injection pump or injectors must be carried out at an authorized workshop. Use only the recommended grade of fuel: See the chapter "Technical Data".

⚠ WARNING! Fire risk. When carrying out work on the fuel system make sure the engine is cold. A fuel spill onto a hot surface or an electrical component can cause a fire. Store fuel soaked rags and other flammable material in fireproof conditions.



Venting the fuel system

The fuel system must be vented after fuel filters have been replaced or after refilling the fuel tank after it has been run dry.

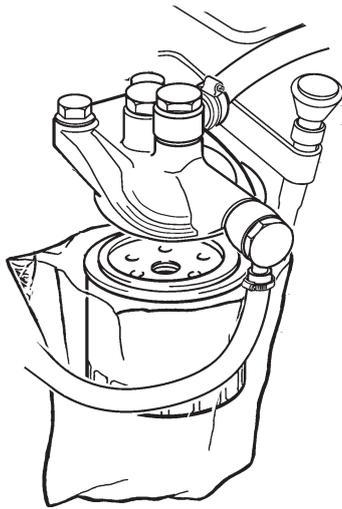
1. Open vent screw (1) on the filter mounting approx. three turns. Avoid fuel spillage. Use rags around the venting point.
2. Pump the fuel using hand pump (2) until there are no more air bubbles visible in the fuel. Continue pumping and at the same time tighten the venting screw.

There is a strainer (3) in the intake manifold for the pump. The strainer does not normally need to be cleaned since the engine should be installed with a fuel pre-filter. Low output may be due to a blocked strainer.

If any of the two o-rings (4) are damaged they need to be replaced.

3. Start the engine and check for leaks.

⚠ WARNING! Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.



Fuel filter. Changing

Clean the filter mounting. To avoid fuel spills put a plastic bag over the filter before it is unscrewed. Unscrew the filter. Moisten the filter rubber gasket with a little oil. Screw on the new filter by hand until it is in contact with the mating surface. And then a further half turn **but no more!** Vent fuel system. **Deposit the old filter at a properly designated disposal site.**

Start the engine and check for leaks.

⚠ WARNING! Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.

Fuel pre-filter. Draining and replacing filter insert

Draining

The fuel pre-filter is an optional extra.

Position a container under the fuel filter. Drain off water and contaminants using the cock/plug at the bottom of the filter bowl.

⚠ IMPORTANT! Wait a few hours after the engine has been turned off before draining the filter.

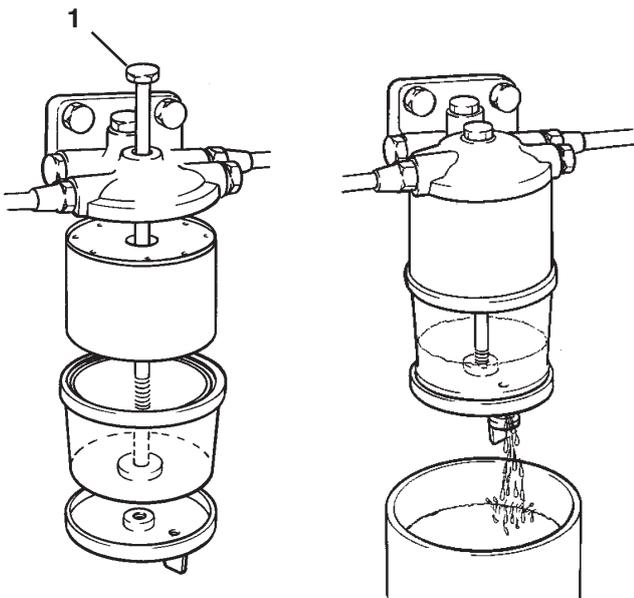
Replacing filter insert

Close fuel cock at the fuel tank. Position a container under the fuel filter.

Remove the filter bowl by undoing screw (1). Empty and clean the filter bowl. Replace insert and reinstall the bowl. Open fuel cock. Vent fuel system. **Deposit the old filter insert at a properly designated disposal site.**

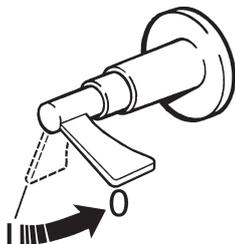
Start the engine and check for leaks.

⚠ WARNING! Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.



Electrical system

⚠ WARNING! Always stop the engine and break the current using the main switches before working on the electrical system. Isolate shore current to the engine block heater, battery charger, or accessories mounted on the engine.



Main switch

The main switch must never be turned off before the engine has stopped. If the circuit between the generator and the battery is cut off when the engine is running the generator can be seriously damaged. For the same reason charging circuits must never be switched over while the engine is running.

⚠ IMPORTANT! Never break the circuit with the main switches while the engine is running.



Electrical connections

Also check that all electrical connections are dry and free of oxidation and that there are no loose connections. If necessary, spray these connections with a water-repellent spray (Volvo Penta Universal oil).

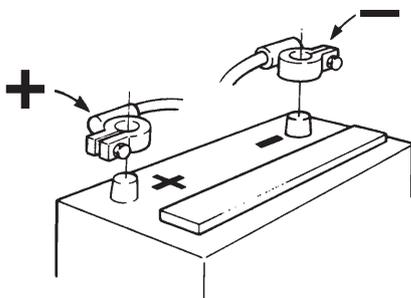


Battery. Maintenance

⚠ WARNING! Risk of fire and explosion. Never allow an open flame or electric sparks near the battery or batteries.

⚠ WARNING! Never mix up battery positive and negative terminals. This may cause sparks and an explosion.

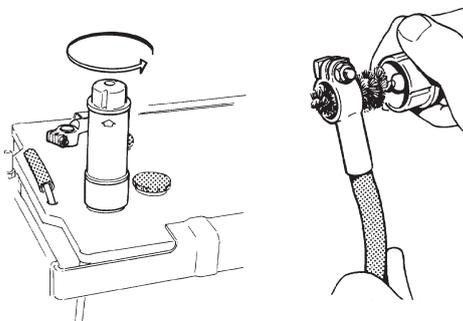
⚠ WARNING! The battery electrolyte contains extremely corrosive sulfuric acid. Protect your skin and clothes when charging or handling batteries. Always use protective goggles and gloves. If battery electrolyte comes into contact with unprotected skin wash off immediately using plenty of water and soap. If battery acid comes into contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.



Connecting and disconnecting

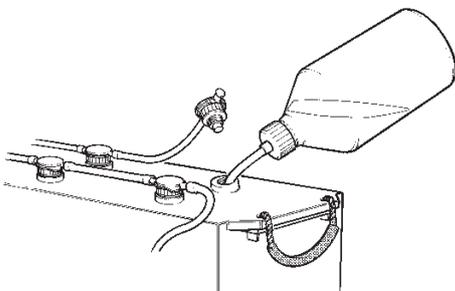
First connect the red battery lead + to the battery + terminal. Then connect the black battery lead - to the battery - terminal.

When disconnecting the battery, disconnect the -lead (black) first and then the + lead (red).



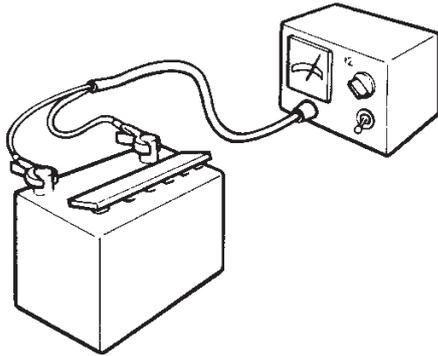
Cleaning

Keep batteries dry and clean. Oxidation or dirt on the battery and battery terminals can cause short-circuits, voltage drop and discharge especially in damp weather. Clean the battery terminals and leads to remove oxidation using a brass brush. Tighten the cable terminals well and grease them with terminal grease or petroleum jelly.



Topping up

The electrolyte should be 5 - 10 mm over the plates in the battery. Top up using **distilled water** if necessary. Charge the battery after topping up for at least 30 minutes by running the engine at fast idle. **NOTE!** Certain maintenance-free batteries have special instructions which must be followed.



Battery. Charging

⚠ WARNING! Danger of explosion! The batteries give off hydrogen gas during charging which when mixed with air can form an explosive gas - oxyhydrogen. A short-circuit, naked flame or spark can cause a large explosion. Ensure that the ventilation is good.

⚠ WARNING! The battery electrolyte contains extremely corrosive sulfuric acid. Protect your skin and clothes when charging or handling batteries. Always use protective goggles and gloves. If battery electrolyte comes into contact with unprotected skin wash off immediately using plenty of water and soap. If battery acid comes into contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.

If the battery has discharged it must be charged. If the boat has not been used for some time charge the battery and then trickle charge it (see manufacturer's recommendations). A poorly charged battery will be damaged and may burst in cold weather.

⚠ IMPORTANT! Follow the instructions supplied with the battery charger carefully. To avoid electrolytic corrosion when an external charger is connected, always disconnect the battery leads before connecting the charger.

When charging, unscrew filler plugs but leave them in their holes. Ventilation should be good, particularly if the batteries are being charged in an enclosed area.

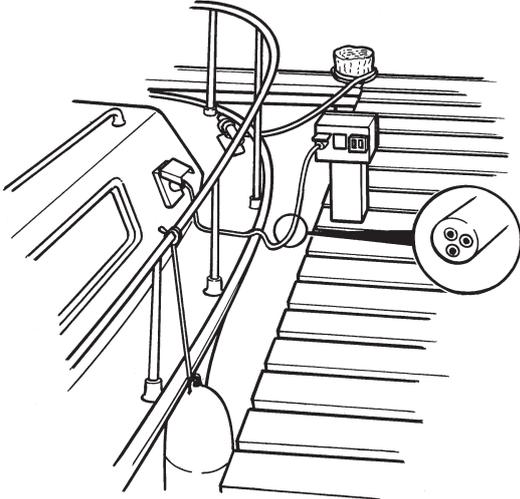
⚠ WARNING! Always switch off the charging circuit **before** removing the battery charger connectors. Never mix up battery positive and negative terminals. This may cause sparks and an explosion.

Special instructions apply when **boost charging** the batteries. Avoid boost charging the batteries as it will shorten their service life.

Electrical installations

Leakage current from the electrical system can be caused by incorrect installation of electrical equipment. Leakage current can knock out the galvanic protection of components such as the drive, propeller, propeller shaft, rudder stock and keel and cause damage by electrolytic corrosion.

⚠ IMPORTANT! Work on the boat's low tension circuit should only be carried out by qualified or experienced persons. Installation or work on the shore power equipment **must only** be carried out by electricians authorized to work with high-voltage installations.



The following should always be observed:

1. If shore power is connected, the protector ground should be ashore, never in the boat. Shore power should always have a ground fault circuit breaker.

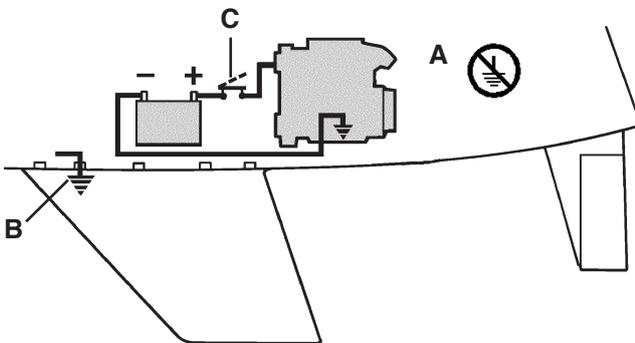
Shore power units (transformer, rectifier, battery chargers etc.) must be intended for marine usage **and the high tension circuit must be galvanically separated from the low tension circuit.**

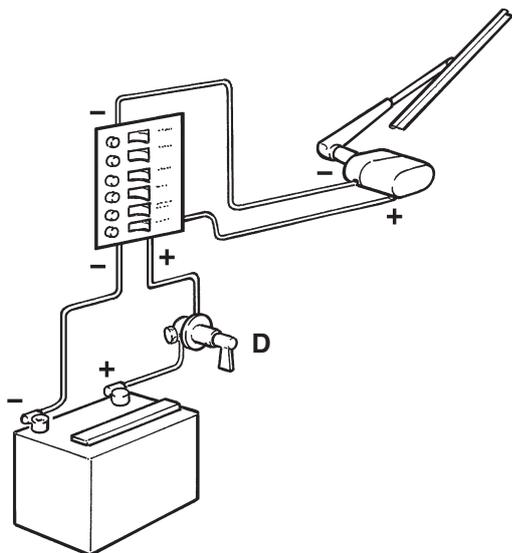
2. Route and clamp electric cables so that they will not be exposed to rubbing, damp or bilge water in the keelson.
3. The S-drive is electrically isolated (A) from the engine and must never be used as a ground.

⚠ IMPORTANT! The S-drive must never be used as a ground or be electrically connected to other equipment such as the radio, navigational equipment, the rudder, bathing steps etc.

Protective grounds for the radio, navigational equipment, rudder, bathing steps or other equipment with separate ground leads must be connected to a common ground terminal (B).

4. There must be a main switch (C) connected to the starter battery positive (+) terminal. The main switch should cut off power to all power consuming equipment and should be switched off when the boat is not in use.





5. If an auxiliary battery is in use, a main switch (D) should be connected between its + terminal and the fuse block. The main switch for the auxiliary battery must cut off all power consuming equipment connected to that battery and be turned off when power is no longer needed.

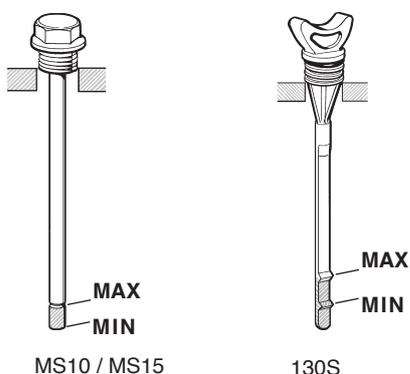
All equipment connected to the auxiliary battery should have separate switches.

To simultaneously charge two independent battery circuits, fit a Volvo Penta charge distributor (accessory) to the regular generator.

S drive and reverse gear

The S drive and in certain cases the propeller (reverse gear) is equipped with a sacrificial anode which prevents galvanic corrosion. Faulty electrical installation can also cause the break down of the galvanic protection. Damage due to electrolytic corrosion occurs rapidly and is often extensive. For further information see the chapter: "Electrical system"

⚠ IMPORTANT! Improperly applied paint or the wrong type of paint on the keel can put the corrosion protection system out of action. For further information on painting see the chapter: Laying up/Launching

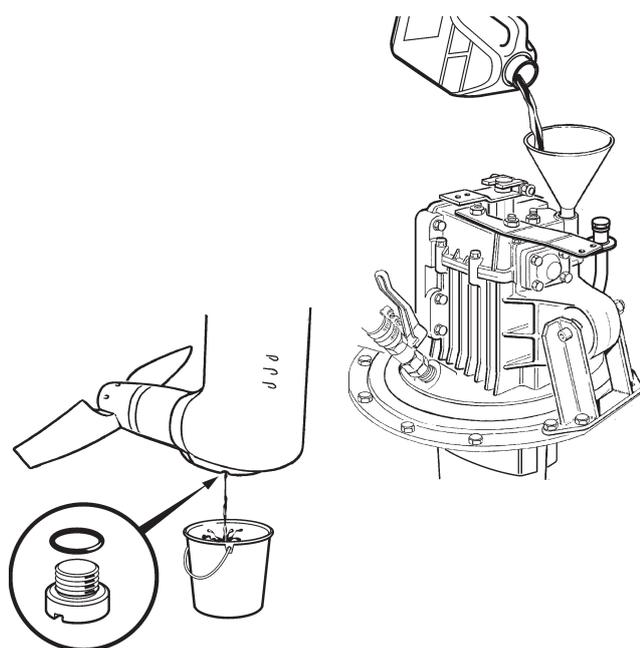


Oil level. Check

Remove the dipstick by turning counter-clockwise. Wipe the dipstick and reinsert it in the drive / reverse gear **without screwing it in**. Remove the dipstick and check the oil level. The correct oil level is between the MAX and MIN markings.

Top up the oil as required using the dip stick tube. For oil quality and capacity: See the chapter "Technical Data".

⚠ IMPORTANT! Do not overfill under any circumstances. The oil level must always be within the recommended level.

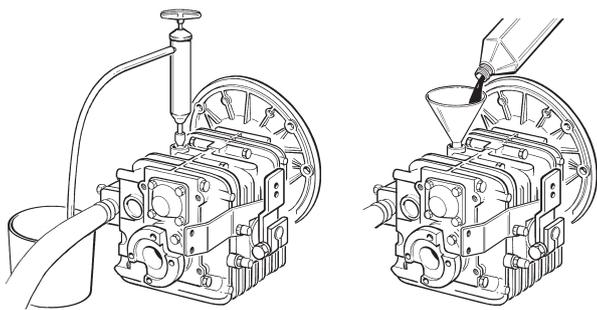


Oil change. S-drive

Remove the oil dipstick. Remove the plug on the propeller gear housing and let the oil run out. Check that the plug o-ring is intact. Replace if necessary. Install the plug and o-ring. Top up oil to correct level through the hole for the oil dipstick. For oil quality and capacity: See the chapter "Technical Data".

Alternatively, it is possible to change oil without taking the boat out of water, e.g. the oil change interval is reached during season. Suck up oil using an oil pump through the oil suction pipe – using this method leaves approximately 0.5 liters (0.13 US gals) in the S-drive. Top up oil to correct level through the hole for the oil dipstick. For oil quality and capacity: See the chapter "Technical Data".

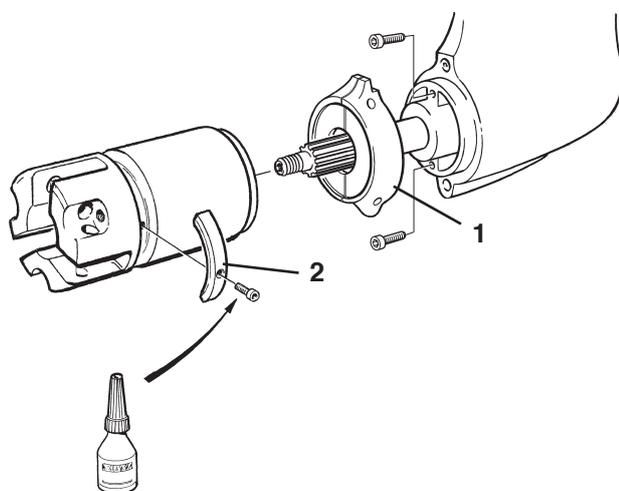
⚠ IMPORTANT! If oil is colored gray then water has entered the drive. Please contact an authorised Volvo Penta workshop.



Oil change. Reverse gear

Remove the dipstick. Suck up oil using an oil pump through the hole for the dipstick. Measure out the correct amount of oil and fill up through the hole for the oil dipstick. For oil quality and capacity: See the chapter "Technical Data".

⚠ IMPORTANT! Never overfill reverse gear. The oil level should always lie at the recommended level.



Corrosion protection. Check

Check the sacrificial anode (1) on the drive and the three sacrificial anodes (2) on the propeller. Replace with a new anode if 50% of the material has perished or at least once per season.

⚠ IMPORTANT! Use zinc sacrificial anodes for salt water and magnesium anodes for freshwater.

Remedy any paintwork damage on the drive according to the instruction in the chapter: Laying up / Launching.

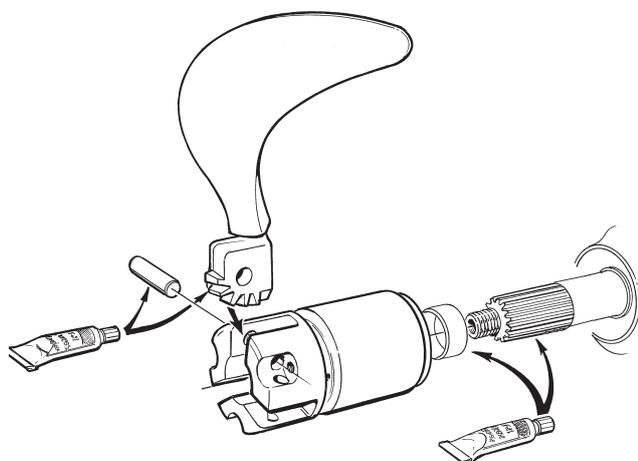
Replacing sacrificial anodes

1. Remove the propeller (see the next section).
2. Remove the sacrificial anodes. Thoroughly scrape clean the mating surfaces on the drive and propeller.
3. Apply thread sealant to the screws for the sacrificial anodes on the propeller.
4. Install the new sacrificial anodes. Tighten the anodes so that there is a good metal contact.
5. Reinstall the propeller.

The sacrificial anodes oxidise when they come into contact with air. This reduces the galvanic protection. There may even be oxidation on the surface of a completely new anode. **Always clean the sacrificial anodes before launching the boat.**

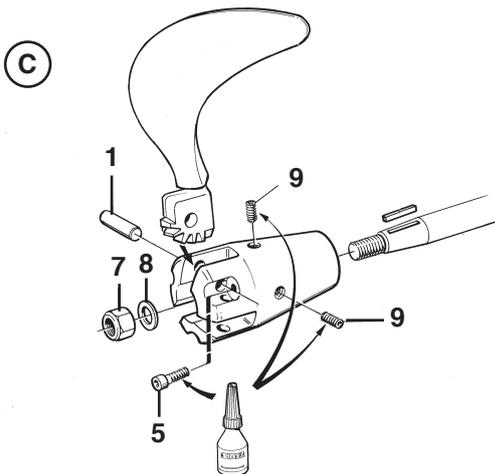
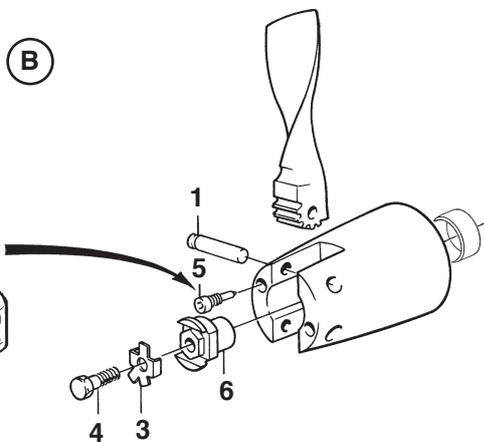
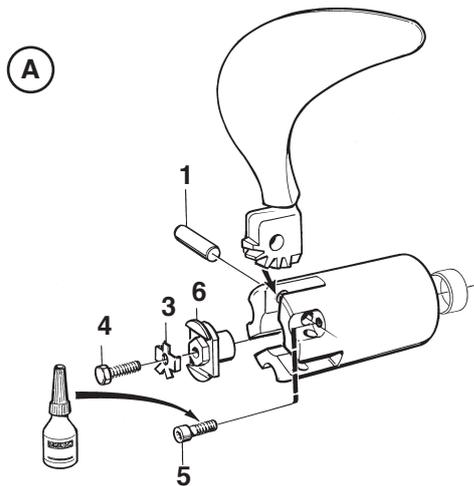
⚠ IMPORTANT! Use emery paper. Do not use steel tools when cleaning, as these may damage the galvanic protection.

Folding propeller. Cleaning



The propeller must be cleaned and lubricated once a year. Remove the propeller and clean all components thoroughly. Apply waterproof grease to the propeller blade teeth and bearing surfaces so that the propeller folds easily. Also apply waterproof grease to the studs, spacing sleeve (drive), propeller shaft and hub.

⚠ WARNING! Prevent accidental starting. Turn off the power at the main switch before working on the propeller.



Removing

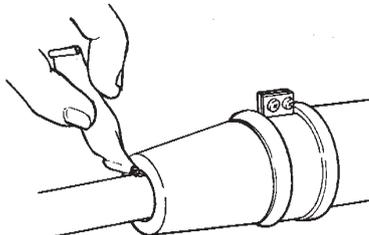
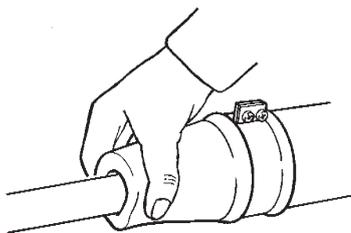
1. Set the control lever in the "Ahead" position.
2. Remove the propeller blade by first undoing the locking screws (5) completely and then pressing out the shaft studs (1).
3. **Drive:** Bend down the tabs of the tab washer (3) and remove the locking screw (4), tab washer and nut (6).
3. **Reverse gear:** Remove the nut (7), washer (8) and then the locking screws (9).
4. Pull off the propeller hub and the spacing sleeve (drive). Clean and lubricate as described.

Installing

1. Reinstall the spacing sleeve (drive) and the propeller hub on the shaft.
2. **Drive:** Install the nut (6). Place a propeller blade on the hub and place a wooden block between the propeller blade and the underwater hull. Tighten locknut to 70 Nm.
2. **Reverse gear:** Install the washer (8) and tighten the nut (7) to 220 Nm. Apply thread sealant to the locking screws (9). After the locking screws have been tightened apply thread sealant to the screw heads as well.
3. **Drive:** Locate the tab washer (3) on the nut. Install and tighten the locking screw (4) to 20 Nm and bend one of the tab washer tabs to the screw head.
4. Install one propeller blade in the propeller hub and push in the stud (1) in such a position so the groove in the stud is exactly centered in the hole for the locking screw (5). Apply thread sealant to the locking screw and tighten to 10 Nm.
5. Install the other blades in the same way. Check the blades are at the same angle to the propeller shaft and that they move easily.

⚠ IMPORTANT! The tab washer (3) must be replaced if necessary. Use only Volvo Penta original locking screws (4).

- A = 3-blade folding propeller (drive)
- B = 2-blade folding propeller (drive)
- C = 3-blade folding propeller (reverse)

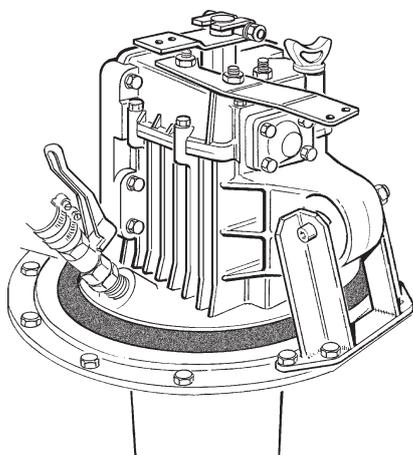


Propeller shaft seal. Reverse gear

If the boat has a Volvo Penta shaft the shaft seal must be vented and lubricated directly after launching.

Vent the bushing by pressing it together while pressing down on the shaft until water appears. Then press in approx. 1 cc **water repellent grease** into the seal.

! **IMPORTANT!** The seal must be replaced every 500 running hours or every 5th year.



Rubber seal. S-drive

Check the rubber seal between the drive and the hull regularly for cracks and wear.

! **WARNING!** The seal must be changed every seven years or earlier if it is defective. This work should be carried out by an authorized workshop.

Laying up and launching

Before taking the boat out of the water for winter/out-of-season storage have an authorized Volvo Penta workshop inspect the engine and other equipment.

Inhibition should be carried out to ensure that the engine and transmission are not damaged while out of commission during the winter/off-season. It is important this is done properly and that nothing is forgotten. We have therefore provided a checklist covering the most important points.

⚠ WARNING! Read the chapter on Maintenance carefully before starting work. It contains instructions on how to carry out the work safely and correctly.

Inhibiting

The following are best carried out with the boat in the water:

- | Change engine oil and replace oil filter.
- | Change oil in the reverse gear.
- | Replace fuel filter. Replace fuel pre-filter if installed.
- | Run engine to normal operating temperature.
- | Take the boat out of the water:

The following should be carried out with the boat out of the water:

- | Clean the hull and drive directly after taking up the boat (before it dries).

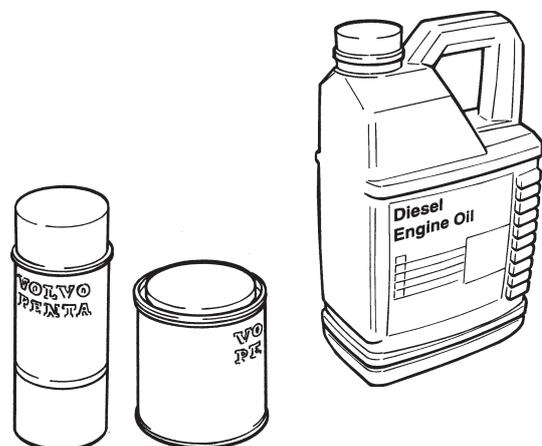
⚠ IMPORTANT! Be careful when cleaning with a high pressure water spray. Never direct the water jet at the propeller shaft seal, grommets etc.

- | Change oil in the drive.
- | Clean the vacuum valve and seawater filter (accessory).
- | Clean and inhibit the seawater system.
- | Remove the impeller from the seawater pump. Store the impeller in a sealed plastic bag in a cool place.
- | Check the condition of the engine coolant anti-freeze. Top up if required.

⚠ IMPORTANT! An anti-corrosion mixture in the engine coolant system provides no protection against freezing. If there is any possibility the engine will be subjected to freezing temperatures then the system must be drained.

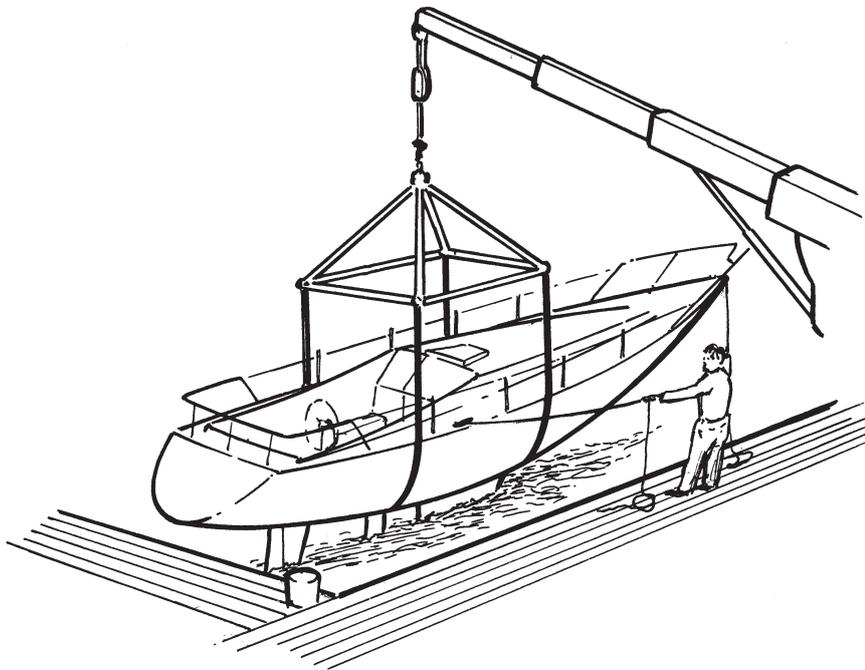
- | Drain any water and contaminants from the fuel tank. Fill the tank completely with fuel to avoid condensation.

- | Clean the outside of the engine. Do not use a high pressure spray to clean the engine. Touch up any damaged areas of paintwork with Volvo Penta original paint.
- | Check all control cables and treat with rust inhibitor.
- | Repair any damaged areas of paintwork with Volvo Penta original paint. NOTE! Read the special instructions on painting the drive under the heading: Painting the drive and underwater hull
- | Disconnect battery leads. Clean and charge the batteries. NOTE! A poorly charged battery may burst as a result of freezing.
- | Spray electrical system components with moisture repellent spray.
- | Remove the propeller for storage. Grease the propeller shaft using water repellent grease. Disassemble folding propellers, clean and grease.
- | Check the rubber seal between the drive and hull carefully.



Bringing out of storage

- | Check oil level in the engine and drive/reverse gear. Top up if necessary. If there is inhibiting oil in the system drain and fill with new oil, change oil filter. For correct oil grade: See the chapter "Technical Data".
 - | Drain the antifreeze from the seawater system.
 - | Install the impeller in the seawater pump (replace if the old one looks worn).
 - | Close/tighten drain cocks/plugs.
 - | Check drive belts.
 - | Check the condition of rubber hoses and tighten hose clamps.
 - | Check engine coolant level and antifreeze protection. Top up if necessary.
 - | Connect the fully charged batteries.
 - | Paint the drive and hull: See next page.
 - | Check the sacrificial anode on the drive. If there is less than 50% of the anode left it must be replaced. Clean with emery cloth just before the boat is launched.
- ⚠ IMPORTANT!** Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.
- | Reinstall the propeller.
 - | Launch the boat. Check for leaks.
 - | Vent and lubricate the propeller shaft seal (reverse gear).
 - | Start the engine. Check that there are no fuel, engine coolant or exhaust gas leaks and that all control functions are operating.



Painting the drive and underwater hull

General

Most countries have introduced legislation controlling the use of anti-fouling agents. In some cases these agents are completely forbidden for use on leisure craft. **In these cases ask your Volvo Penta dealer for advice about alternative methods.**

⚠ IMPORTANT! Find out what regulations apply to the use of anti-fouling agents.

Drive

The paintwork is part of the drive's anti-corrosion protection and it is therefore important that any paintwork damage is remedied.

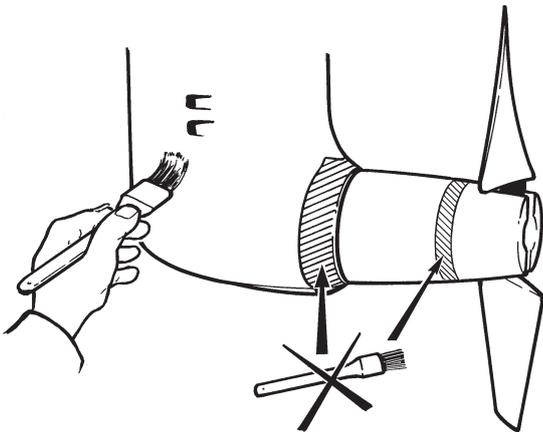
Sand down metal surfaces lightly using a 120 grade paper and a finer grade for painted surfaces. Wash off using thinners or similar. Any pores in the surface should be filled and sanded down. Paint using Volvo Penta original primer and topcoat. Let the paint dry.

The drive should be painted with Volvo Penta anti-fouling to prevent fouling. Apply according to the instructions on the packaging.

⚠ IMPORTANT! The sacrificial anodes on the drive and propeller must not be painted.

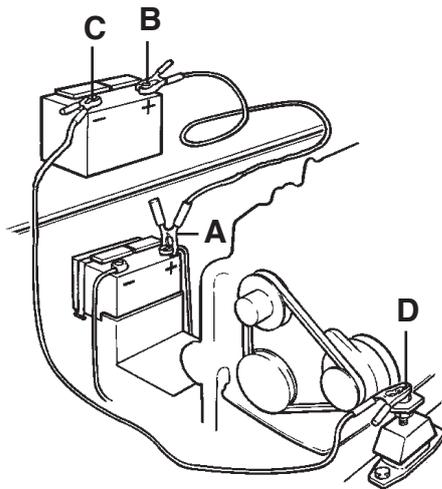
Underwater hull

Anti fouling agent containing copper oxide can increase the risk of galvanic corrosion and therefore should never be used.



In case of emergency

Despite regular maintenance according to the maintenance schedule and perfect operation, it may occur faults which must be attended to before the boat can travel further. This chapter contains tips for rectifying some of the possible faults.



Starting using auxiliary batteries

⚠ WARNING! Batteries produce oxyhydrogen. This gas is easily ignited and highly volatile. A short-circuit, naked flame or spark can cause a large explosion. Ensure that the ventilation is good.

Never mix up battery positive and negative terminals. This may cause sparks and an explosion.

1. Check the auxiliary batteries have the same rated voltage as the engine's system voltage.
2. First connect the red jump lead to the discharged battery's **+ terminal** (A) and then to the auxiliary battery's **+ terminal** (B).
3. First connect the black jump lead to the auxiliary battery's **- terminal** (C) and then to a site (D) where there is good contact with the cylinder block as far away from the discharged battery as possible.
4. Start the engine and run it at a fast idle for approximately ten minutes to charge the battery.

⚠ WARNING! Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.

Do not touch the connections while trying to start the engine: This may cause sparks. Do not lean over the batteries.

5. Stop the engine. Remove the jump leads in **exactly** the opposite order to which you put them on.

Fault-tracing

A number of symptoms and possible reasons for engine problems are described in the table below. In case of faults or mishaps which you cannot solve, always contact the Volvo Penta dealership.

⚠ WARNING! Read the safety precautions for maintenance and service in the chapter: Safety Information, before starting work.

Symptoms and possible causes

Starter motor not turning or slow	1, 2
Engine will not start	4, 5, 6, 7, 8, 9
Engine starts but stops again	6, 7, 8, 9
Engine difficult to start	6, 7, 8, 9
Engine does not reach correct speed at full speed	7, 8, 9, 10, 11, 12, 13, 18
Engine knocks	14
Engine runs unevenly	6, 7, 8, 9, 13, 14
Engine vibrates	18, 19
High fuel consumption	10, 11, 13, 15, 18
Black exhaust smoke	5, 13, 15, 18
Blue or white exhaust smoke	15, 25
Low oil pressure	16, 17
Engine coolant temperature too high	20, 21, 22, 23, 24
No or poor charging	2, 26

- | | | |
|-------------------------------------|------------------------------------------------|------------------------------------------|
| 1. Discharged battery | 11. Fouling on underwater hull/drive/propeller | 17. Blocked fuel filter |
| 2. Loose connection/open-circuit | 12. Limited speed control lever movement | 18. Defective/incorrect propeller |
| 4. Stop control pulled out | 13. Insufficient air supply | 19. Defective engine mounting |
| 5. Inadequate pre-heating | 14. Engine coolant temperature too high | 20. Too little coolant |
| 6. Lack of fuel | 15. Engine coolant temperature is too low | 21. Blocked seawater intake/pipe/filter |
| 7. Fouled fuel filter | 16. Lubricating oil level too low | 22. Circulation pump drive belt slipping |
| 8. Air in the fuel injection system | | 23. Defective impeller |
| 9. Water/contaminants in the fuel | | 24. Defective/incorrect thermostat |
| 10. Boat abnormally loaded | | 25. Lubricating oil level too high |
| | | 26. Generator drive belt slipping |

Technical Data

Engine model

Engine model.....	D1-13	D1-20	D1-30	D2-40
Crankshaft power, kW (hp).....	9.0 (12.2)	13.8 (18.8)	20.9 (28.4)	29.1 (39.6)
Propeller shaft power, kW (hp).....	8.6 (11.8)	13.3 (18.0)	20.1 (27.3)	27.9 (38.0)

Technical data according to ISO 8655

General

After market designation.....	D1-13 B	D1-20 B	D1-30 B	D2-40 B
Displacement, l (in3).....	0.51(31)	0.76 (46.5)	1.13 (69)	1.51 (92.1)
Number of cylinders.....	2	3	3	4
Bore/stroke, mm	67/72	67/72	77/81	77/81
Bore/stroke, (in.).....	(2.64/2.83)	(2.64/2.83)	(3.03/3.19)	(3.03/3.19)
Compression ratio	23.5:1	23.5:1	23.5:1	23.5:1
Engine speed, rpm	2800-3200	2800-3200	2800-3200	2800-3200
Idling speed, rpm.....	850 ±25	850 ±25	850 ±25	850 ±25
Rotation, viewed from in front.....	Clockwise	Clockwise	Clockwise	Clockwise
Max. permitted rake backwards while running	20°	20°	20°	20°
Max. list while running	30°	30°	30°	30°
Weight, dry engine.....	96 kg	118 kg	127 kg	148 kg

Cooling system

Thermostats, no.....	1 screws	1 screws	1 screws	1 screws
The thermostat starts opening at.....	90° ±2°C	90° ±2°C	90° ±2°C	90° ±2°C
fully open at.....	102°C (203°F)	102°C (203°F)	102°C (203°F)	102°C (203°F)
Freshwater system capacity, approx.	2.7 litres	3.0 litres	4.0 litres	6.4 litres

Lubrication system

Oil capacity incl. oil filter, approx.:				
no engine inclination	1.9 litres	2.8 litres	3.5 litres	6.5 litres
Viscosity at -5° - +50°C*	SAE 15W/40, SAE 20W/50	SAE 15W/40, SAE 20W/50	SAE 15W/40, SAE 20W/50	SAE 15W/40, SAE 20W/50
Oil drain plug tightening torque.....	30–40 Nm	30–40 Nm	30–40 Nm	30–40 Nm

* Constant ambient air temperature

Oil grade ¹⁾	Oil change interval, reached first in operation ²⁾ :	
VDS-3 or VDS-2 and ACEA E7 ³⁾ or VDS-2 and Global DHD-1 or VDS-2 and API CH-4 or VDS-2 and API CI-4	D1-13, D1-20, D1-30	D2-40
	200 hr. or 12 months.	500 hr. or 12 months.

NOTE! Mineral based oil, either fully or semi-synthetic, can be used on condition that it complies with the quality requirements.

¹⁾ When oil quality specifications are joined by “**or**”, **either** engine oil specification can be used.

When oil quality specifications are joined by “**and**”, the engine oil must fulfill both requirements.

²⁾ If sulphur content is > 1.0% by weight, use oil with TBN > 15.

³⁾ ACEA E7 has replaced ACEA E5, but if available ACEA E5 can be used.

VDS = Volvo Drain Specification

ACEA = Association des Constructeurs Européenne d’Automobiles

API = American Petroleum Institute

TBN= Total Base Number

Gloal DHD = Global Diesel Heavy Duty

Electrical system

System voltage	12 V
Battery capacity (starter battery)	70 Ah
AC generator voltage/max. current	14V/115A
output approx.	1610 W
Starter motor, output approx.	2.0 kW

Reverse gear

Type designation	MS10A-B ; MS10L-B	MS15A-B ; MS15L-B
Gear ratio.....	2.35:1, 2.72:1	2.14:1, 2.63:1
Angle (output shaft):		
MS10A, MS15A.....	8°	8°
MS10L, MS15L.....	0°	0°
Oil volume, approx.....	0.35 liters (0.09 US gals)	0.56 liters (0.15 US gals)
Oil grade	ATF (Dexron II, III)	ATF (Dexron II, III)
Weight	11 kg (24 lbs)	16 kg (35 lbs)

Sailing boat drive

Type designation	130S-B, 130SR-B
Gear ratio.....	2.19:1
Oil volume, approx.....	2.9 liters (0.77 US gals)
Oil grade	ATF (Dexron II, III)
Weight	26.5 kg (58 lbs)
Tightening torque:	
oil drain plug.....	10 ±5 Nm (7.4 ±3.7 lbf.ft)

Fuel specification

Fuel must meet national and international standards at least. For example:

EN 590 (with national environmental and cold standards)

ASTM D 975 No 1-D and 2-D

JIS KK 2204

Sulphur content: According to statutory requirements.

Fuels with low density (“urban diesel” in Sweden and “city diesel” in Finland) can cause a drop in output of 5% and an increase in fuel consumption of 2–3%.

ENG

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ARU2, Dept. 64620
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Sweden
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Orders can also be placed via the Internet:

<http://www.volvopenta.com/manual/coupon>

Yes please,

I would like an operator's manual in English at no charge.

Publication number: 774 7098

Name

Address

Country

*NB! This offer is valid for a period of 12 months from delivery of the boat.
Availability after this period will be as far as supplies admit.*

**VOLVO
PENTA**

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GER

Schicken Sie den Coupon per Post oder als Fax an:

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<http://www.volvopenta.com/manual/coupon>

Ja,

ich will kostenlos eine Betriebsanleitung in deutscher Sprache erhalten.

Publikationsnummer: 774 5926

Name

Anschrift

Land

Bitte beachten Sie, dass dieses Angebot für die Dauer von 12 Monaten ab dem Lieferdatum des Bootes gilt, danach bis zum Aufbrauchen des Lagerbestandes.

**VOLVO
PENTA**

42200/615001/155099900192

FRE

Envoyez ou faxez le bon de commande à:

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Fax: +46 31 545 772

Vous pouvez également passer la commande par Internet:

<http://www.volvopenta.com/manual/coupon>

Oui merci,

Je souhaite recevoir un manuel d'instructions gratuit en français.

Numéro de publication: 774 5927

Nom

Adresse

Pays

Notez que l'offre est valable pendant 12 mois à partir de la date de livraison du bateau, ensuite seulement en fonction des stocks disponibles.

**VOLVO
PENTA**

42200/615001/155099900192

SPA

Franquear o enviar fax a:

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SE-405 08 Göteborg
Suecia
Fax: +46 31 545 772

El pedido puede hacerse también por internet:

[http://www.volvopenta.com/
manual/coupon](http://www.volvopenta.com/manual/coupon)

Sí gracias,

deseo recibir gratuitamente un libro de instrucciones en español.

Número de publicación: 774 5929

Nombre

Dirección

País

Nótese que el ofrecimiento vale durante 12 meses después de la fecha de entrega de la embarcación, y posteriormente solamente mientras duren las existencias.

**VOLVO
PENTA**

42200/615001/155099900192

ITA

Spedire il tagliando per posta o per fax a:

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ARU2, Dept. 64620
SE-405 08 Göteborg
Svezia
Fax: +46 31 545 772

L'ordinazione può essere fatta anche su Internet:

[http://www.volvopenta.com/
manual/coupon](http://www.volvopenta.com/manual/coupon)

Sì, grazie,

desidero ricevere gratuitamente un manuale d'istruzioni in lingua italiana.

Public. No.: 7745932

Nome e Cognome

Indirizzo

Paese

Si ricorda che l'offerta è valida per 12 mesi dalla data di consegna dell'imbarcazione; dopo il suddetto periodo l'offerta resta valida solo in base alla disposizione della pubblicazione in oggetto.

**VOLVO
PENTA**

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SWE

Posta eller faxa kupongen till:

Dokument & Distribution center
Ordermottagningen
ARU2, Avd. 64620
SE-405 08 Göteborg
Sverige
Fax: +46 31 545 772

Beställningen kan även göras via internet:

[http://www.volvopenta.com/
manual/coupon](http://www.volvopenta.com/manual/coupon)

Ja tack,

jag vill kostnadsfritt ha en instruktionsbok på svenska.

Publikationsnummer: 7745925

Namn

Adress

Land

Observera att erbjudandet gäller i 12 månader från båtens leveransdatum, därefter endast i mån av tillgång.

**VOLVO
PENTA**

42200/615001/155099900192

DUT

Stuur of fax de coupon naar:

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U kunt ook bestellen via internet:

[http://www.volvopenta.com/
manual/coupon](http://www.volvopenta.com/manual/coupon)

Ja graag,

Ik wil kosteloos een instructieboek in het Nederlands ontvangen.

Publicatienummer: 7745928

Naam

Adres

Land

Denk eraan dat het aanbod geldt gedurende 12 maanden na de datum waarop de boot werd afgeleverd, daarna alleen indien nog verkrijgbaar.

**VOLVO
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DAN

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Bestillingen kan også ske på internet:

[http://www.volvopenta.com/
manual/coupon](http://www.volvopenta.com/manual/coupon)

Ja tak,

jeg vil gerne gratis have en instruktionsbog på dansk

Publikationsnummer: 7745933

Navn

Adresse

Land

Bemærk at tilbudet gælder i 12 måneder fra bådens leveringsdato, Derefter kun så længe lager haves.

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FIN

Postita tai faksaa kuponki osoitteella:

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Ruotsi
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Tilauksen voi tehdä myös Internetissä:

[http://www.volvopenta.com/
manual/coupon](http://www.volvopenta.com/manual/coupon)

Kyllä kiitos,

haluan suomenkielisen ohjekirjan veloituksetta.

Julkaisunumero: 7745934

Nimi

Osoite

Maa

Huomaa, että tarjous on voimassa 12 kuukautta veneen toimituspäivämäärästä lukien ja sen jälkeen vain niin kauan kuin kirjoja riittää.

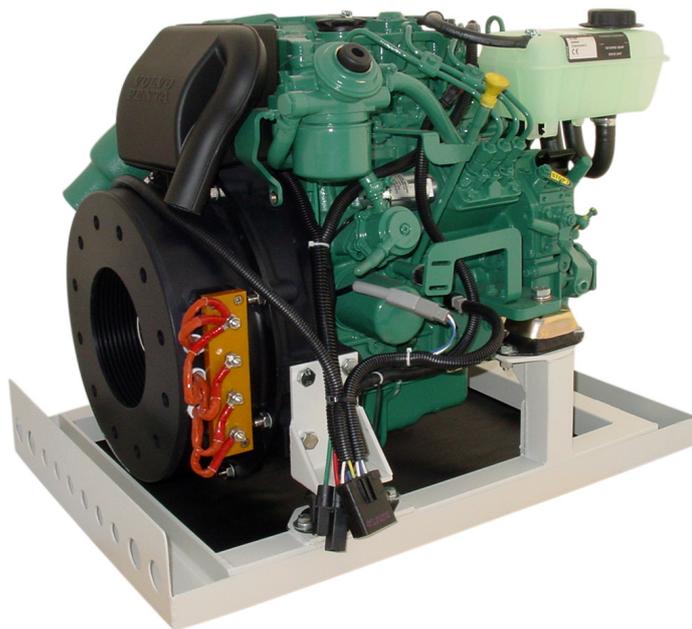
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Operations Manual

Volvo Penta - Engine



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