VOLVO PENTA

OPERATOR'S MANUAL

D9/GENSET

⚠ WARNING!

Operating, servicing and maintaining a marine vessel can expose you to chemicals including engine exhaust, carbon monoxide, phthalates, and lead which are known to the State of California to cause cancer and birth defects or other reproductive harm.

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. To minimize exposure, avoid breathing exhaust when operating, servicing and maintaining the engine.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Wear gloves or wash your hands frequently when servicing the vessel.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information
www.P65warnings.ca.gov/marine
www.p65warnings.ca.gov/products/diesel

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Foreword

Welcome!

Volvo Penta engines are designed to fulfill Volvo's core values; quality, safety and environmental care. After more than 100 years as en engine manufacture, the Volvo Penta brand has also become a symbol of reliability, technical innovation, top-of-the-range performance and long service life. Volvo Penta engines are used all over the world, in all possible operating conditions.

Make sure to thoroughly read through the Operator's Manual regarding operating and maintenance. It contains the information you need to be able to operate and maintain the engine safely and correctly. Pay careful attention to the safety instructions included in the manual.

As the owner of a Volvo Penta engine, you become part of a worldwide network of dealers and service workshop that assist you with technical advice, service requirements and replacement parts. Contact you nearest authorized Volvo Penta dealer for assistance.

It is possible to buy additional literature about your Volvo Penta engine, e. g. the Service & Maintenance manual. More information on how to do this can be found at www.volvopenta.com.

Information about your closest Volvo Penta dealer and other useful news and information can be found at www.volvopenta.com and by following Volvo Penta on Facebook.

VOLVO PENTA

www.volvopenta.com

www.facebook.com/volvopenta

Safety Information

This chapter describes how safety precautions are presented in the manual and on the product. Read the chapter through very carefully before you start the engine or do any maintenance or service. It has to do with your safety; an incorrect operation can lead to personal injury and damage to products or property. It also gives you an introduction to the basic safety rules for using and looking after the engine.

If anything remains unclear or if you are unsure of something, contact your Volvo Penta dealer for assistance.

IMPORTANT:
Always follow local safety instructions and regulations.

Safety texts have the following order of priority:

⚠ DANGER!
Indicates a hazardous situation, which, if not avoided, result in death or serious injury.

⚠ WARNING!
Indicates a hazardous situation, which, if not avoided, could result in death or serious personal injury.

⚠ CAUTION!
Indicates a hazardous situation, which, if not avoided, could result in minor or moderate personal injury.

IMPORTANT:
Indicates a situation, which, if not avoided, could result in property damage.

NOTICE! Used to draw attention to important information that facilitates work or operations.


This symbol is may be used on the product to call your attention to the fact that this is safety information. Always read such information very carefully.

Make sure that warning and information symbols on the engine are clearly visible and legible. Replace symbols that have been damaged or have been painted over.


In some cases, this symbol is used on our products and refers to important information in the Operator's Manual.

Most chemicals such as engine and transmission oils, glycol, petrol and diesel oil and chemicals used in workshops such as degreasing agents, paint and solvents are harmful to health.

Carefully read the instructions on the product packaging! Always follow the safety regulations, such as the use of protective masks, goggles, gloves, etc. Make sure that other personnel are not exposed to substances that are hazardous to health. Ensure good ventilation.

Manage used and leftover chemicals in the prescribed manner.

Daily Checks

⚠ WARNING!
Do not start the engine if there is reason to suspect fuel leaks or if there is explosive material nearby.

Make it a habit to give the engine and engine compartment a visual check before the engine is started and after operations, once the engine has stopped. This helps you to quickly discover fuel, coolant or oil leakages or any other abnormality that has occurred, or is about to occur.

Personal safety equipment

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⚠ CAUTION!
Always use appropriate safety equipment. Personal protective equipment does not eliminate the risk of injury but it will reduce the degree of injury if an accident does happen.

Some examples are ear protection, eye and face protection, protective footwear, personal protective equipment, head protection, protective clothing, gloves and respirators.

⚠ WARNING!
Ensure that all machine guards and safety devices are in place and are functional.

⚠ CAUTION!
Never use tools or products that show signs of damage.

Protect your eyes

⚠ CAUTION!
Wear safety glasses.

Always wear safety glasses if there is a risk of splintering, sparks and spray from the electrolyte (so-called battery acid), or other chemicals. Your eyes are very delicate and damage can result in loss of sight!

Protect your skin

⚠ CAUTION!
Risk of skin damage.

Avoid getting oil on your skin! Prolonged or repeated exposure to oil can dry out the skin. Thereafter, irritation, dryness and eczema and other skin problems may occur.

Use protective gloves and avoid oil-soaked clothes and rags. Wash regularly, especially before eating. Wear suitable protective creams to prevent skin from drying out and to facilitate cleaning.

Fire safety

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⚠ WARNING!
Fire and Explosion Risk!
Accidental spark could ignite fuel vapors.

All fuels – as well as many lubricants and chemicals – are flammable. Do not allow open flames or sparks near them. **Smoking forbidden!** Hydrogen from the batteries is also very flammable and explosive in certain mixture with air.

Ensure that the workplace is well ventilated and take the necessary precautions before welding or grinding begins. Always ensure that there is a fire extinguisher close at hand in the work area.

Spare parts — safety

⚠ WARNING!
Always use spare parts with the same quality as genuine Volvo Penta parts to minimize the risk of an explosion or fire.

Components in fuel systems and electrical systems on Volvo Penta engines are designed and manufactured to minimize the risk of explosions and fire, in accordance with applicable legal requirements.

Used oils, filters and chemicals etc.

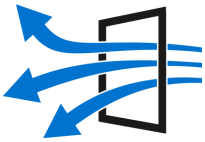
⚠ WARNING!
Risk of fire.
Store fuel soaked rags and other flammable material so that there is no danger of them catching fire.

Oil-soaked rags can spontaneously ignite under certain circumstances.

IMPORTANT:
Used fuel and oil filters are environmentally hazardous waste and must be taken to an approved waste management facility for correct handling, as must any used lubricating oil, contaminated fuel, paint residue, solvents, degreasers and wash residue.

Prevent start of the engine

⚠ WARNING!
Immobilize the engine by turning off the power supply with the main switch(es) and lock it (them) in the off position before starting work. Place a warning notice at the main switch.
If the engine is equipped with BMS (Battery Management System), always disconnect both battery cables from the battery terminals.



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Ventilation when running the engine

⚠ WARNING!

Only start the engine in a well-ventilated area. If operating the engine in a closed area ensure that there is exhaust ventilation leading out of the work area to remove exhaust gases and crankcase ventilation emissions.

The engine must not be operated in areas where there are explosive materials or stored gas.

P0024808

Rotating parts and hot surfaces

⚠ DANGER!

Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.
If the engine is in operation and operates another device, you must not, under any circumstances, staying close to the engine.

Work on running engines is strictly prohibited. There are however adjustments that require the engine to be run. Approaching a running engine is a safety risk. Loose clothing and long hair can get caught in the rotating parts; careless movements or a dropped tool can lead to serious personal injury.

Be careful to avoid hot surfaces (exhaust pipes, turbochargers, charge air manifolds, start elements etc.) and hot fluids in pipes and hoses on engines that are running or have just stopped. Re-install all protective covers that were removed during maintenance work before starting the engine.

Information on the engine

IMPORTANT:

Make sure that all warning and information decals on the product are always visible. Replace decals which have been damaged or painted over.

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Prohibition on use of start spray

⚠ WARNING!
Never use start spray or similar agents to start an engine. This may cause an explosion in the inlet manifold. Risk of personal injury.

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Before start of engine

⚠ WARNING!
Never start the engine if there is reason to suspect fuel and/or gas leaks, or if there is explosive material nearby.

IMPORTANT:
Only start the engine with the air filter and protective caps fitted. Foreign objects in the inlet line could cause machine damage. Also make sure that no tools or other parts have been left next to the engine.

⚠ WARNING!
Never start the engine with the valve cover removed. There is a risk of personal injury.
For engines with turbochargers, the rotating compressor turbine can in addition cause serious personal injuries.

Before any work on the electrical system

⚠ WARNING!
Always stop the engine first. Then disconnect the current at the main switches and any external power supply before working on the electrical system – to minimize the risk of electrical hazards.

IMPORTANT:
Never disconnect the current using the main switches when the engine is running or by disconnecting the battery cables.
The alternator and electronics could be damaged.

Avoid damage to the engine control module and other electronics

IMPORTANT:
Switch off the main switch before connecting or disconnecting a connector.

Before welding work

IMPORTANT:
Before any work with electric weld can begin, the connection to all control units must be disconnected. After finished welding, re-connect the connection to all control units before connecting any battery cable.

P0024484

Before any work on the cooling system

⚠ WARNING!

Stop the engine and let it cool before starting work on the cooling system. Hot fluids and hot surfaces can cause burns.

Risk of water penetration/sinking

⚠ WARNING!

If a launched boat is equipped with sea water tap and safety valve, **ensure that these are closed** before any work is allowed to begin on the cooling system. Remember to open the tap and valve before starting the engine!

Hot coolant under pressure

⚠ CAUTION!

Hot coolant can cause burns. Avoid opening the filler cap for the coolant when the engine is still hot. Steam or hot coolant can spray out and system pressure is lost.

Open the filler cap slowly and release the pressure in the cooling system if the filler cap or valve must be opened – or if a plug or a coolant hose must be removed from a hot engine.

Hot oil under pressure

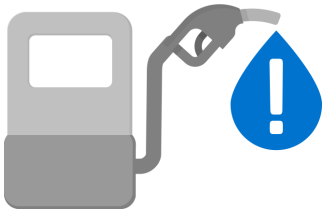
⚠ CAUTION!

Hot oil can cause burns. Avoid getting hot oil on the skin. Ensure that the lubrication system is not pressurized before starting any work. Never start or operate the engine without the oil filler cap is on. There is a risk that hot oil can spray out.

Refueling

⚠ WARNING!

There is always a risk of fire and explosion during refueling. Smoking is forbidden and the engine must be stopped.



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Proper fuel quality

IMPORTANT:
Always use the fuel recommended by Volvo Penta. See *Technical Data* in Operator's Manual. Other fuel can damage the engine.
Wrong fuel quality can also lead to higher service costs.

⚠ WARNING!
Risk of personal injury.
Wrong fuel quality in a diesel engine can cause the fuel control mechanism to bind which can cause the engine to overspeed!

Legal requirements to use proper fuel

IMPORTANT:
To meet regulatory requirements for certified emission levels must always recommended fuel according to *Technical Data* in the Operator's Manual be used.

At any leak detection on the fuel system

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⚠ WARNING!
Wear safety goggles!
Be extremely careful when searching for leaks in the fuel system high-pressure circuits. There is very high pressure in the jet from pipes and injectors. The fuel may penetrate the tissue and cause serious risk of blood infection (septicemia).

Handling of fuel pipes

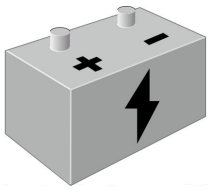
IMPORTANT:
High pressure pipes for fuel must not be bent or straightened under any circumstances. Cracks may occur. Damaged pipes must be replaced.

Safe handling of batteries

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

A spark caused by an incorrectly connected battery can be enough for the battery to explode with serious injuries.

Do not touch the connections during start attempts. Sparking hazard! Do not lean over batteries.



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Correct polarity of the batteries

IMPORTANT:
Make sure that the positive (+) and negative (–) battery cables are correctly connected to the corresponding battery terminals. Wrong connection may cause severe damage to electrical equipment.

Risks of electrolyte in batteries

⚠ WARNING!
Always wear protective goggles when charging or handling batteries.
Battery electrolyte is highly corrosive.

Rinse immediately with copious amounts of water if the electrolyte gets in your eyes. Search directly after the rinsing help by medical staff.

If it comes electrolyte to unprotected skin, wash immediately with soap and water.

Layout of the battery compartment

IMPORTANT:
Make sure the battery compartment is designed according to current safety standards.

Cleaning the engine and components

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IMPORTANT:
Never use a high pressure washer for cleaning of engine or engine components.

Cleanliness for sensitive components

IMPORTANT:
Observe meticulous cleanliness when handling system components.
Even minimal amounts of dirt could cause a breakdown.

Adjustment of the clutch

⚠ CAUTION!
Clutch adjustments must be carried out with the engine stopped.

Introduction

Check that you heave received the correct operator’s manual before continuing reading. If not, please contact your Volvo Penta dealer. Read the Operator’s Manual carefully and learn to handle the engine, controls and other equipment in a safe manner before you start the engine.

For engine designations, refer to *Technical Data, page 88*. The designation is stated on the engine plate, refer to *Technical Data, page 93*.

The illustrations in this book may cover several product types, which means that there may be slight differences between the illustrations and the purchased product. This does, however, not affect the validity of the information and/or instructions in the manual. Volvo Penta reserves the right to make alterations to specifications, design features, and illustrations without prior notice.

At service, software can be updated that affects the functionality described in this manual.

About this Manual

This Operator's Manual has been prepared to give you the greatest possible benefit from your Volvo Penta marine engine. It contains necessary information regarding safe and correct engine operation and maintenance.

Always have the Operator's Manual available. Store it safely and do not forget to hand it over to the next owner if you sell your boat.

Warranty

Your new Volvo Penta marine engine is covered by a limited warranty, subject to the conditions compiled in the Warranty Information. Note that AB Volvo Penta's liability is limited to the specification in the Warranty Information (included CD) and Emission Control System Warranty Statement.

Read the information carefully, as soon as possible after delivery. It includes important information about service and maintenance; the owner is responsible for being familiar with, checking and implementing these. Otherwise AB Volvo Penta may deny its warranty obligations in part or in full.

NOTICE! Make sure that a Commissioning has been carried out on your Volvo Penta engine. This should be done together with your Volvo Penta dealer when finalizing the purchase. Without a proper Commissioning registration the warranty will not be valid.

Contact your Volvo Penta dealer if you have not received the Warranty Information or Service Book.

Running in the engine

The engine must be run in during the first 10 hours of operation. Do this by using the engine in normal operation, where full load is only applied for short periods of time. Never run the engine at constant speed for any longer periods of time.

Since oil consumption is higher during the running in period, be sure to control the oil level more frequently than normally recommended. See *Maintenance* for more information.

Fuel, oils and coolant

Only use the fuels and oils recommended in the Operator's Manual, since other grades may cause malfunctions, increased fuel consumption, and possibly shorten the life of the engine.

Always change the oil, oil filters, and fuel filter at the specified maintenance intervals.

Make sure to always use suitable and correctly mixed coolant.

Future warranty claims related to engine and accessories may be denied if an unsuitable coolant has been used, or if the instructions for coolant mixture have not been followed.

Maintenance and replacement parts

Volvo Penta engines are designed for maximum reliability and long life and built to withstand a demanding environment. The engines also are designed to have a minimal environmental impact. These qualities will be maintained through regular servicing and the use of spare parts with the same quality as genuine Volvo Penta parts. If reliable and purpose-built parts are not used, your safety, health, and the machine's function may be compromised. Volvo Penta has a world-wide network of authorized dealers.

The authorized dealers are Volvo Penta product specialists, and have the accessories, genuine parts, test equipment and special tools needed for high quality service and repair work. Always observe the maintenance intervals in the manual, the complete Service Protocol can be found at *volvopenta.com*. Remember to note the engine / transmission identification number when you **order service and spare parts.**

Excessive strain on a product and components

Volvo Penta products and components are not dimensioned for external loads. Never stand or step onto an engine, transmission or its components. Loads can bring about damage and the malfunction of a product or property.

Volvo Penta EVC system, integrity and modification

The Electronic Vessel Control (EVC) system is a complete vessel control system for engine, gear, and vessel steering control. Modifying the EVC system or connecting spare parts or systems that do not comply with the quality of genuine Volvo Penta parts may adversely affect the system performance, safety, and warranty coverage.

Volvo Penta recommends only the use of electronic systems and spare parts with the same quality as genuine Volvo Penta parts. Contact your local Volvo Penta dealer for detailed information and advice.

Environmental care

Environmental care is a core value at Volvo Penta. Energy efficiency and low emissions are among the most important product related aspects and priority focus areas for Volvo Penta business. Several of the global challenges the world faces are directly or indirectly related to power industries and transports. We recognize that Volvo Penta is part of the environmental problems, but we are also convinced that we are a part of the solution.

Volvo Penta currently has a broad engine program in which great advances have been made in reducing exhaust emissions in the same time as the fuel consumption has been improved. Through regular maintenance, the Volvo Penta engines retain its low fuel consumption and low emissions. We hope that you will be keen to preserve these qualities.

Always follow the directions in the Operator's Manual regarding fuel grades, operation and maintenance to avoid unnecessary environmental impact. Contact your Volvo Penta dealer if you notice any changes such as increased fuel consumption or exhaust smoke.

Remember always to hand in environmental hazardous waste such as drained oil, coolant, old batteries, etc. for treatment at a recycling facility. Our united efforts can make a valuable contribution to the environment.

Recording engine data

One or more computers in your Volvo Penta engine can record detailed information. Data — such as usage and information of other systems and modules on the engine — can be included. This data can include information such as boat position and usage. Only a limited amount of data can be stored.

AB Volvo Penta and authorized workshops will not distribute this stored information without permission. AB Volvo Penta may, however, be forced to provide this information if required by national legislation. In general, AB Volvo Penta and authorised workshops may read and use the information.

Certified Engines

If you own an emission-certified engine used in an area where exhaust emissions are regulated by law, this places special demands on the care and maintenance you provide your engine.

NOTICE! Neglects or failure to follow the points listed here may invalidate the engine emission certificate. This means AB Volvo Penta can no longer guarantee engine conformity with the certified model. Volvo Penta is not responsible for damages or costs arising as a result of this.

- Certification means that an engine type has been checked and approved by the relevant authority. The engine manufacturer guarantees that all engines of the same type are equivalent to the certified engine.
- It is the responsibility of the operator/user to ensure that no intentional misuse of the engine takes place.
- Volvo Penta maintenance and service intervals must be complied with.
- Any case of malfunction must be rectified without delay.
- Only use genuine Volvo Penta parts or spare parts with the same quality as genuine Volvo Penta parts.
- Volvo Penta recommends that service to injection pumps, pump settings and injectors always are carried out by a qualified workshop.
- The engine must not be converted or modified in any way, except with accessories and service kits that Volvo Penta has approved for the engine.
- No installation changes to the exhaust pipe and engine air inlet ducts may be made.
- No warranty seals (where present on the product) may be broken by unauthorized persons.
- The general instructions in the Operator's Manual concerning operation, service and maintenance apply.

Volvo Penta Dealer Network

The Volvo Penta global network of authorized dealers is at your service. We strongly recommend that you take your product to an authorized Volvo Penta dealer for service and repair. They are specialists in Volvo Penta products and have the accessories, genuine Volvo Penta parts, the special tools and the latest service information for high quality service and repair work.

Dealer Locator Services

Locate the nearest Volvo Penta dealer through our dealer locator on ***www.volvopenta.com*** or download the dealer locator app to your smartphone.

Volvo Penta Action Service

Our global dealer network, your first line of contact, is backed up by Volvo Penta Action Service, a phone based breakdown and support service providing assistance 24 hours a day, every day of the year.

How it works

A dedicated operator will support you all the way through your case and keep you updated on status and progress.
Whenever on-site assistance or technical support is needed, the operator will put you in contact with the closest Volvo Penta dealer that can support your product.

Phone numbers

Find your Volvo Penta Action Service phone number and more information on ***www.volvopenta.com***.

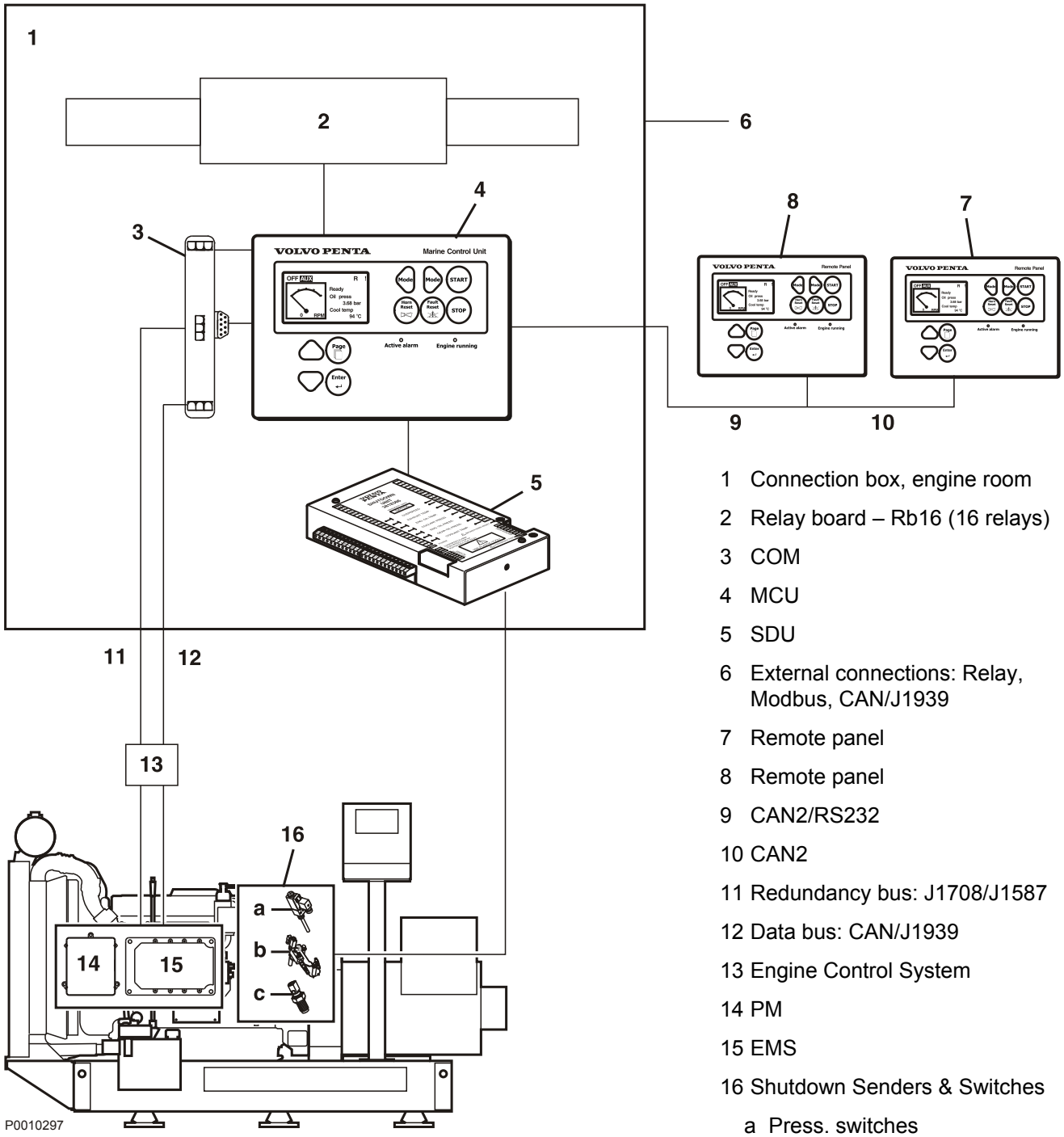
Marine Commercial Control System (MCC)

Marine Commercial Control (MCC), is a type-approved control system that monitors your Volvo Penta engine. MCC comprises an marine control unit (MCU), remote panel (RP), shutdown unit (SDU) and a relay card.

The MCU is the main system panel and it communicates with all of the engine control units. The slave panel may be located outside the engine compartment and handles in exactly the same way as the MCU.

The SDU manages automatic engine shutdown should the engine show critically low oil pressure (including reverse gear) or high coolant temperature. It also has overspeed protection. Electronic systems in the vicinity of the engine comprise the engine management system (EMS) and a power management unit (PM). The engine management unit manages the injection of fuel with the aid of a number of sensors. The power management system manages primary and secondary battery supply and supplies electrical power to the engine management unit, MCU and SDU. The unit has overcurrent protection with automatic reset.

MCC system, Overview



1 Connection box, engine room

2 Relay board – Rb16 (16 relays)

3 COM

4 MCU

5 SDU

6 External connections: Relay, Modbus, CAN/J1939

7 Remote panel

8 Remote panel

9 CAN2/RS232

10 CAN2

11 Redundancy bus: J1708/J1587

12 Data bus: CAN/J1939

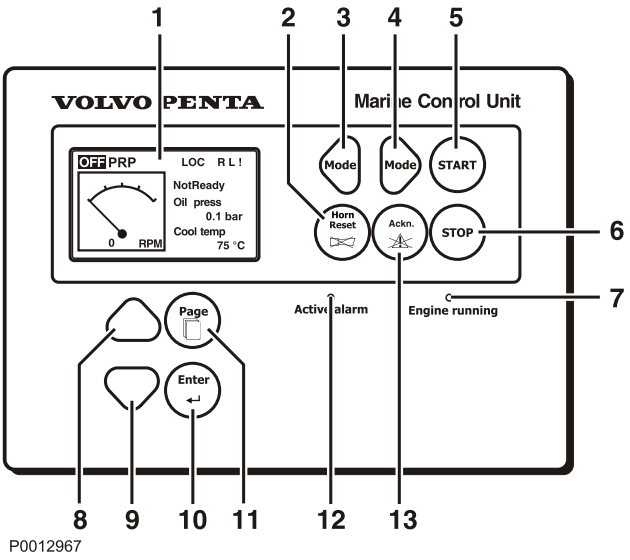
13 Engine Control System

14 PM

15 EMS

16 Shutdown Senders & Switches

- a Press. switches
- b Temp. switches
- c RPM sender



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MCU panel

The MCU, Marine Control Unit, is the control system's control unit. A panel on the unit shows engine information and alarms.

1 Display

2 Acknowledgement of audible alarms

3 Changing modes, switching to OFF

4 Changing modes, switching to PRP

5 Start button

6 Stop button

7 Green lamp; indicates engine is running

8 Up button; selecting and increasing

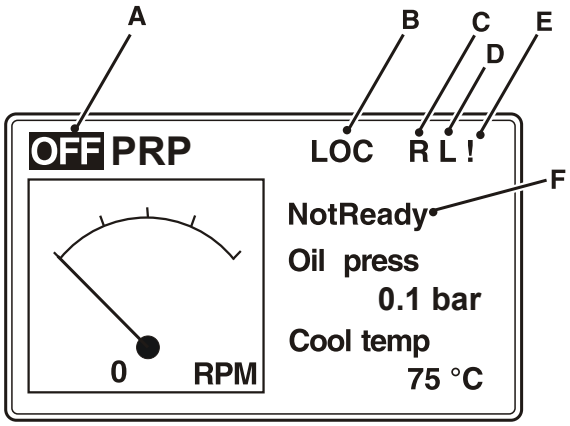
9 Down button; selecting and decreasing

10 Enter; confirming selection

11 Page; switching windows between Measurement (engine data), Adjustment and History.

12 Red lamp; indicates that there is an alarm.
The lamp flashes when a new alarm occurs. The lamp shines continuously when an alarm is active and acknowledged.

13 Ackn: acknowledge selection, acknowledge alarm
The button is also used to reset the SDU.



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Display

A Highlighted text indicates engine mode; in operation or start mode (PRP), or OFF.

B LOC: local mode. The engine can only be controlled from the main panel.

C R: a remote connection – a slave panel – is on line.

D L: locked. The main panel is locked and the slave panel is in control.

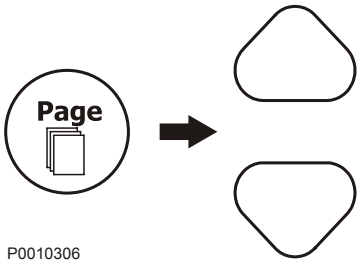
E ! There is an alarm in the alarm list.

F Engine status:
NotReady the system is not ready and the engine cannot be started.
Ready the system is ready and the engine can be started.
Running: the engine is in operation.
LoadShar: the engine is under load and in operation with another engine.

Menus

The system has four menus:

- Main Menu
- Measurements
- Adjustment
- History



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Main Menu

Browse with the Page button to the main menu (Main). Browse between windows using the up/down buttons.

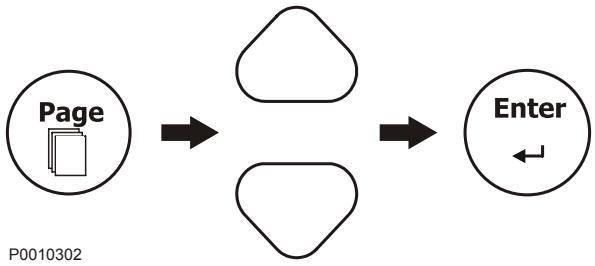
Measurements

1 Browse with the Page button to the engine data menu (Measurement).

2 Browse in the engine data menu with the up/down buttons.

Adjustment

The review and changing of setpoints is carried out in the adjustment menu.



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1 Browse with the Page button to the Adjustments menu.

2 Browse between the different setpoints using the up/down buttons.

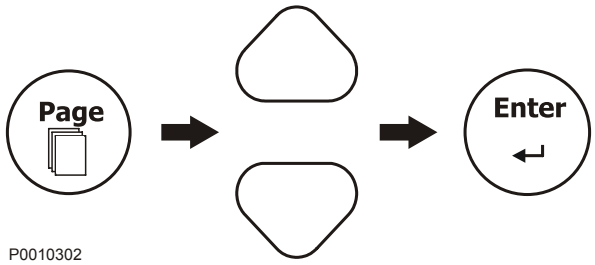
3 Press Enter to confirm the selection.

4 Browse with the up/down buttons to the desired setpoint. Setpoints marked with an asterisk (*) are password protected.
Press Enter to confirm the selection.

5 Use the up/down buttons to adjust the setpoint. Depress the up/down buttons for 2 seconds to activate automatic repetition.

6 Press Enter to confirm the selection. To finish without any change press the Page button.
Press the Page button to select setpoint group.

History



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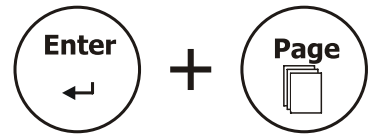
1 Browse to the History menu using the Page button.

2 Browse with the up/down buttons to the desired event.

3 Press Enter to see more detailed information about the event. Continue to press Enter to see all information about the event.
When all information is shown the first image is visible again. Browse in the window using the up/down buttons.

4 Exit the menu with the Page button.



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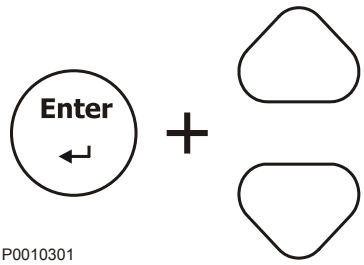

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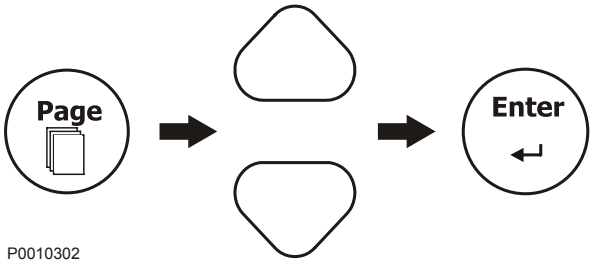

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Settings

Serial number and software version

In order to see the engine serial number and software version installed go to the main menu.
Press the Enter button and hold it down and press the page button at the same time.
The system returns automatically to the main menu.

Backlighting

Panel backlighting is adjusted in the info menu.
Press the Enter button and hold it down; adjust backlighting with the up/down buttons.

Contrast is adjusted in the main menu. Press the Enter button and hold it down; adjust the contrast with the up/down buttons.

Changing language

Setting the language the information on the screen will be shown in. There are six languages to choose from.

1 Press the Enter button and hold it down to reach the info menu. Press the Page button.

2 Browse using the up/down buttons.

3 Press Enter to select the language and close the menu.

Setting password

The password consists of 1–4 numerals.
The default password is 0 on delivery.

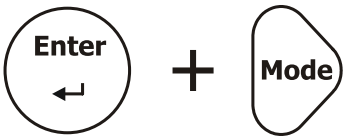
1 Navigate to the Adjustments menu.

2 Browse to “Password” using the up/down buttons. Press Enter to confirm the selection.

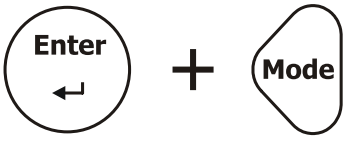
3 Browse using the up/down buttons to “Enter Password” where 0 is shown. Press Enter to confirm the selection.

4 Exit the menu by pressing Page.

The password gives full access to the MCU. Parameters may only be changed by trained personnel.

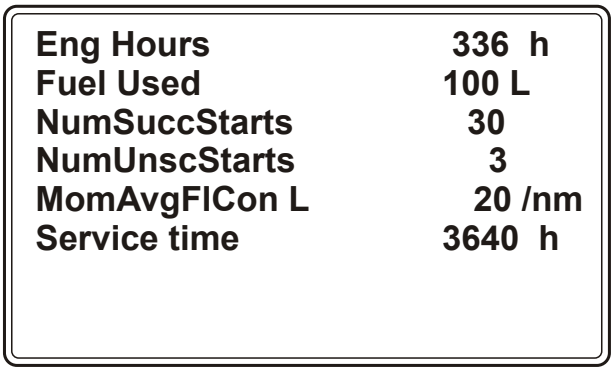


P0010303



P0010304

P0010305



P0012968

Working mode

Local mode

In Local Mode the engine can only be started from the main panel. External start/stop commands are ignored.

The mode is activated by pressing Enter and the right Mode button.

Exit mode by pressing Enter and the left Mode button.

Operations mode (PRP)

In operations mode (PRP) the engine is ready for start when the status shows "Ready".

Off mode (OFF)

The engine cannot be started in OFF mode. All relay output signals are temporarily disconnected and the status is changed to “Not Ready”.
Activate OFF mode by pressing the left Mode button.

NOTICE! The engine cannot be started; if the engine is running it will be shut down when OFF mode is activated.

Activate OFF mode by repeatedly pressing the left Mode button until "off" is shown in the display's top left corner.

Statistics

In the main menu, press the up button three times.

1 Operation hours

2 Total quantity of fuel used

3 Number of successful starts

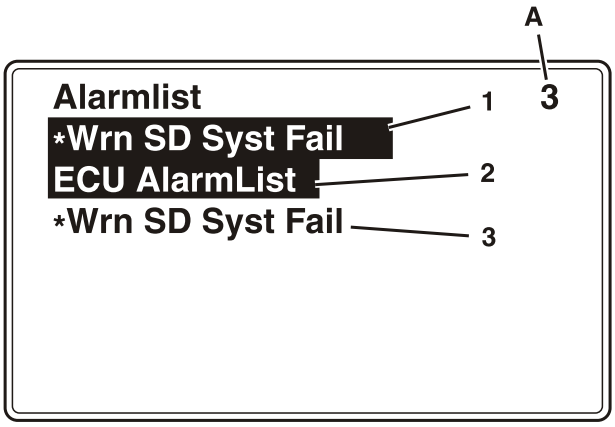
4 Number of unsuccessful starts

5 Momentary average fuel consumption(1)

6 Service time (hours until next service)

Statistical values can be adjusted with PC software (password protected); contact your Volvo Penta dealer.

1. Not standard; adaptation of software required.



P0010307

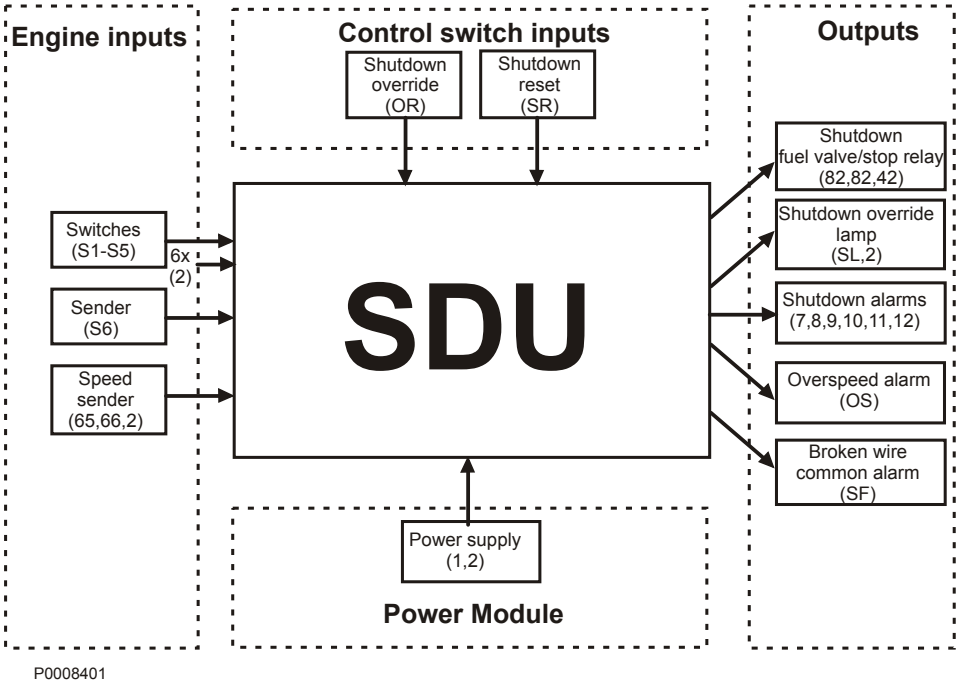
Alarm list

Alarms

If the system discovers a fault the alarm list is shown on the display when the main menu is active.
The alarm list is not activated while values, parameters and alarm history are being reviewed.

For further information on how to handle alarms and take recommended actions, refer to the *Fault handling, page 40* chapter.

Shutdown Unit (SDU)



NOTICE! The information in this section is only valid for type approved installations.

Overview

The SDU has six shutdown channels and one overspeed shutdown.

S1 – Cooling water temperature

S2 – Lubricating oil pressure, marine gear

S3 – Lubricating oil pressure, engine

S4 – Cooling water pressure

S5 – Oil temperature

S6 – Exhaust temperature

Shutdown reset

Activated shutdown must be reset before engine can be restarted. Shut down reset button on engine connection box.

Overspeed shutdown

The overspeed function shuts down the engine in case of overspeed.

Overspeed test

To test overspeed function push the overspeed test button (inside the SDU). When pushed the overspeed limit drops 25%.

Emergency mode (shutdown override)

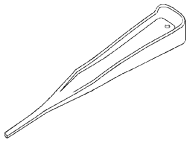
The system can be overridden by activating the OR input (the Emergency mode lamp, when installed on output SL, will be activated). Override does not include overspeed.

Run detection

To avoid alarms when starting and stopping the engine an interlock for the shutdown pressure switches (run detection) is implemented.

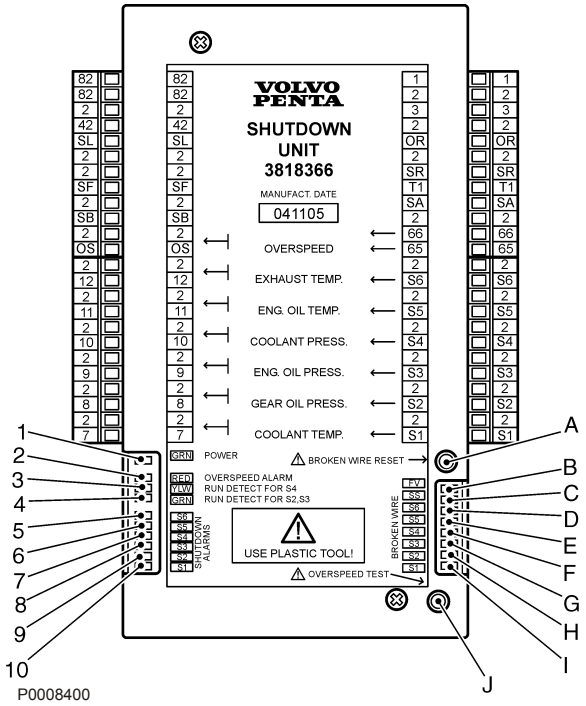
Broken wire

All channels are equipped with broken wire detection that activate an alarm if connection is lost or power supply to SDU is lost.
Yellow LED indicates broken wire. Reset alarm on button “Broken wire reset”, see *SDU control panel*.


P0008415

NOTICE! Only use Volvo Penta tool supplied with SDU for reset.

SDU Indications



1 Green – Power

2 Red – Overspeed Alarm

3 Yellow – Run dectection S4

4 Green – Run detection S2, S3

5 Red – S6 Shutdown active

6 Red – S5 Shutdown active

7 Red – S4 Shutdown active

8 Red – S3 Shutdown active

9 Red – S2 Shutdown active

10 Red – S1Shutdown active

A Broken wire reset button

B Yellow – Fuel valve wire detected

C Yellow – Speed sender Broken wire detected

D Yellow – S6 Broken wire detected

E Yellow – S5 Broken wire detected

F Yellow – S4 Broken wire detected

G Yellow – S3 Broken wire detected

H Yellow – S2 Broken wire detected

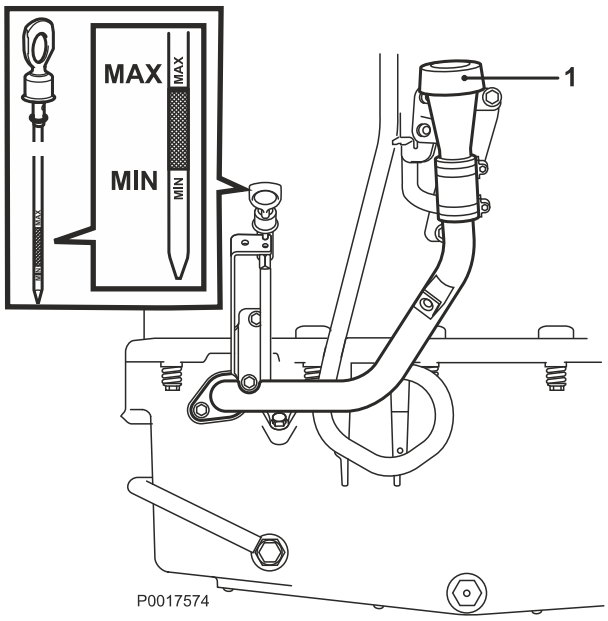
I Yellow – S1 Broken wire detected

J Overspeed shutdown test button

Starting

Make it a habit of giving the engine and engine room a visual check before starting. This will help you to discover quickly if anything abnormal has happened, or is about to happen.
Also check that instruments and warning displays show normal values after you have started the engine.

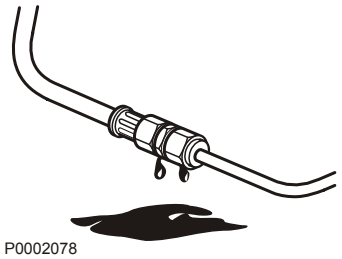
⚠ WARNING!
Never use start spray or similar agents to start an engine. This may cause an explosion in the inlet manifold. Risk of personal injury.



Before Starting

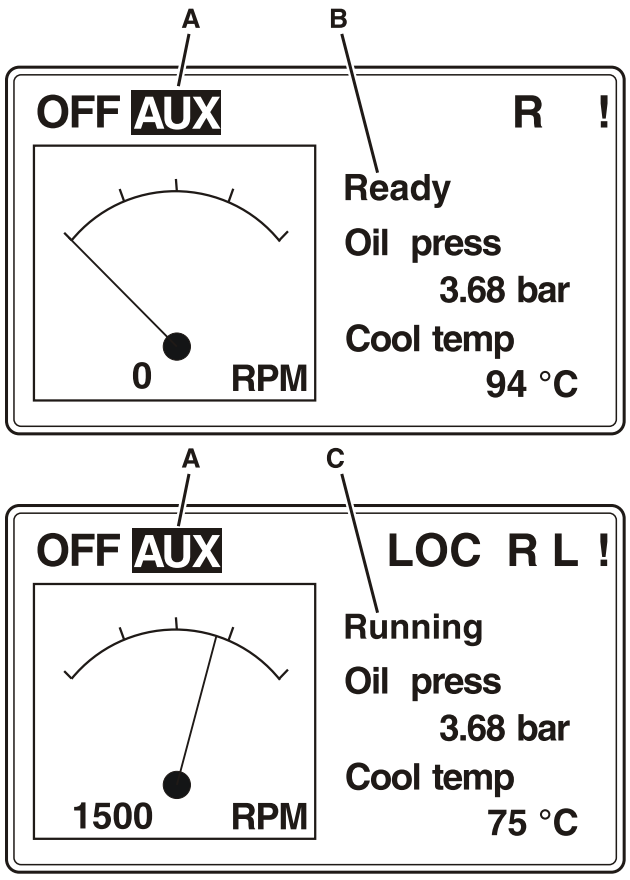
- Check that the oil level is between the MIN and MAX marks.
  For filling refer to *Oil level, checking and topping up, page 62*.
- Open the fuel valves.
- Check the fuel pre-filter; refer to *Fuel pre-filter, page 67*.
- Check the coolant level and that the radiator is not blocked externally. Refer to *Maintenance, page 74* and *Charge Air Cooler, External Cleaning, page 72*

  ⚠ WARNING!
  Do not open the coolant filler cap when the engine is hot, except in emergencies as this could cause serious personal injury. Steam or hot fluid could spray out.



- Check that no leakage of oil, fuel or coolant is present.
- Turn the main switch(es) on.
- Move the engine speed control to idle, and open the disengageable clutch/gearbox if installed.

IMPORTANT!
Never break the circuit with the main switch while the engine is running, as this may damage the alternator.



P0010310

Starting the Engine

1 In the main menu, browse to start mode (PRP) (**A**) using the Mode button

2 Check that engine status is "Ready" (**B**).

3 Depress the Start button; engine status will change to "Running" (**C**).

If the engine is not ready to start (Not Ready), check the following:

- Check the alarm list. Acknowledge any alarms.
- Check the ECU alarm list. Acknowledge any alarms.
- Check the wiring between the MCC cabinet and the engine.

Overheating protection

If the starter motor is engaged for its maximum activation time (30 seconds), the starter motor circuit is cut automatically to protect the starter motor from overheating. If possible, leave the starter motor to cool for at least five minutes before making a new start attempt.

Read the instruments and warm the engine up

Allow the engines to idle for the first ten seconds. Check that instruments and warning displays show normal values.
Check that no messages are displayed and no warning signs are showing. If a fault is registred, please refer to section *Fault handling, page 40* for further information and recomended actions. Warm the engine up at low speed and low load, so normal operating temperature is reached before full power is used.

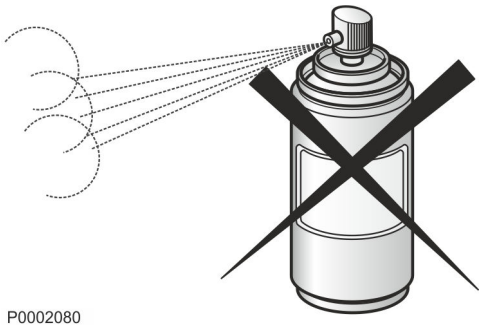
IMPORTANT:
Never race the engine when it is cold.
Racing the engine when it is cold can damage the engine components and decrease the engine lifetime.

Starting in Extreme Cold

Certain preparations must be made to enable engine starting in extreme cold, and in some cases to make starting possible at all:

- Use a winter grade fuel (of a well-known make) that is approved for the prevailing temperature. This reduces the risk of paraffin wax precipitation in the fuel system. At extremely low temperatures, we recommend the use of a fuel heater.
- Use a synthetic engine oil of a viscosity recommended for the prevailing temperature to achieve satisfactory lubrication. Refer to *Viscosity*. Synthetic lubricants are able to handle a wider temperature range than mineral-based lubricants.
- Pre-heat the coolant with a separately-installed electric engine heater. In extreme cases, a diesel-fired engine heater may be necessary. Ask your Volvo Penta dealer for advice.
- Make sure the cooling system is filled with a coolant mixture. Refer to *Cooling System*.
- The batteries must be in good condition. Cold weather reduces battery capacity. Increased battery capacity may be necessary.

Never Use Start Spray


P0002080

⚠ WARNING!
Never use start spray or similar agents to start an engine. This may cause an explosion in the inlet manifold. Risk of personal injury.

Operation

Reading the Instruments

Read all instruments and alarm displays directly after starting, and then regularly during the voyage.

Alarms

The alarm is shown in two different alarm lists depending on the cause of the alarm. Alarms discovered by EMS or PM are shown in the ECU Alarmlist, and alarms from the SDU or MCU are shown in the Alarmlist.

P0010311

P0010312

1 Acknowledge the audible alarm by pressing the Horn Reset button.

2 Reading alarms.
To see active alarms, press the up button in the main menu once for the SDU/MCU alarm list and twice for the ECU alarm list.
If there are several alarms, browse in the alarm list using the Enter button.

3 Depress the Ackn button to acknowledge all alarms.
Take the necessary action; refer to the *Fault handling, page 40* section for further information.

Alarm notations remain in the alarm list until they have been acknowledged and rendered "inactive" (fault remedied).

Maneuvering

Operation at low load

Avoid long-term operation at idle or at low load. It takes a long time for the engine to reach working temperature, resulting in high viscosity of the oil and large clearances in the engine mechanics. In cold climate, it takes even longer.

The combustion temperature and cylinder pressure can become so low that an effective combustion cannot be ensured. At these conditions unburned fuel could dilute the lubricant oil. Because of the low cylinder pressure, the piston ring performance could be affected causing oil from the crankcase to pass the rings and go further out with the exhaust gases. This mixture of unburned fuel and oil in exhaust gases is referred to as “slobber”. A new engine produces more “slobber” at low load compared to an engine with more hours of operation.

At low load, the pressure in the turbocharger is low and oil could seep past the turbocharger seals and mix with the air into the engine. The consequences can be carbon build-up on valves, piston crowns and the exhaust turbine, which could affect engine performance.

Both conditions can lead to increased oil consumption and eventually external oil leakage from joints in the exhaust system. For example, leakage could be seen at the exhaust manifold, before and after the turbo, around the muffler and in worse case even in the exhaust end pipe. Consequences could lead to clogged exhaust gas recirculation systems and exhaust aftertreatment systems.

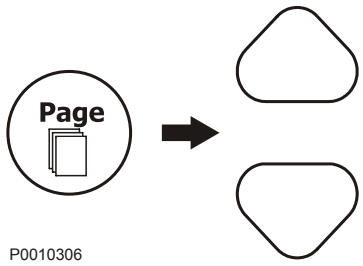
Signs of oil leaking caused by "slobber" do not indicate an engine problem but indicates low load operation. To minimize the risk of malfunctions caused by operation at low load, follow these points as a complement to normal maintenance:

- Run in the engine as soon as possible.
- Load the engine so it reaches working temperature as soon as possible.
- Turn off the engine instead of running on idle for longer periods.
- Avoid load levels below 20% as constant operation.
- If the engine is regularly tested without load, limit the duration of the operation to 5 minutes. Run the engine at full load for about 4 hours once a year, for

the carbon deposits in the engine and exhaust system to burn off.

- If visible slobber has occurred, it can be burned off by running the engine on at least 30% load for about 40-60 minutes.

Running data



P0010306

Monitor running data that is not shown in the main menu:

1 Browse with the Page button to the engine data menu (Measurements).

2 Use the up/down buttons to select the desired engine data.

Engine Shutdown

Before Engine Shutdown

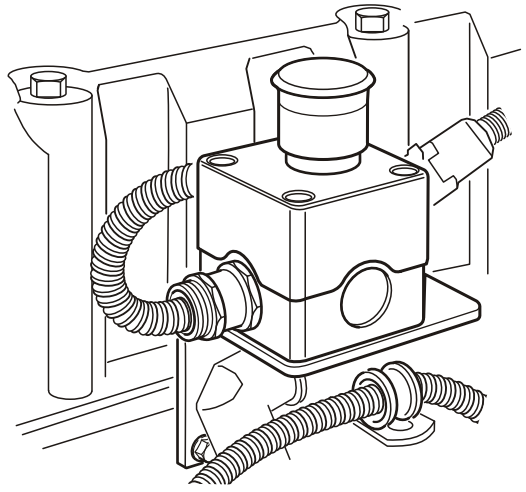
Let the engine run at high idle (1500 or 1800rpm) for a minimum of 5 minutes before the shutdown after normal use. Normal use is defined as minimum 50% load. After use with less than 50% load, high idle for approximately 3 minutes is sufficient. This allows engine temperature equalization and prevents boiling once stopped and also allows the turbochargers to cool down. This contributes to long, fault-free service life.

NOTICE! Do not turn off the main switch within 30 seconds after turning off the ignition. This is in order to save engine data to the engine control unit.

Stop the Engine

1 Press the stop button until engine speed begins to fall.

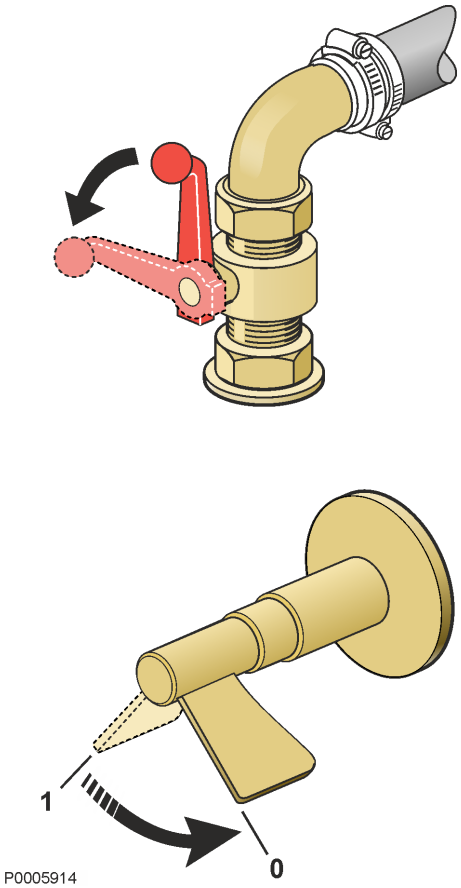
2 Check that the rpm reading drops to 0 and that engine status changes to “Ready".



P0005904

Emergency stop

If a fault occurs that prevents you stopping the engine in the normal way, you can stop it by pressing the emergency button.
If the engine has been stopped using the emergency stop button, the button locks in the down position. In order to be able to restart the engine, the button must be reset to its original position. To do this, pull the button upwards until you hear a click.



After Engine Shutdown

- Check the engine and engine bay for leakages.
- Close the fuel tap.
- Close the sea cock where fitted.
- Take an hour meter reading and carry out preventive maintenance according to the maintenance schedule.
- Boats with stern drives: Trim the stern drive down to maximum to protect the trim ram piston's untreated surfaces from fouling.
  If there is a risk of the boat striking bottom with the stern drive, the drive must instead be trimmed up to the maximum lift position.
- Turn off the main switch before any long stoppage.

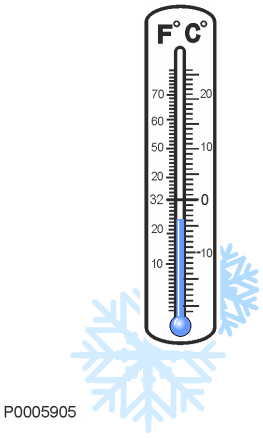
NOTICE! Depending on the model and setup, there could be more than one switch.

NOTICE! Do not turn off the main switch within 30 seconds after turning off the ignition. This in order to save engine data to the engine control unit.

Operation Break

If the boat is not used, but left in the water, the engine must be warmed up at least once every fortnight. This prevents corrosion damage in the engine.
If you expect the boat to be unused for two months or more, it must be inhibited, please refer to *Storage, page 86*.

Cold Weather Precautions

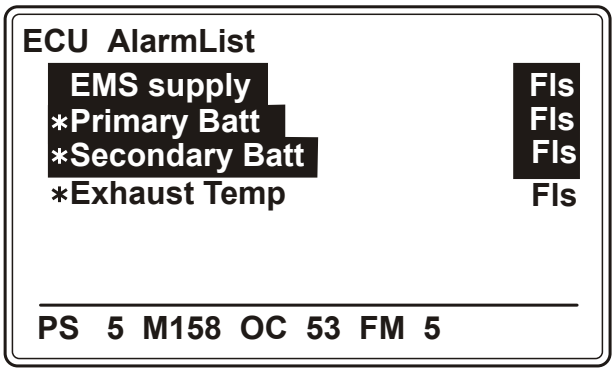


P0005905

If the engine bay cannot be kept frost free, the sea water system must be drained and the freshwater system coolant must have sufficient freeze protection to prevent freeze bursting; refer to *Maintenance, page 72* and *Seawater System, Draining, page 78* respectively for more detailed information.
Check the charge status of the battery. A poorly-charged battery can freeze and burst.

Fault handling

Despite regular maintenance according to the maintenance schedule and perfect operation conditions, faults that need to be attended to during travel, may occur. This chapter describes some possible alarms and fault handling. Note that the content of this chapter does not provide full coverage of the possible fault messages and alarms. Contact a Volvo Penta workshop for assistance with diagnostic readouts and unresolved faults.



P0013089

Message from engine and MCC system

If a malfunction is discovered the driver is warned by a buzzer sounding and a message showing in the display.
The message toggles between cause of fault and tasks to perform.

Information regarding ”cause of fault” and ”measures to take” is found in chapter *Fault Code Register*.

The engine, transmission and MCC system is monitored by the diagnostic function. Should the diagnostic function discover a malfunction it protects the engine and ensures continued operation by affecting the engine. Depending on how serious the malfunction is the effect on the engine varies.

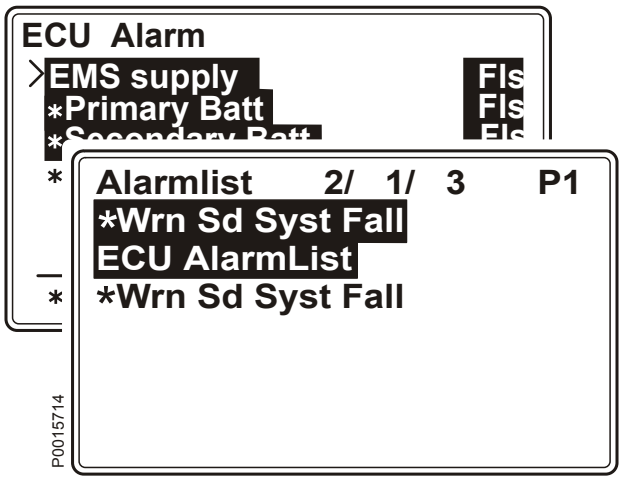
- Minor malfunction which does not damage the engine or transmission.
  Affect on engine: None.
- Serious malfunction which will not immediately damage the engine or transmission e.g. high coolant temperature.
  Affect on engine: Engine power is reduced until faulty value becomes normal.
- Serious malfunction which will cause serious damage to engine or transmission.
  Affect on engine: Engine power is reduced.
- Serious malfunction which makes it impossible to control the engine or transmission.
  Affect on engine: Transmission is disengaged and engine speed is reduced.
  It is possible to perform emergency shifting, please refer to *Emergency Shifting*.
- Serious malfunction on transmission or in the engine fuel injection system.
  Affect on engine: Engine is stopped.
  It is possible to perform emergency shifting, please refer to *Emergency Shifting*. In emergency situations it is also possible to start the engine with gear engaged after acknowledging the alarm.

Acknowledge message

P0010312

The Ackn button acknowledges all alarms. Alarms that are not active disappear from the list.

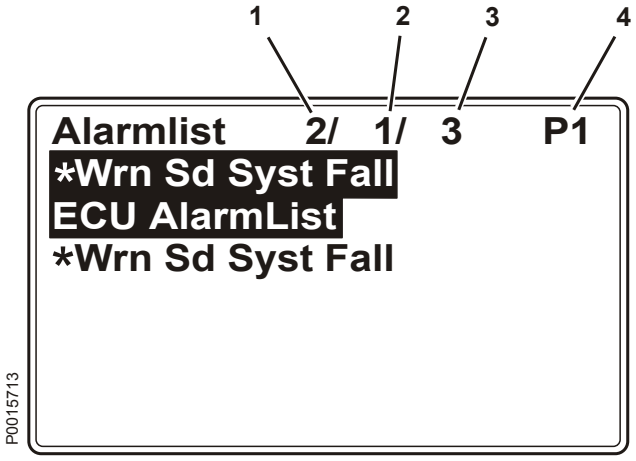
Alarm List



The alarm list and ECU alarm list are the two first windows in the main menu.
From the main menu press the up button once to reach the alarm list and twice for the ECU alarm list.

Alarm List (Alarm list)

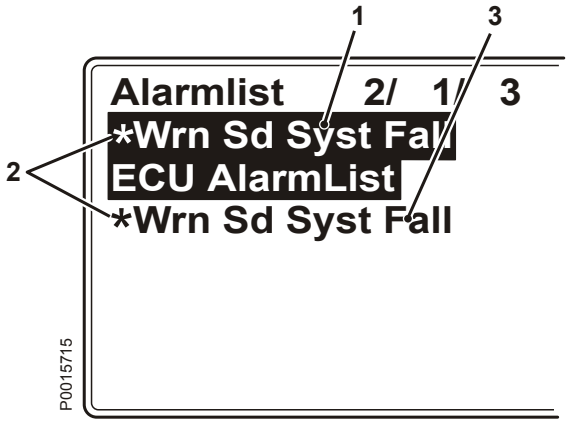
The alarm list is automatically displayed when a new alarm is triggered and the main menu is active.
The alarm list is not activated while values, parameters and alarm history are being reviewed.



Alarm List

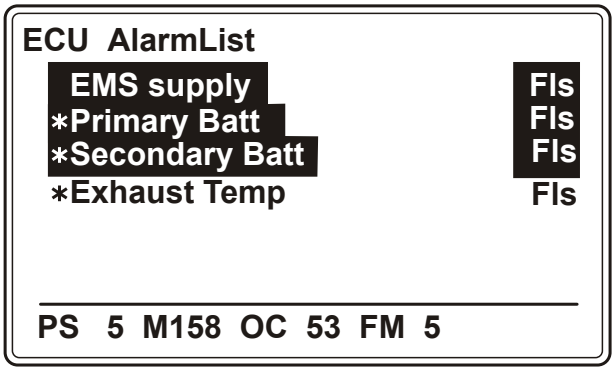
The alarm list heading shows:

- Number of active alarms (**1**)
- Number of unacknowledged alarms (**2**)
- Total number of alarms (**3**)
- Number of pages (**4**).
  Scroll between the alarms in the list with the enter key.



Status of alarm

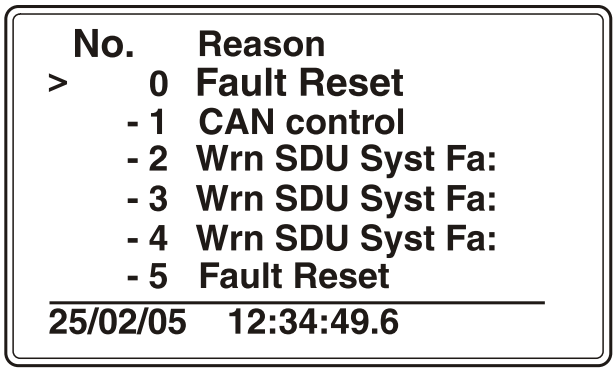
- Active alarms are indicated by a black background (**1**)
- Unacknowledged alarms are marked with * (**2**)
- Inactive alarms are displayed without a black background (**3**)



P0013089

ECU alarm list

If ECU AlarmList is visible in the list then there are fault codes from the engine control unit or power management system.



P0010309

Alarm list and history

Abbreviations in alarm list and history

Abbreviation	Meaning
Wrn	Warning
Sd	Automatic shutdown
Fls	Sensor failure General alarm

Fault Tracing

A number of symptoms and possible causes of engine malfunctions are described in the table below. Always contact your Volvo Penta dealer if any problems occur that you cannot solve by yourself.

NOTICE! Read the safety regulations for care and maintenance in the *Safety precautions for maintenance and service operations* chapter before work you start work.

Symptoms and possible causes

Engine cannot be stopped	2
Starter motor does not rotate	1, 2, 3, 6, 7, 9, 10, 35, 3
Starter motor rotates slowly	1, 2
Starter motor rotates normally but engine does not start	11, 12, 13, 14, 37, 38
Engine starts but stops again	4, 11, 12, 13, 14, 19, 36
Engine does not reach correct operating speed at full throttle	5, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 33, 36, 38,
Engine runs unevenly	5, 14, 15,
Engine vibrates	24
High fuel consumption	15, 16, 18, 21, 36
Black exhaust smoke	19
Blue or white exhaust smoke	21, 34
Lubricating oil pressure too low	22
Coolant temperature too high	25, 26, 27, 28, 29, 30, 31, 32
Coolant temperature too low	31
No charge, or poor charge	2, 8

1. Discharged batteries
2. Poor contact/open circuit in cables
3. Main switch in off position
4. Shut down system activated
5. Check valve in feed pump leaks
6. Control lever not in neutral/helm station not activated
7. Faulty shutdown relay
8. Alternator drive belt broken/slips
9. Faulty starter relay
10. Faulty starter motor
11. Lack of fuel
    - fuel taps are closed
    - fuel tank is empty
    - wrong tank connected
12. Blocked primary fuel filter/secondary fuel filter
(due to contamination or paraffin precipitation in the fuel at low temperatures)
13. Air in the fuel system
14. Water or contaminants in fuel
15. Boat abnormally loaded
16. Fouling on hull/propeller
17. Cables for unit injector damaged (open circuit)
18. Faulty unit injector

19. Insufficient air supply to engine
    - blocked filter
    - leak between turbocharger and inlet manifold
    - fouled compressor section in turbocharger
    - faulty turbocharger
    - poor engine bay ventilation
20. Coolant temperature too high
21. Coolant temperature too low
22. Oil level too low
23. Faulty/wrong propeller
24. Faulty engine mounting
25. Coolant level too low
26. Air in the freshwater system
27. Faulty circulation pump
28. Closed seawater inlet
29. Blocked seawater inlet, lines or filters
30. Defective impeller in the seawater pump
31. Defective thermostat
32. Clogged heat exchanger insert
33. Clogged charge air cooler
34. Lubricating oil level too high
35. Water entry into engine
36. High back pressure in exhaust system
37. Faulty engine speed sensor
38. Unacknowledged fault codes in the alarm list or ECU alarm list

Fault Code Register

BattPotential Wrn

Battery voltage to engine control unit

- Check belt tension. Refer to *Drive belt, check and change, page 61*.
- Check battery fluid level. Refer to *Battery, page 83*.

Coolant Level Wrn

Low coolant level.

- Check for coolant leakage.
  Check coolant level., Refer to *Maintenance, page 74*.

Crankcase Press Wrn

Crankcase pressure too high Engine power is reduced.

- Check that the crankcase ventilation is not blocked.

EMS supply FIs

EMS supply.

- Overcurrent protection has tripped.
- Check emergency stop button if any. Reset if necessary.

Remedy the problem. Reset the system by switching the main switch off and on.
Contact a Volvo Penta workshop if the fault remains.

EngCool Temp Wrn

Coolant temperature too high Engine power is reduced.

- Check coolant level., Refer to *Maintenance, page 74*
- Check that the seawater filter is not blocked., Refer to *Seawater Filter, Check and Cleaning, page 81*
- Check the impeller in the seawater pump., Refer to *Impeller, Check and Change, page 80*
- Check that no leakage occurs.

EngineOilLevel Wrn

Oil level too low.
The system may wrongly detect too low an engine oil level in heavy following seas or head seas. If this occurs, acknowledge the fault and check the following items for safety's sake.

- Checking Engine Oil Level, Refer to *Oil level, checking and topping up, page 62*.
- Check that no leakage occurs.

EngOil Press Wrn

Oil pressure too low. Engine power is reduced.

- Checking Engine Oil Level, Refer to *Oil level, checking and topping up, page 62*.
- Check that no leakage occurs.

Extra Supply Fls

Auxiliary supply
Overcurrent protection for the auxiliary supply has tripped.

- Check the auxiliary stop connections for short circuits.

Reset the system by switching the main switch off and on.
Contact a Volvo Penta workshop if the fault remains.

ExtSTOP Active Fls

Emergency Stop Switch

- Check emergency stop button if any. Reset if necessary.

Fls

Miscellaneous system faults
Engine performance can be affected.Several possible causes of engine problems are described below.

- Battery voltage incorrect
  Check belt tension. Refer to *Drive belt, check and change, page 61*.
  Check battery fluid level. Refer to *Battery, page 83*.
- Fuel pressure incorrect.
  Engine performance can be affected.
- Communication failure
  Gear automatically set to neutral. Engine performance can be affected.
- Oil pressure too low.
  Engine power is reduced.
  Check the oil level in the engine. Refer to *Oil level, checking and topping up, page 62*.
  Check that no leakage occurs.
- Sensor failure

Contact a Volvo Penta workshop if the fault remains.

Fls Throttle In

Engine speed demand to system lacking

- Check Control Lever

FuelDelPress Wrn

Fuel pressure too low.

- Check fuel level.
- Check that the fuel filters are not blocked. Replace filters if necessary. Refer to *Engine Fuel Filter Replacement, page 66*
- Check for fuel leakage.

Fuel Press Wrn

Fuel pressure too low.

- Check fuel level.
- Check that the fuel filters are not blocked. Replace filters if necessary. Refer to *Engine Fuel Filter Replacement, page 66*
- Check for fuel leakage.

Oil Level Wrn

Oil level too low.
The system may wrongly detect too low an engine oil level in heavy following seas or head seas. If this occurs, acknowledge the fault and check the following items for safety's sake.

- Checking Engine Oil Level, Refer to *Oil level, checking and topping up, page 62*
- Check that no leakage occurs.

Primary Batt Fls

Primary Battery.
Poor batteries or charging Refer to *Battery, Charging*

Sd Coolant Temp

Wrn ECU, Wrn J1587
Critical system fault Engine shuts down automatically.
Coolant temperature too high Engine power is reduced.

- Check coolant level., Refer to *Maintenance, page 74*.
- Check that the seawater filter is not blocked., Refer to *Seawater Filter, Check and Cleaning, page 81*.
- Check the impeller in the seawater pump., Refer to *Impeller, Check and Change, page 80*.

Contact a Volvo Penta workshop if the fault remains.

Sd Gear Oil Press

Wrn ECU, Wrn J1587
Critical system fault Engine shuts down automatically.
Reverse gear oil pressure too low.

- Check the oil level. Refer to *Reverse gear, ZF*.
- Check that the oil strainer is not blocked. Refer to *Reverse gear MGX*.

Contact a Volvo Penta workshop if the fault remains.

Sd Oil Pressure

Wrn ECU, Wrn J1587
Critical system fault Engine shuts down automatically.
Oil pressure too low.

- Checking Engine Oil Level
- Check that no leakage occurs.

Contact a Volvo Penta workshop if the fault remains.

Sd Overspeed SDU

Wrn ECU, Wrn J1587
Critical system fault Engine shuts down automatically.
Contact a Volvo Penta workshop if the fault remains.

Secondary Batt Fls

Secondary Battery.
Poor batteries or charging Refer to *Battery, Charging*

SeaWater Press Wrn

Seawater pressure too low Engine power is reduced.

- Check that the seawater filter is not blocked., Refer to *Seawater Filter, Check and Cleaning, page 81*
- Check the impeller in the sea water pump. Refer to *Impeller, Check and Change, page 80*.
- Check that no leakage occurs.

Water in fuel Wrn

Water in Fuel.

- Empty the water trap underneath the fuel filters. Refer to *Fuel pre-filter with water separator*.

Wrn

Miscellaneous system faults
Engine performance can be affected. Several possible causes of engine problems are described below.

- Battery voltage incorrect
  Check belt tension. Refer to *Drive belt, check and change, page 61*.
  Check battery fluid level. Refer to *Battery, page 83*.
- Fuel pressure incorrect.
  Engine performance can be affected.
- Communication failure
  Gear automatically set to neutral. Engine performance can be affected.
- Oil pressure too low.
  Engine power is reduced.
  Check the oil level in the engine. Refer to *Oil level, checking and topping up, page 62*.
  Check that no leakage occurs.

Wrn Derate Alarm

Engine performance can be affected. Several possible causes of engine problems are described below.

- Battery voltage incorrect
  Check belt tension. Refer to *Drive belt, check and change, page 61*.
  Check battery fluid level. Refer to *Battery, page 83*.
- Fuel pressure incorrect. Engine performance can be affected.
- Oil pressure too low. Engine power is reduced.
  Checking Engine Oil Level. Refer to *Oil level, checking and topping up, page 62*.
  Check that no leakage occurs.

Contact a Volvo Penta workshop if the fault remains.

Wrn SD System Fail

Internal fault in SDU system
Break in wiring to sensor or internal SDU fault. Limited or no shutdown function.
Contact a Volvo Penta workshop if the fault remains.

Wrn Underspeed

Engine Speed.
Engine is emergency stopped.
Engine revolutions are lower than expected.

30 supply Fls

30 V supply
Overcurrent protection for the supply to the MCC system has tripped. Short circuit in the system between the engine and the MCC cabinet.
Remedy the problem. Reset the system by switching the main switch off and on
Contact a Volvo Penta workshop if the fault remains.

In Case of Emergency

Despite regular service in accordance with the planned maintenance schedule and perfect operating conditions, faults may occur that must be remedied before the boat can continue its trip. This chapter provides advice on how to remedy a number of conceivable faults.
When certain faults occur safety functions engage to protect the engine. The following may occur:

- Engine cannot be started.
- The engine rpm is limited
- The engine stops

If a fault occurs, confirm any fault alarm and take the necessary measures. Refer to this section and *Fault Code Register*.

P0002107

Starting Using Auxiliary Batteries

⚠ WARNING!
Explosion hazard. Batteries contain and give off an explosive gas which is highly flammable and explosive. A short circuit, open flame or spark could cause a violent explosion. Ventilate well.

⚠ WARNING!
Never confuse the positive and negative poles on the batteries. Risk of arcing and explosion.

1 Check that the auxiliary battery has the same voltage as the engine system voltage.

2 Connect the red positive cable to the plus (+) terminal on the discharged battery and then to the plus terminal on the auxiliary battery.

3 Connect the black start cable to the minus (–) terminal on the auxiliary battery and to a place a little distance away from the discharged battery, e.g. the start motor's negative terminal.

⚠ WARNING!
The black jumper cable (–) must never come in contact with the positive connection on the starter motor.

4 Start the engine and let it run at fast idle for approximately 10 minutes to charge the batteries. Make sure there is no extra equipment connected to the electrical system.

⚠ WARNING!
Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

⚠ WARNING!
Do not touch the connections during the start attempt: Risk of arcing.
Do not bend over any of the batteries either.

5 Turn off the engine. Remove the start cables in the exact opposite order to their connection.

Maintenance Schedule

Your Volvo Penta engine and its equipment are designed for high reliability and long life. The engines are built to have the smallest possible environmental impact. If given preventive maintenance, according to the maintenance schedule, these qualities will be retained and unnecessary malfunctions will be avoided. In order for the warranty to be valid, the owner must make sure that the services in the service intervals are performed.

NOTICE! For emission related warranty rights see Emission Control System Warranty Statement.

Service Intervals

Service intervals are shown below. The service content can be found in the Service Protocol available for download at **www.volvopenta.com**.

NOTICE! More information on how to perform service and maintenance can be found in the Service and Maintenance handbook. Information on how to purchase the Service and Maintenance handbook can be found at www.volvopenta.com.

Extended service intervals

The interval between engine oil changes may be extended in certain circumstances. To determine whether the service interval may be extended, Volvo Penta's conditions for extended service intervals must be met and an oil analysis performed. Contact your Volvo Penta dealer for further information.

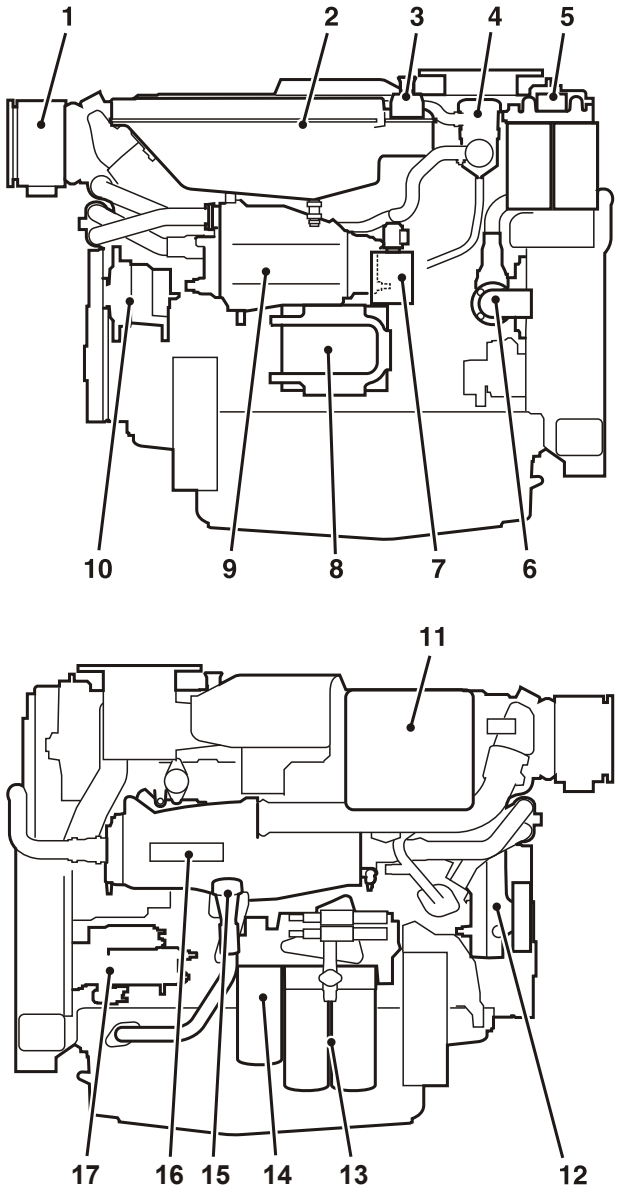
Where both operational and calendar times are specified, perform the maintenance item at whichever time is the sooner.

Maintenance

This chapter contains general technical information and instructions on how the prescribed maintenance items must be carried out. Read through the instructions carefully before starting work. The times when maintenance items must be carried are indicated in the *Maintenance Schedule*.
Read through the safety precautions for maintenance and service in the *Safety precautions for maintenance and service operations* chapter before work on the engine is begun.
Volvo Penta recommend that all servicing with the engine running should be undertaken by an authorized Volvo Penta workshop.

⚠ WARNING!
Care and maintenance work should be done with the engine stopped unless otherwise specified. Stop the engine before opening or removing the engine hatch/hood. Make it impossible to start the engine by removing the start key and cutting the system voltage with the main switches.

NOTICE! More information on how to perform service and maintenance can be found in the Service and Maintenance handbook. Information on how to purchase the Service and Maintenance handbook can be found at www.volvopenta.com.



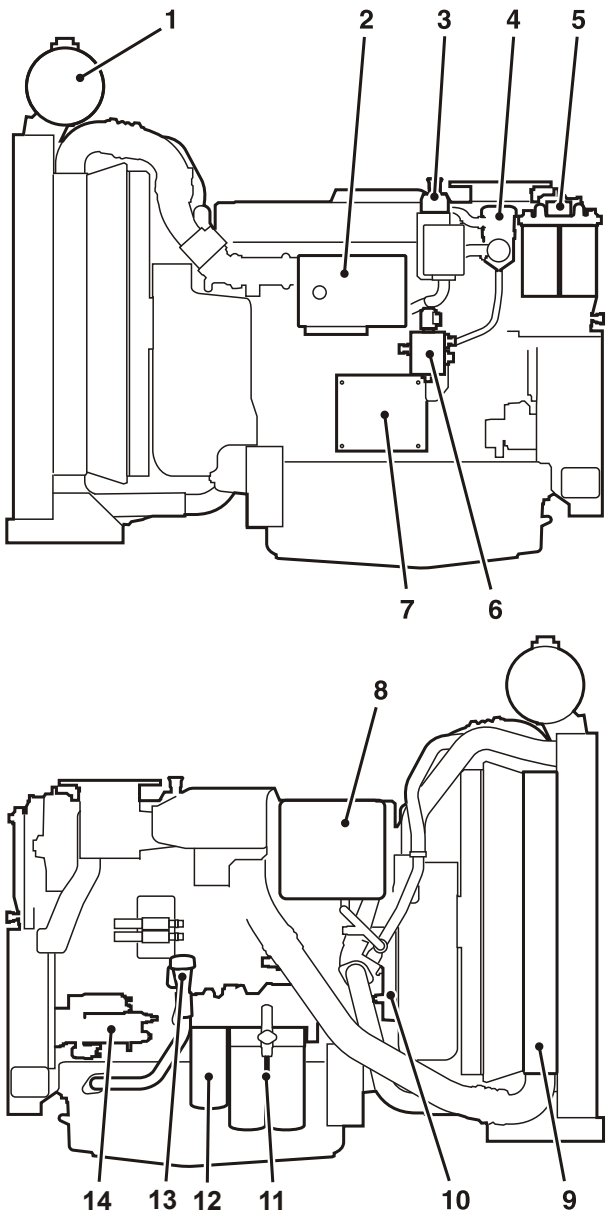
D9 MG HE genset engine

The D9 MG HE is a turbocharged, in-line, direct injection, 6-cylinder, 4-stroke genset engine. It is equipped with an engine mounted heat exchanger suitable for seawater cooling or connection to a central cooling system
Different starting and control systems are available.

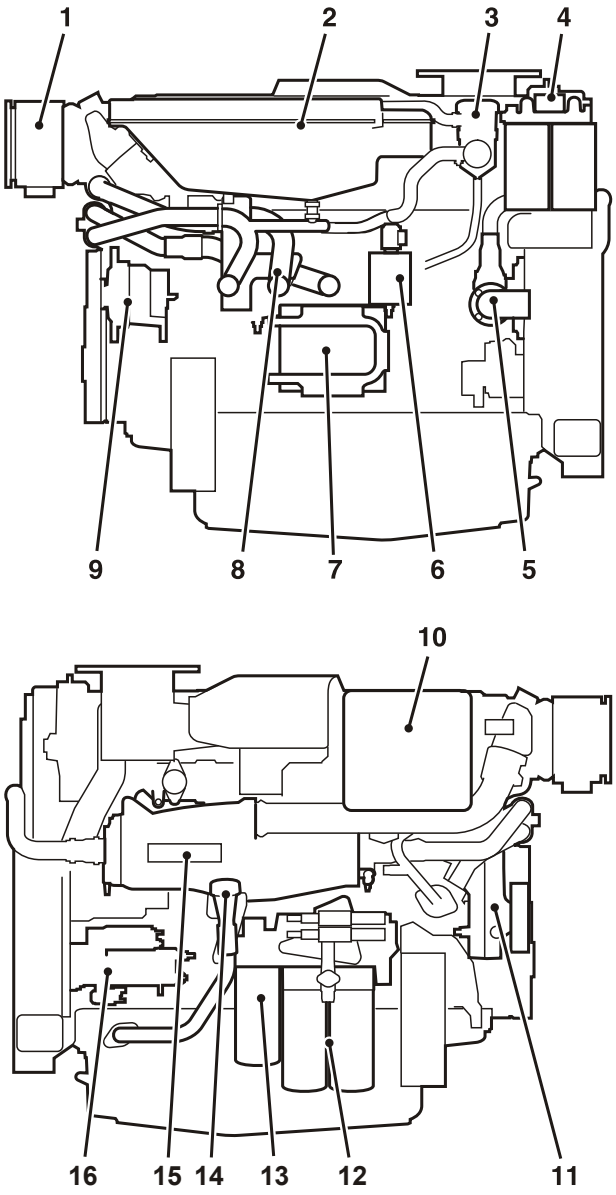
1 Electrical connection box with SD reset
2 Expansion tank
3 Emergency Stop
4 Crankcase ventilation filter
5 Switchable fuel filters
6 Raw water pump
7 Fuel Shut-off Valve
8 Engine Control Unit
9 Heat exchanger
10 Alternator
11 Air Filter
12 Fresh water pump
13 Engine Oil Filter
14 By-pass filter for engine oil
15 Engine Oil, Filling
16 Charge air cooler
17 Extra starter motor

D9 MG RC genset engine

The D9 MG RC is an in-line, direct injection, 6-cylinder, 4-stroke genset engine equipped with radiator cooling. Different starting and control systems are available.



1 Expansion tank
2 Electrical connection box with SD reset
3 Emergency Stop
4 Crankcase ventilation filter
5 Switchable fuel filters
6 Fuel Shut-off Valve
7 Engine Control Unit
8 Air Filter
9 Radiator with charge air cooler
10 Fresh water pump
11 Engine Oil Filter
12 By-pass filter for engine oil
13 Engine Oil, Filling
14 Extra starter motor



P0010291

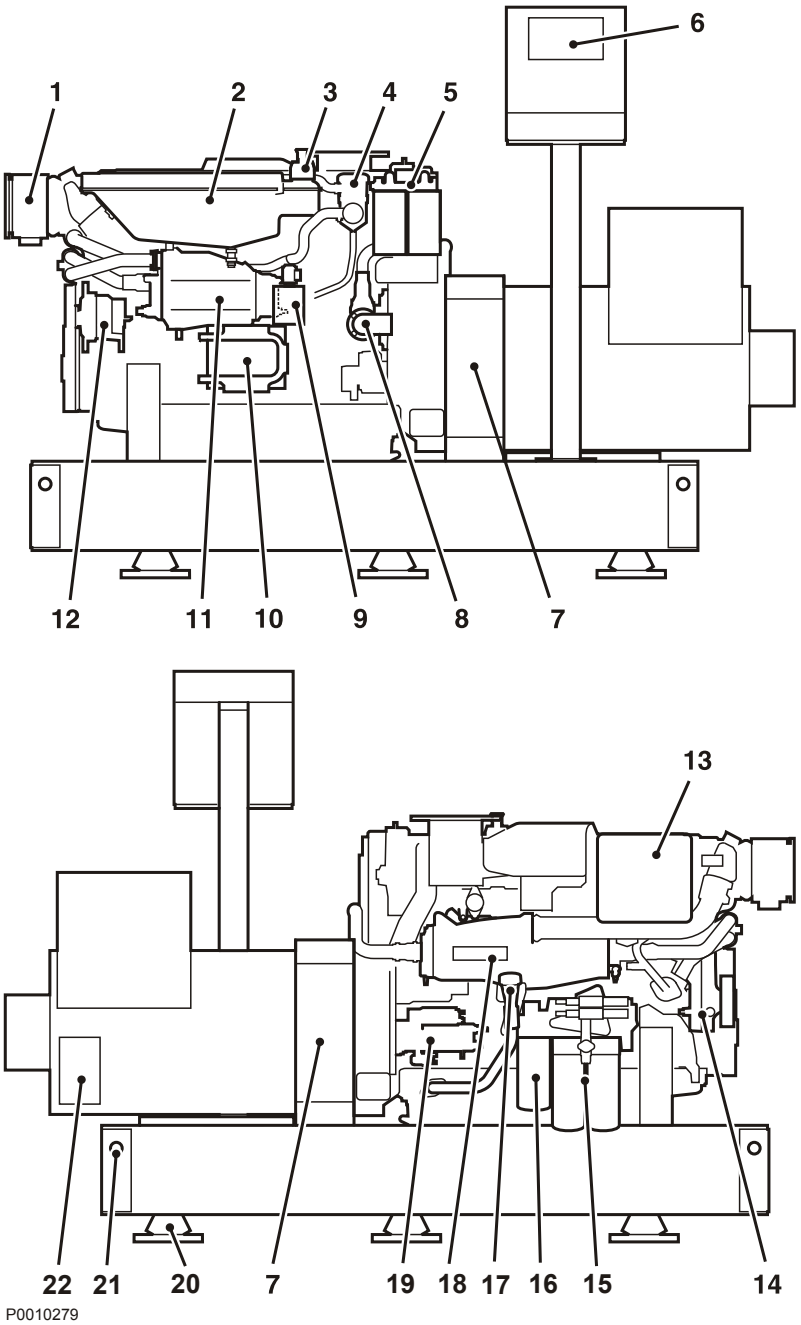
D9 MG KC genset engine

The D9 MG KC is a turbocharged, in-line, direct injection, 6-cylinder, 4-stroke genset engine. It is equipped with connections for keel cooling. Different starting and control systems are available.

1 Electrical connection box with SD reset
2 Expansion tank, högtemperatursystem
3 Crankcase ventilation filter
4 Switchable fuel filters
5 Circulation pump, low temperature circuit
6 Fuel Shut-off Valve
7 Engine Control Unit
8 Keel cooling connections
9 Alternator
10 Air Filter
11 Circulation pump, high temperature circuit
12 Engine Oil Filter
13 By-pass filter for engine oil
14 Engine Oil, Filling
15 Charge air cooler
16 Extra starter motor

D9 MG HE marine genset

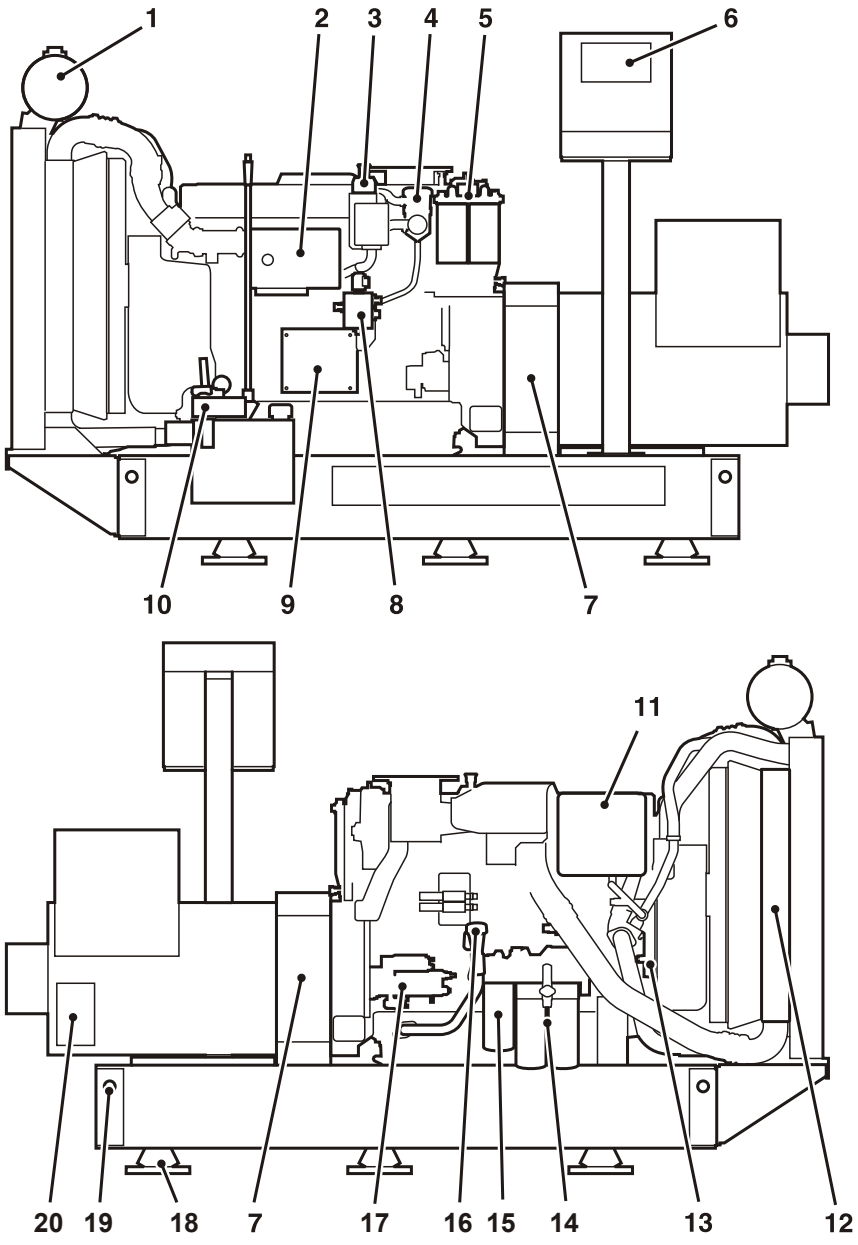
The D9 MG HE is a turbocharged, in-line, direct injection, 6-cylinder, 4-stroke marine genset. It is equipped with an engine mounted heat exchanger suitable for seawater cooling or connection to a central cooling system. The engine is mounted on a frame with a Stamford single or double bearing marine generator. Different starting and control systems are available.



1 Electrical connection box with SD reset
2 Expansion tank
3 Emergency Stop
4 Crankcase ventilation filter
5 Switchable fuel filters
6 MCU connection box with panel
7 Air outlet generator
8 Raw water pump
9 Fuel Shut-off Valve
10 Engine Control Unit
11 Heat exchanger
12 Alternator
13 Air Filter
14 Fresh water pump
15 Engine Oil Filter
16 By-pass filter for engine oil
17 Engine Oil, Filling
18 Charge air cooler
19 Extra starter motor
20 Flexible engine mounting
21 Lifting eye x 4
22 Air inlet generator

D9 MG RC marine genset

The D9 MG RC is a turbocharged, in-line, direct injection, 6-cylinder, 4-stroke marine genset equipped with radiator cooling. The engine is mounted on a frame with a Stamford single or double bearing marine generator.
Different starting and control systems are available.

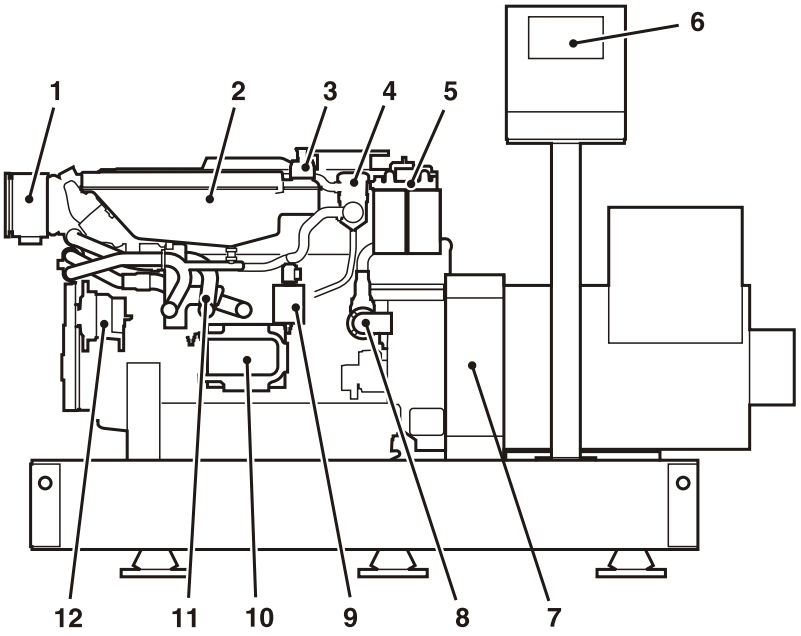


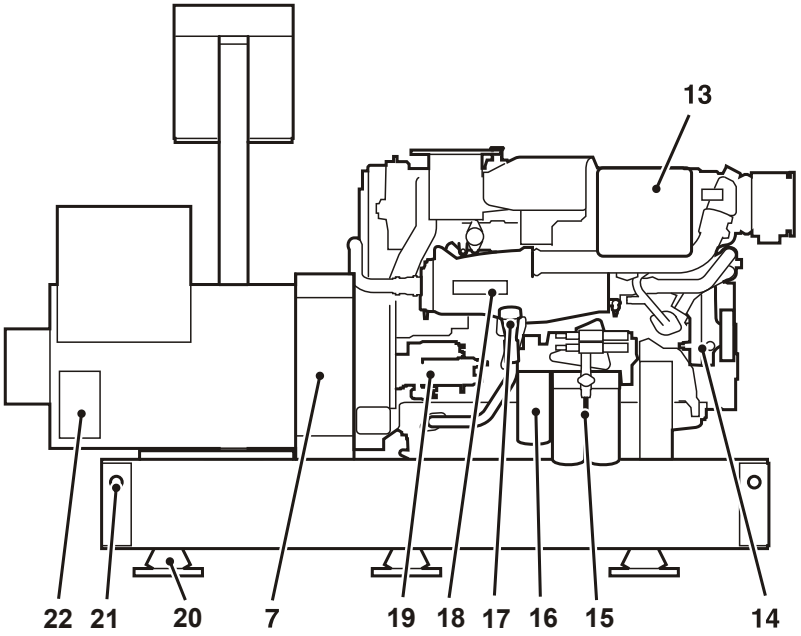
P0010281

1 Expansion tank
2 Electrical connection box with SD reset
3 Emergency Stop
4 Crankcase ventilation filter
5 Switchable fuel filters
6 MCU connection box with panel
7 Air outlet generator
8 Fuel Shut-off Valve
9 Engine Control Unit
10 Hydraulic starter unit
11 Air Filter
12 Radiator with charge air cooler
13 Fresh water pump
14 Engine Oil Filter
15 By-pass filter for engine oil
16 Engine Oil, Filling
17 Extra starter motor
18 Flexible engine mounting
19 Lifting eye x 4
20 Air inlet generator

D9 MG KC marine genset

The D9 MG RC is a turbocharged, in-line, direct injection, 6-cylinder, 4-stroke marine genset. It is fitted with connections for keel cooling. The engine is mounted on a frame with a Stamford single or double bearing marine generator.
Different starting and control systems are available.





P0010280

1 Electrical connection box with SD reset
2 Expansion tank, high temperature circuit
3 Emergency Stop
4 Crankcase ventilation filter
5 Switchable fuel filters
6 MCU connection box with panel
7 Air outlet generator
8 Circulation pump, low temperature circuit
9 Fuel Shut-off Valve
10 Engine Control Unit
11 Keel cooling connections
12 Alternator
13 Air Filter
14 Circulation pump, high temperature circuit
15 Engine Oil Filter
16 By-pass filter for engine oil
17 Engine Oil, Filling
18 Charge air cooler
19 Extra starter motor
20 Flexible engine mounting
21 Lifting eye x 4
22 Air inlet generator

Engine, General

General inspection

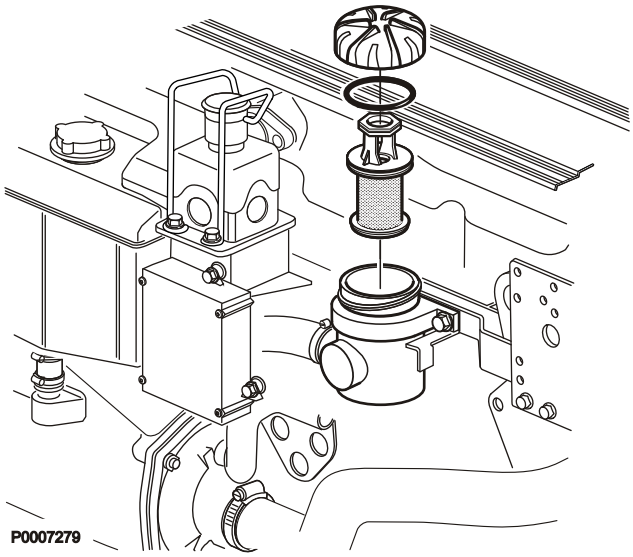
Make a habit of visually checking the engine and engine bay before starting, and after operations when you have stopped the engine. This will help you to quickly discover abnormalities, or if something is about to happen.
Look especially carefully for oil, fuel and coolant leakages, loose bolts, worn or poorly-tensioned drive belts, loose cable connections, damaged electrical cables and hoses. This inspection only takes a few minutes and can prevent serious malfunctions and expensive repairs.

⚠ WARNING!
Risk of fire.
Remove all accumulations of fuel, oil and grease when detected on the engine or in the engine room.

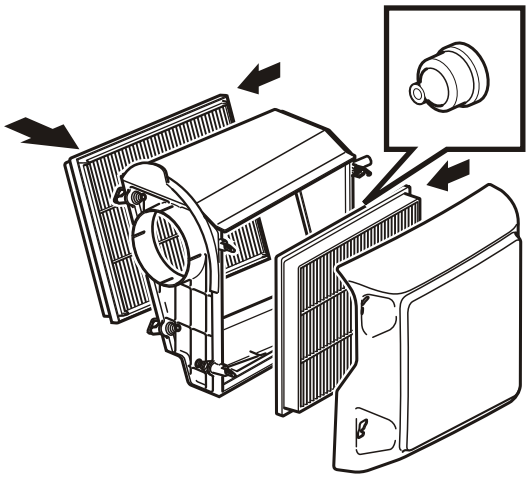
⚠ WARNING!
If an oil, fuel or coolant leak is detected, the cause must be investigated and the fault rectified before the engine is started.

Never direct the jet from a high-pressure washer at seals, rubber hoses or electrical components. Never use the high pressure setting for engine cleaning.

Crankcase Ventilation, Filter Change



1 Unscrew the cover and remove the old filter.
2 Clean the filter housing and cover as necessary. Be careful to prevent contamination from entering the engine.
3 Install the new filter and screw the cover back on.



P0007714

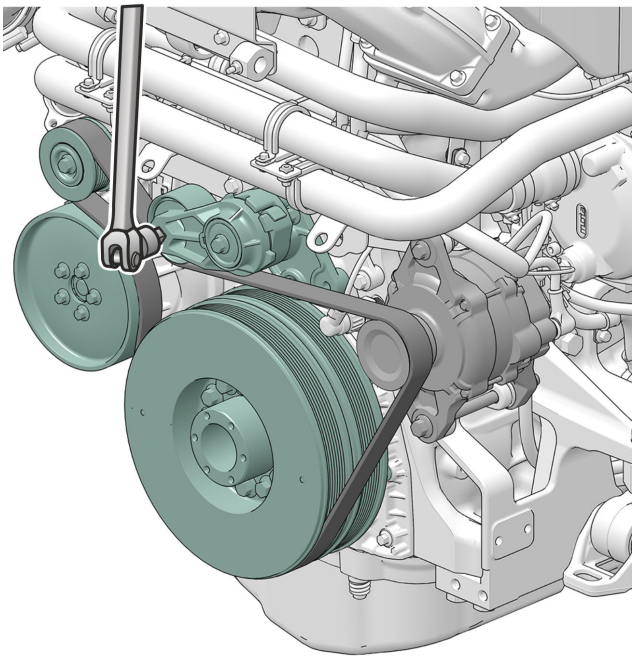
Air Filter, Check and Replace

1 Remove the old filter cartridges. Make sure that no contaminants enter the engine.

2 Install new filter cartridges. Tighten the hose clamps carefully.

3 If needed reset the pressure drop indicator by pressing the button on the indicator.

IMPORTANT:
Discard the old filter cartridges. They may not be cleaned.



P0004718

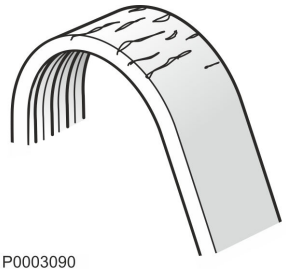
Drive belt, check and change

⚠ WARNING!
Stop the engine before doing any maintenance work.

General

Check belt tension and condition regularly. The drive belt has an automatic tensioner and need not be adjusted. Check that the belt tensioner does not bottom.

IMPORTANT:
Always change a belt which looks worn or cracked.



P0003090

Changing the alternator belt

1 Remove the protective cover over the drive belt.

2 Put a socket wrench in the tensioning roller square fitting. Turn the tensioning roller aside and secure it by inserting a screwdriver or similar into the space which opens up.

3 Remove the drive belt.

4 Install the new drive belt and release the locking of the belt tensioner. Make sure the drive belt fits properly into the grooves.

5 Fit the protective cover over the drive belt.

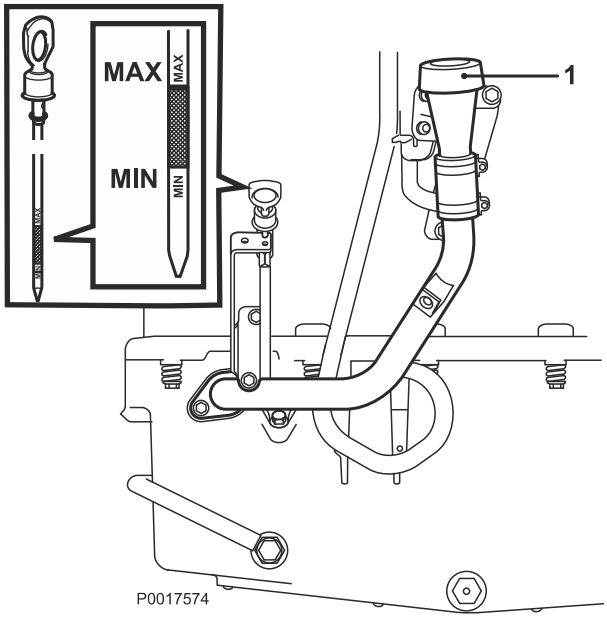
P0002089

Lubrication System

Oil change intervals can vary depending on oil grade and sulphur content of the fuel, please refer to *Technical Data, page 89*.

Oil change intervals must never exceed a period of 12 months.

If you want longer oil change intervals than stated in the table *Technical Data, page 89*, the condition of the oil must be checked by the oil manufacturers through regular oil testing.



P0017574

Oil level, checking and topping up

The oil level must be inside the marked area on the dipstick and should be checked daily before the first start.

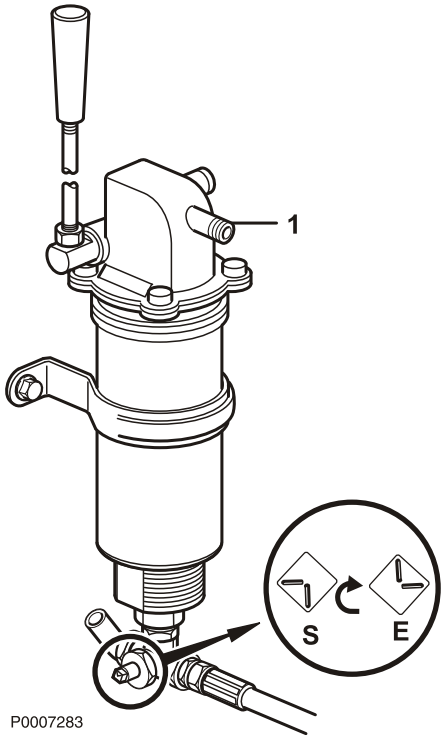
1 Top up the oil through the filling hole on the right side of the engine (**1**).

2 Wait 15 minutes to allow the oil to run down into the sump.

3 Check that the correct oillevel has been achieved.

IMPORTANT!

Do not fill up above the maximum oil level. Only use a recommended grade of oil, please refer to section *Technical Data, Lubrication System*.



Engine Oil, Change

Always follow the recommended oil change interval. Use an oil drain pump (optional) to pump the oil out of the oil pan.

1 Run the engine until warm so that the oil is easier to pump. Then stop the engine.
Wait 15 minutes to allow the oil time to reach the sump.

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

2 Connect a suitable hose to the drain pump discharge (**1**) and lead it to a collection vessel.

3 Open the tap (**2**) under the drain pump to the position for draining engine oil (**E**).

4 Replace the oil filter and by-pass filter at every oil change. Refer to *Oil Filter/By-pass Filter, Change*.

5 Close the tap (**S**). Refill with new oil to the correct level. For engine oil quantity, refer to *Oil level, checking and topping up, page 62*.

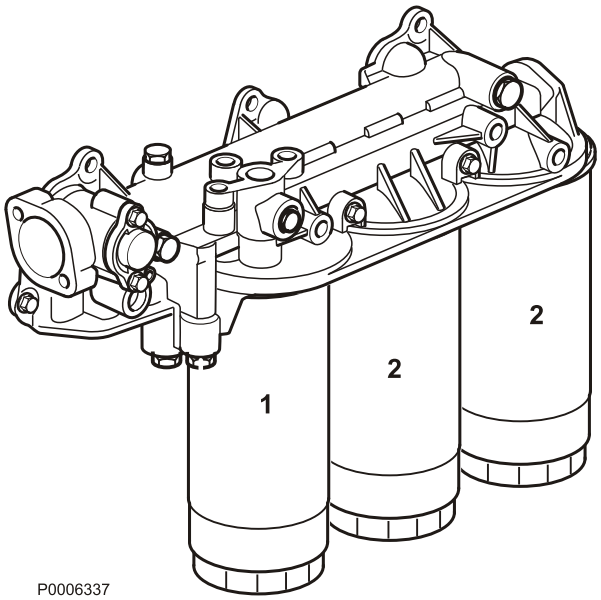
IMPORTANT:
Do not fill up above the maximum oil level. Only use a recommended grade and quality of oil.

6 Start the engine and let it idle. Check the oil pressure. Check that no leaks are present at the filters.

⚠ WARNING!
Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

7 Stop the engine. Wait 15 minutes before checking the oil level. Top up as needed.

Hand in the old oil and filters to a recycling station.



P0006337

Oil Filter/By-pass Filter, Change

The oil filter and bypass filter must be replaced at every oil change.
Remember to hand the old filters in to a re-cycling station.

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

1 Place a collection vessel underneath the filter drip tray to avoid oil spillage.

2 Clean the filter bracket.

3 Unscrew the bypass filter (**1**) and the oil filters (**2**) with a suitable puller.

4 Check that the mating surfaces on the filter bracket are clean and that no remains from the old gaskets are left.

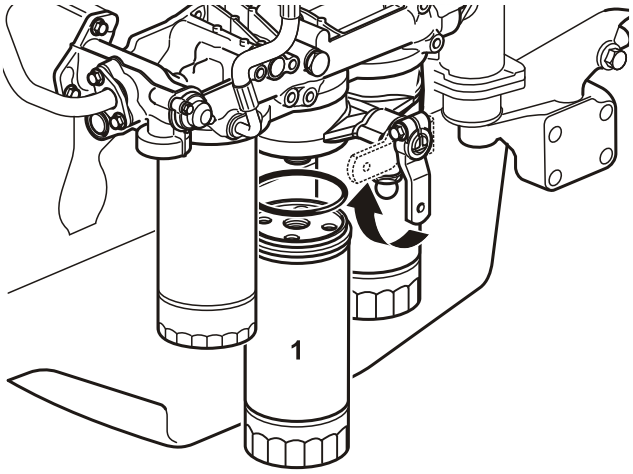
5 Moisten the gaskets on the new filters with engine oil.

6 Screw on the filter by hand until the rubber gasket touches the filter bracket mating surface. Then turn a further 3/4 to 1 turn.

7 Start the engine, run at low idle, and check that no leakage occurs. Check the oil level after the engine has stopped.

Switchable oil filters

IMPORTANT:
Even though it is possible, change-over filters must not be replaced while the engine is running except in an emergency.



P0015686

1 Clean the filter holder.

2 Disconnect the filter (**1**) by turning the handle clockwise to the end position. Pull down on the knob below the handle to release the handle.

3 Unscrew the filter and scrap it. Use a filter tool if necessary.

4 Check that the filter holder sealing surfaces are clean and that there are no gasket residues left from the old filter.

5 Lubricate the rubber gasket for the new filter.

6 Screw on the filter by hand until the rubber gasket just touches the filter holder sealing surface. Then tighten the filter a further 3/4 to 1 turn.

7 Turn the handle counterclockwise to end position and replace the right oil filter in the same way.

8 Put the handle in the operating position, straight down.

9 If necessary, top up the system at the first stop. Refer to section *Engine Oil, Change, page 63*.

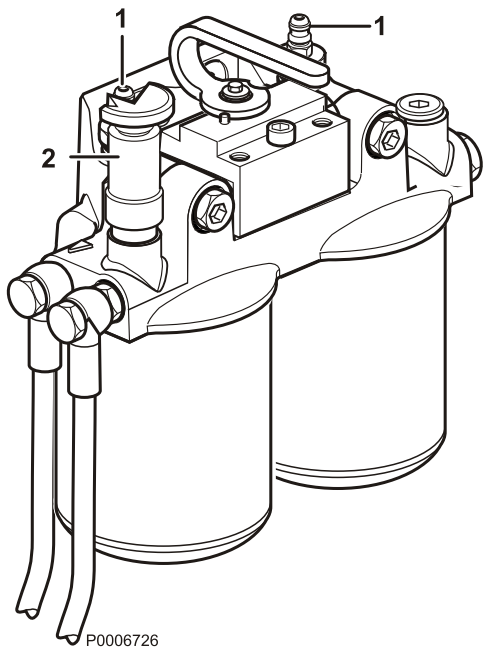
Fuel System

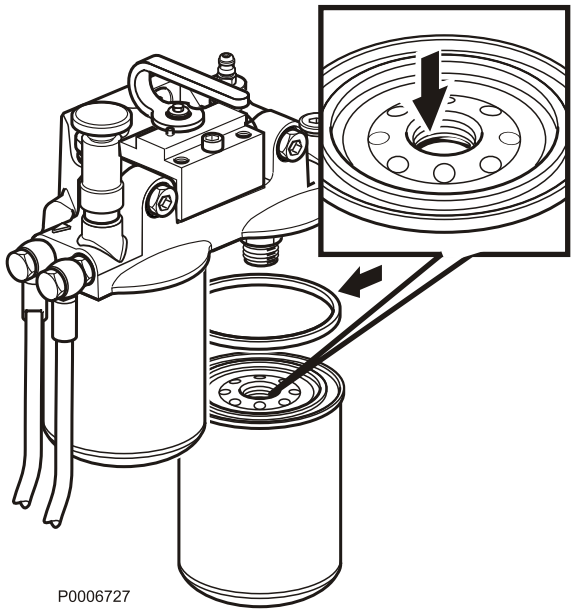
Only use the grades of fuel recommended in the fuel specification, refer to *Technical Data, page 89*. Always observe the greatest cleanliness during refueling and work on the fuel system.

All work on the unit injectors of the engine must be carried out by an authorized Volvo Penta workshop.

⚠ WARNING!
Fire hazard. 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 so that they cannot cause fire.

⚠ WARNING!
Store fuel soaked rags and other flammable material so that there is no danger of them catching fire. Fuel soaked rags can ignite spontaneously under certain conditions.





Engine Fuel Filter Replacement

Stationary engine

1 Close the fuel valve/valves.

2 Clean the filter bracket and put a suitable vessel under the filter. Remove the protective cap from the venting nipple. Connect a transparent plastic hose to the nipple and lower the hose into the vessel.

3 Relieve pressure inside the filter by opening the bleeding nipple (**1**).

⚠ CAUTION!
Open the tap with caution. Hot fuel can spray out in any direction.

4 Unscrew the filter, use a filter wrench if needed.

5 Clean the sealing surface on the filter bracket. Make sure the new filter is absolutely clean and that the sealing surfaces are undamaged. Moisten the seals with fuel, including the inner rubber seal on the inside of the threaded hole in the center of the filter.

NOTICE! Do not fill the new filter with fuel before assembly. Contaminations may get into the system and cause damage and malfunction.

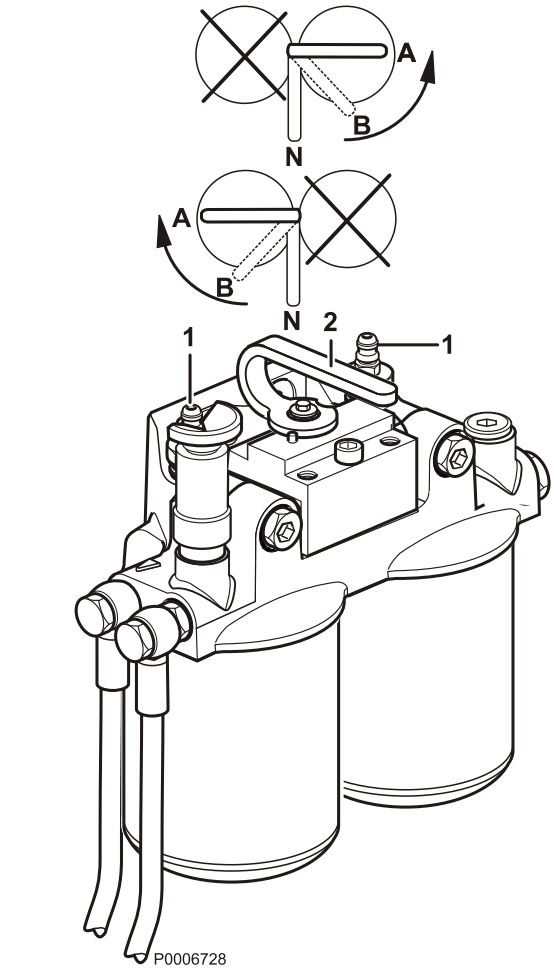
6 Screw the new filter on by hand until the seal just touches the mating surface. Then tighten a further 3/4 turn.

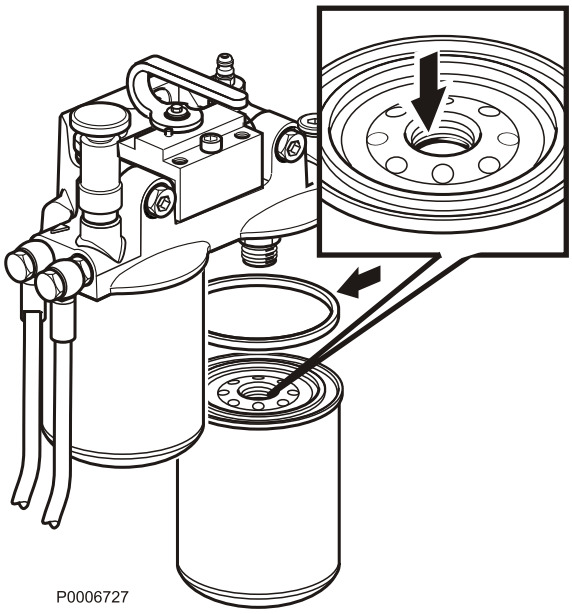
7 Open the fuel valve/valves.

8 Open the bleeding nipple (**2**) and work the pump until air-free fuel flows out. Tighten the bleeding nipple while fuel is flowing out.

9 Remove the hose and put the protective cap back on the nipple.

10 Start the engine and check for leakages.





Running engine

1 Clean the filter bracket and put a suitable vessel under the filter.

2 Remove the protective cap from the bleeding nipple (**1**) Connect a transparent plastic hose to the nipple and lower the hose into the vessel.

3 Shut off fuel flow through one of the filters by lifting the handle (**2**) to release it and then turn it to its end position (**A**).

4 Relieve pressure inside the filter by opening the venting nipple (**1**).

5 Unscrew the filter, use a filter wrench if needed.

6 Make sure the new filter is absolutely clean and that the sealing surfaces are undamaged. Moisten the seals with fuel, including the inner rubber seal on the inside of the threaded hole in the center of the filter.
IMPORTANT!
Do not fill the new filter with fuel before assembly. Contaminations may get into the system and cause damage and malfunction.

7 Screw the new filter on by hand until the seal just touches the mating surface. Then tighten a further 3/4 turn.

8 Bleed by turning the handle (**2**) to bleeding position (**B**). This allows a reduced flow of fuel through the filter and the air is evacuated through the vent. Tighten the bleeding nipple when air-free fuel flows out.

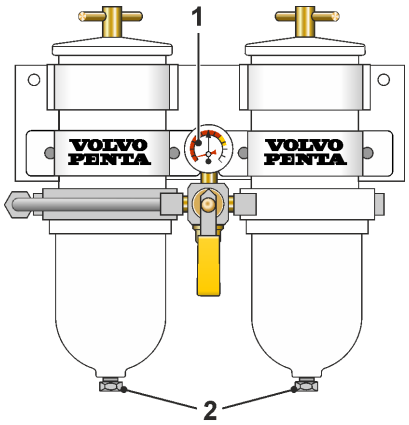
9 Remove the hose and put the protective cap back on the nipple.

10 Repeat the procedure with the other filter.

11 Turn the handle to normal operating position (**N**). Check for leakages.

Fuel pre-filter

Volvo Penta fuel pre-filters are supplied in single and double models.



p0004926

Checks

The double filter is fitted with a pressure gauge **1** that indicates when it is time to replace the filter cartridges.

The filter cartridges must be replaced according to maintenance schedule recommendations, or earlier if the pressure gauge shows a pressure drop of 6–10 in. Hg at idle or 16–20 in. Hg at full rpm/engine load.

⚠ WARNING!
Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

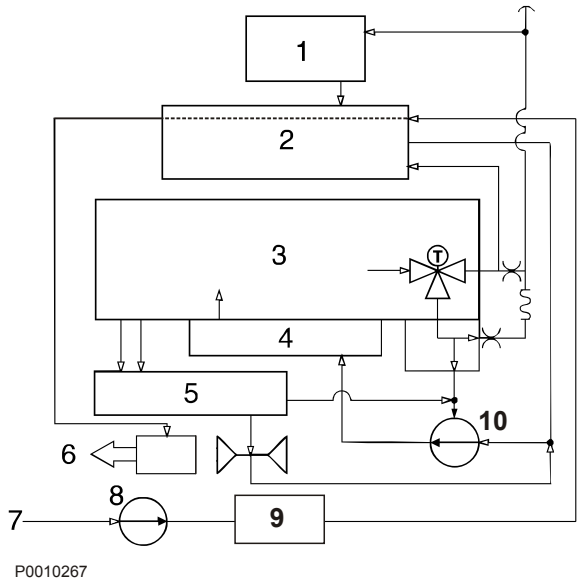
Draining

Place a vessel under the filter. Empty the water and sediment through the plugs (**2**).

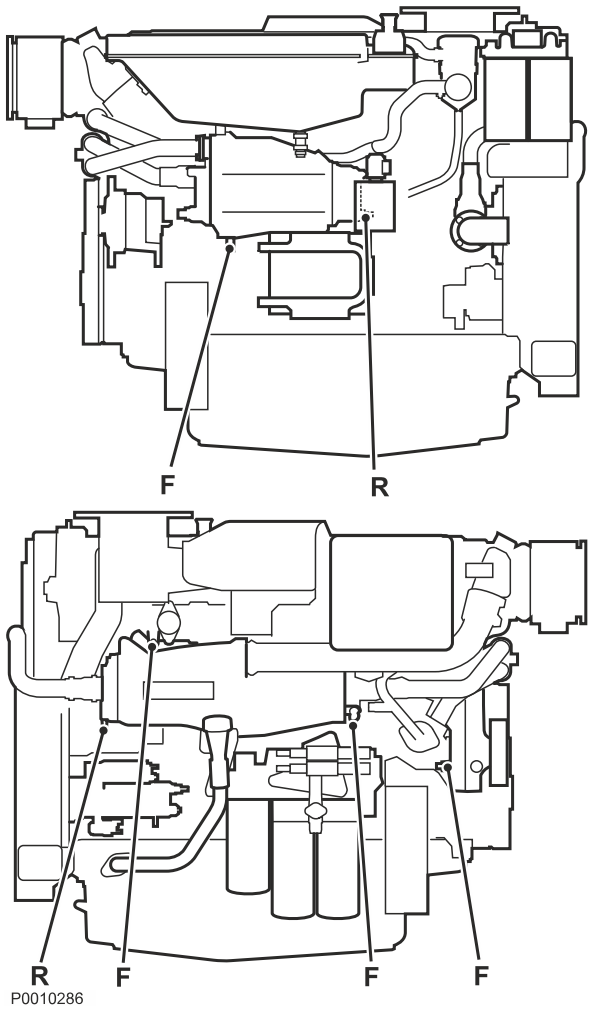
Cooling System

Engine Mounted Heat Exchanger HE

The cooling system includes two circuits. The freshwater system is a closed circuit system, and the raw water system is connected to a seawater inlet or a central cooling system.



1 Expansion tank
2 Heat exchanger
3 Engine
4 Oil cooler
5 Exhaust Manifold
6 Raw water outlet
7 Raw water inlet
8 Raw water pump
9 Charge air cooler
10 Fresh water pump

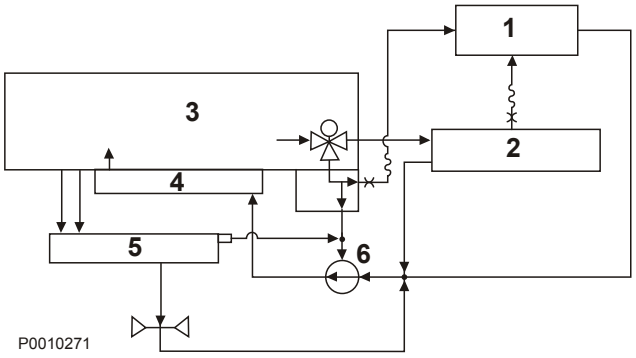


Drain points

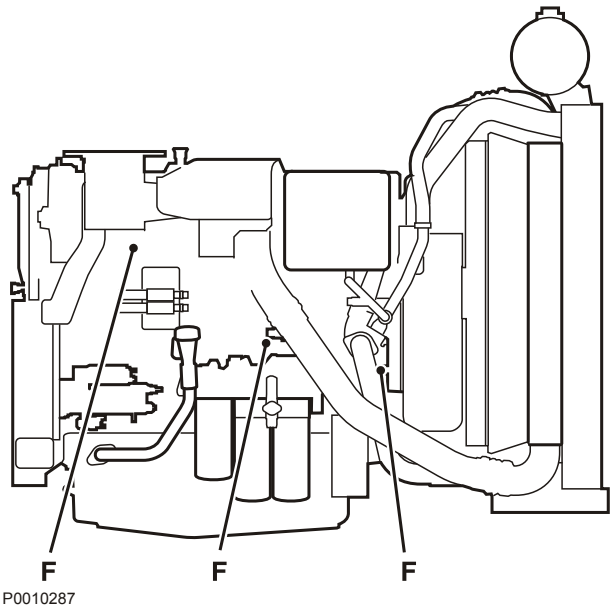
R = Raw water drain points
F = Fresh water drain points

Radiator RC

The engine cooling water is cooled by a radiator in a one-circuit cooling system.



1 Expansion tank
2 Radiator
3 Engine
4 Oil cooler
5 Exhaust Manifold
6 Coolant Pump



Drain points

F = Fresh water drain points

Twin circuit system with twin keel coolers KC

The engine cooling water is cooled by an external heat exchanger.
Components such as expansion tanks etc. are not always supplied by Volvo Penta. These components are not the responsibility of Volvo Penta. The boundaries of Volvo Penta supplier responsibility is marked in the diagram with:

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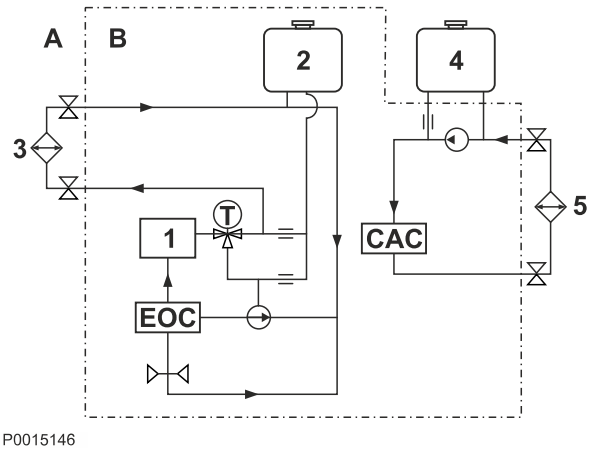
⚠ WARNING!
All coolant is hazardous and harmful to the environment. Do not consume. Coolant is flammable.

IMPORTANT:
Always use the same type of coolant that is already in the engine.
Different types of coolant must not be mixed with each other.
Risk of reduced cooling function and performance by clogging and isolation.

Coolant, Mixing

Engine circuit: 40% coolant and 60% water
Charge air cooler circuit: 20% coolant and 80% water



P0015146

A External systems

B Volvo Penta internal system

1 Engine

2 Expansion tank

3 Keel cooler, engine coolant circuit

4 Expansion tank, charge air cooler circuit (accessory)

5 Keel cooler, charge air cooler circuit

EOC Oil cooler

CAC Charge air cooler

Connection flange or thread for valve

Thermostat valve

Coolant Pump

Seawater Pump

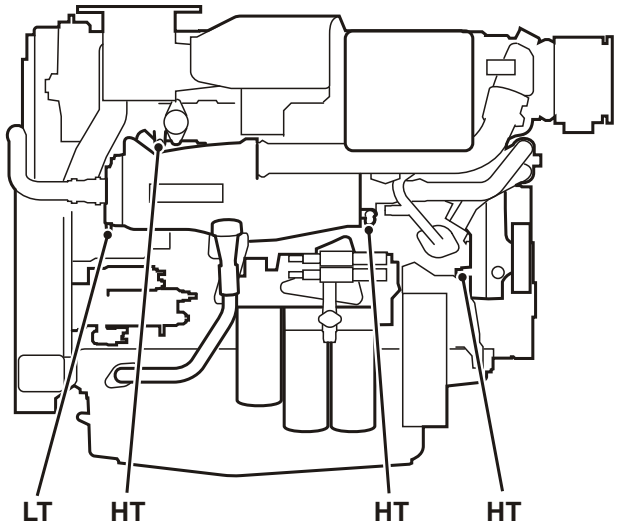
Venting nipple

Reduction

Radiator

Turbo

Shut-off valve

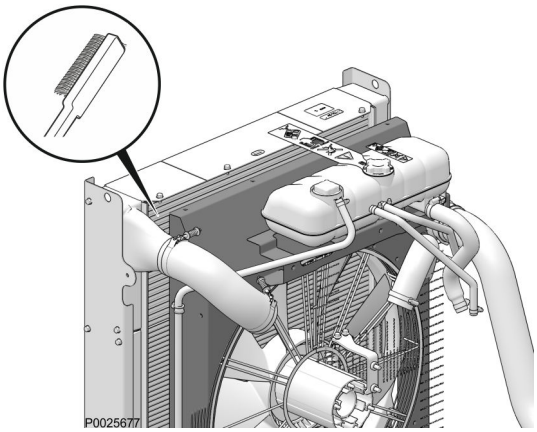


P0010293

Drain points

HT = Drain points, high temperature circuit
LT = Drain points, low temperature circuit

Charge Air Cooler, External Cleaning


P0025677

IMPORTANT:
Do not use a high pressure power washer.

Remove guards as necessary, to access the radiator. Clean with water and a mild detergent. Use a soft brush. Be careful not to damage the radiator vanes. Reinstall removed parts.

Freshwater System

P0013077

The cooling system ensures that the engine operates at the correct temperature. It is a closed system that should always be filled with a coolant mixture.

IMPORTANT:
Coolant of a suitable chemical composition must be used all year round to protect the engine against internal corrosion, cavitation and freeze bursting. This even applies when there is no risk for freeze damage, to make sure the engine always has a complete corrosion protection.

Therefore, the use of anti-corrosion agents alone, or water alone as a coolant, is not permitted in Volvo Penta engines.

The coolant must be based on Organic Acid Technology (OAT). Using an improper coolant or

mixing with another coolant will rapidly reduce the performance and lifetime of the engine. Material incompatibility can lead to leakages, which - in the worst case - can cause engine breakdown.

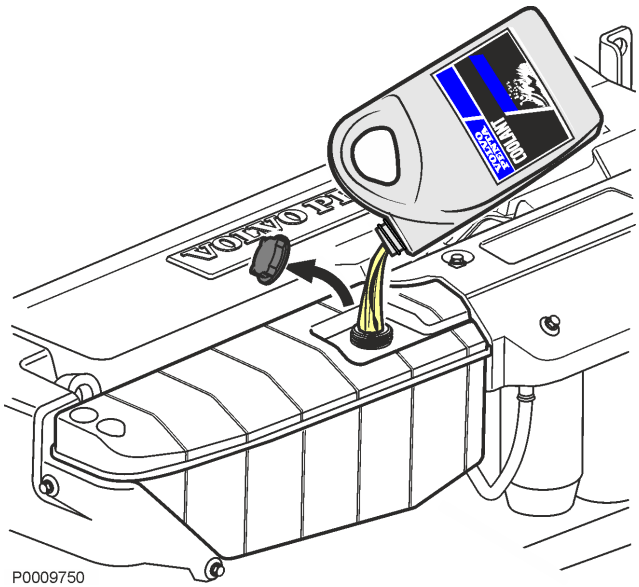
Volvo Penta strongly recommend the use of our own coolants, ”Volvo Penta Coolant VCS Ready Mixed” or the concentrate ”Volvo Penta Coolant VCS”, which ensure the protection of the cooling system components from corrosion, ageing, swelling and cracking, thereby ensuring optimal engine lifetime.

Over time the corrosion protection additives become less effective, and consequently the coolant must be changed at regular intervals to maintain sufficient protection of the engine. The latest Service Protocol that specifies service intervals can be found at *volvopenta.com*.

Coolant, Mixing

It is extremely important that the system is filled with the correct coolant concentration; refer to *Technical Data, page 90*.
The coolant should be mixed with distilled, deionized water. For Volvo Penta specified water requirements; refer to *Technical Data, page 90*.

NOTICE! If water quality can not be guaranteed, use ready mixed coolant.



P0009750

Filling with coolant

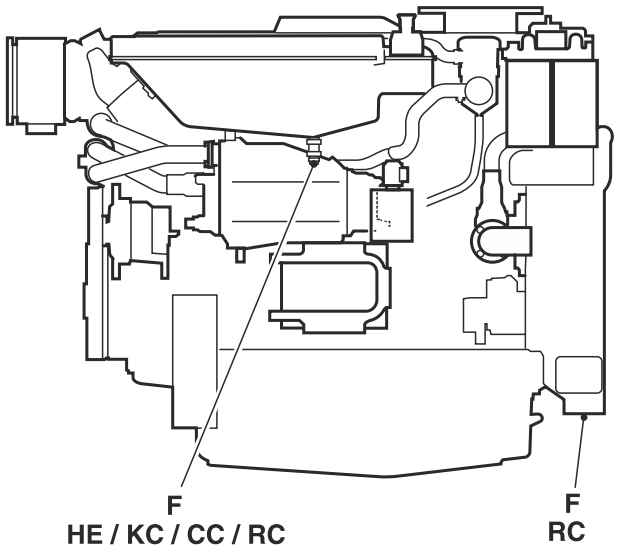
⚠ WARNING!
Burn hazard. Steam and hot fluid may spray out. Stop the engine and allow it to cool before opening the filler cap.

IMPORTANT:
Only use coolant recommended by Volvo Penta.
Top up with the same type of coolant as already used in the system.
Different types of coolant must not be mixed.

Topping up

Top up coolant to the correct level through the filler opening on the expansion tank. Fill slowly, to allow air that is displaced to flow out through the filler opening.

When filling an empty system, or if for some reason the coolant level has sunk so low that it cannot be seen through the filler opening, filling must be carried out according to “Filling a completely empty cooling system”.



P0017636

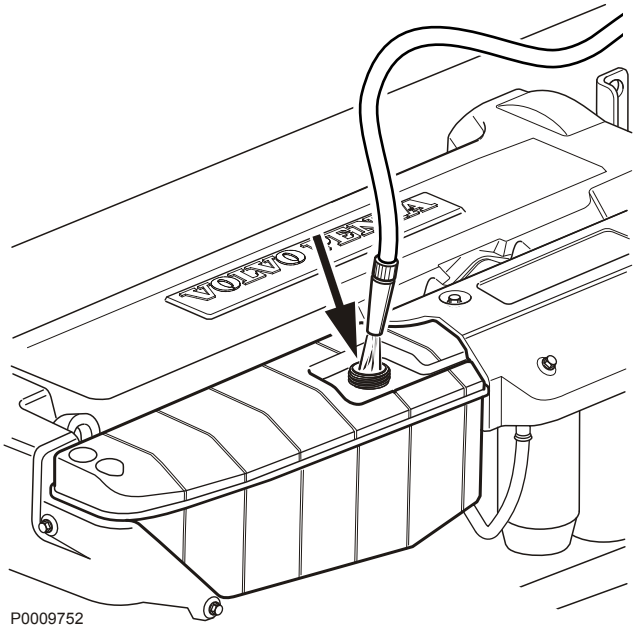
Coolant, Draining

⚠ WARNING!
Stop the engine and let it cool before starting work on the cooling system. Hot fluids and hot surfaces can cause burns.

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

Drain the coolant via taps (**F**).

1. Remove the filling cap (**1**) from the expansion tank.
2. Connect a hose to each drain point. Open the taps and allow all the coolant to drain off into a suitable vessel.
   Check that all coolant really does drain out. Deposits may need to be cleared away, inside the drain plug(s)/tap(s).
3. Also drain the heating system, tap water heater etc., if connected to the engine’s freshwater system.
4. Close all drain taps.
5. Collect the old coolant and hand it to a re-cycling station for destruction.



P0009752

Freshwater system, Flushing

The cooling system should be flushed when the coolant is changed, to avoid loss of cooling performance due to deposits in the cooling system.

1 Drain the coolant, please refer to *Coolant, Draining, page 74*.

2 Put a hose into the filling hole in the heat exchanger and flush with fresh water.

3 Flush until the water which runs out of the drain points is clean.

4 Close all drain points when all coolant has run out.

5 Fill up with coolant, please refer to *Maintenance, page 74*.

Twin circuit system with twin keel coolers KC

The engine cooling water is cooled by an external heat exchanger.
Components such as expansion tanks etc. are not always supplied by Volvo Penta. These components are not the responsibility of Volvo Penta. The boundaries of Volvo Penta supplier responsibility is marked in the diagram with:

_.–.–.–.–

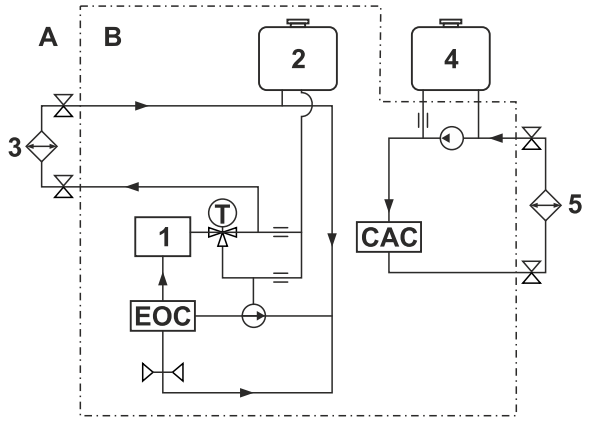
⚠ WARNING!
All coolant is hazardous and harmful to the environment. Do not consume. Coolant is flammable.

IMPORTANT:
Always use the same type of coolant that is already in the engine.
Different types of coolant must not be mixed with each other.
Risk of reduced cooling function and performance by clogging and isolation.

Coolant, Mixing

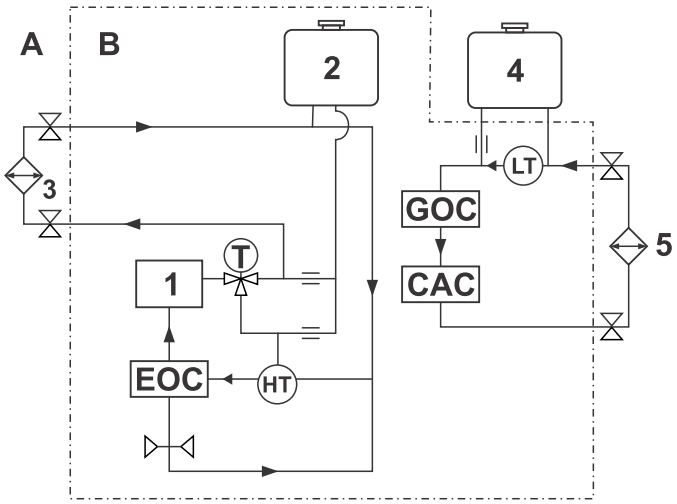
Engine circuit: 40% coolant and 60% water
Charge air cooler circuit: 20% coolant and 80% water

D9 AUX



P0015146

D9



P0010841

A External systems

B Volvo Penta internal system

1 Engine

2 Expansion tank

3 Keel cooler, engine coolant circuit

4 Expansion tank, charge air cooler circuit (accessory)

5 Keel cooler, charge air cooler circuit

EOC Oil cooler

GOC Reverse gear oil cooler

CAC Charge air cooler

Connection flange or thread for valve

Thermostat valve

Coolant Pump

Seawater Pump

LT Circulating pump

HT Circulating pump

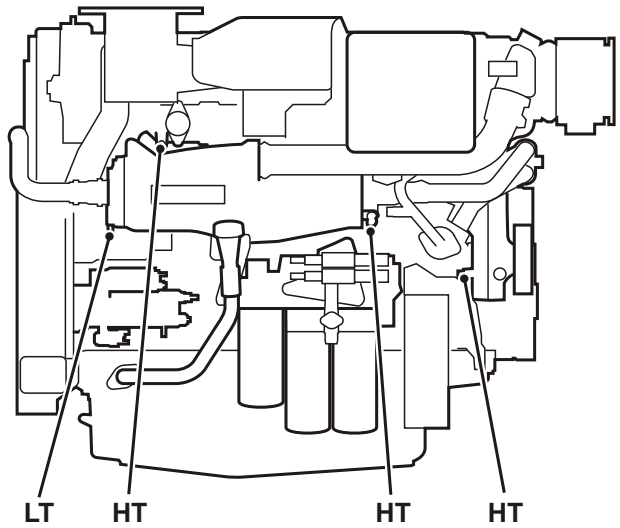
Venting nipple

Reduction

Radiator

Turbo

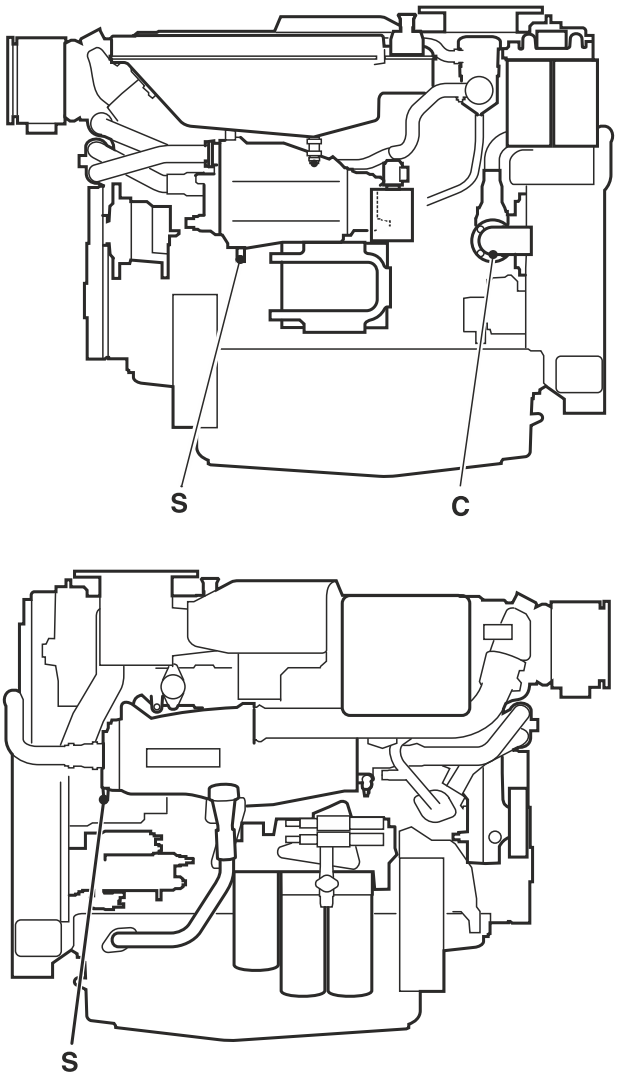
Shut-off valve



P0010293

Drain points

HT = Drain points, high temperature circuit
LT = Drain points, low temperature circuit



P0017637

Seawater System

The raw water system is the engine's external cooling system and it is either a seawater system or a central cooling system. It cools the internal cooling system in an engine mounted or externally mounted heat exchanger. The system is protected against galvanic corrosion by zinc anodes located in the heat exchanger.

⚠ WARNING!
Risk of water entry. Close and drain the raw water system before starting any work on the system.

Seawater System, Draining

⚠ WARNING!
Risk of water entry. Close the seawater cocks before doing any work on the seawater system.

The seawater system must be drained in cold weather, if there is a risk of freezing, to prevent freeze damage. An alternative to draining is to keep the engine bay above freezing temperature, by means of a fan heater which is approved for outdoor use.

Draining:

1 Close the sea cock.

2 Connect a hose to each drain tap before opening the tap (one at a time).

3 Open the drain taps/remove the drain plugs (**S**) and allow the water to run out.

Drain points:

- tap at rear of heat exchanger
- tap at rear of charge air cooler
- remove the lid (**C**) on the seawater pump

  Check that all water really does drain out. Deposits may need to be cleared away, inside the drain plug/tap.

4 Also drain/empty any auxiliary equipment such as the seawater filter, flushing/bilge pump etc.

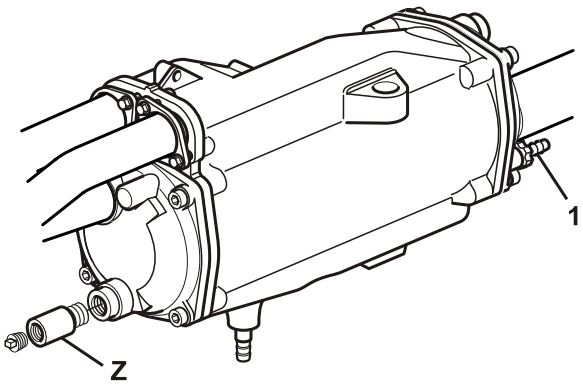
5 Install the lid on the seawater pump. Connect all hoses.

6 Close/install all drain taps and plugs.

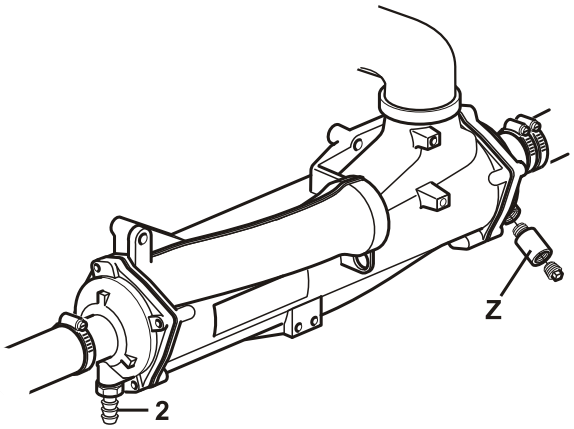
7 Check for leaks before you leave the boat.

Anodes, Check and Change

⚠ WARNING!
Risk of water entry. Close the seawater cocks before doing any work on the seawater system.



P0004922



P0004921

1 Close the sea cock.

2 Open the drain tap (**1**) on the heat exchanger and the tap (**2**) on the charge air cooler, and drain off the seawater.

3 Remove the zinc anodes (**Z**) in the heat exchanger and in the reverse gear oil cooler.

4 Check the zinc anodes and replace them if more than 1/3 of their original size has been used up. If not, clean the zinc anodes with emery cloth to remove the oxide layer before re-installing them.

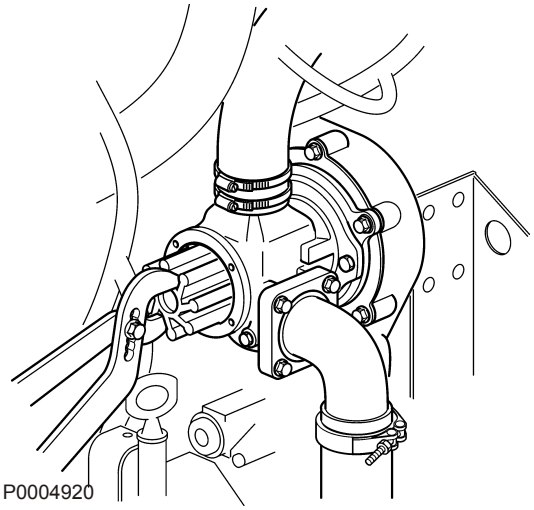
IMPORTANT:
Use an emery cloth for cleaning. Do not use steel tools, since this could impair the galvanic protection.

5 Install the zinc anodes. Make sure that good metallic contact is obtained between the anode and the casting.

6 Close the drain taps (**1** and **2**).

7 Open the sea cock before starting the engine.

8 Check that no leakage occurs.


P0004920

Impeller, Check and Change

⚠ WARNING!
Risk of water entry. Close the seawater cocks before doing any work on the seawater system.

1 Remove the seawater pump lid, and pull the impeller out with water pump pliers.

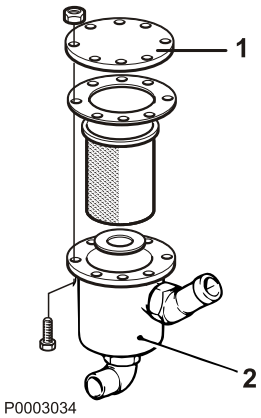
2 Check the impeller. If any cracks or other defects are visible, the impeller must be changed.

3 Lubricate the pump housing and the inside of the lid with water-resistant grease (which is not aggressive to rubber). The impeller will be easier to work with if it is put in hot water prior to fitting.

4 Press the impeller in with a circular motion (clockwise). The shaft of the pump has an internal thread (M8). Screw a stud into the end of the shaft and press the impeller in using a washer and nut. Fit the cover, using a new O-ring.

5 Open the sea cock.

NOTICE! Always carry a spare impeller on board.



P0003034

Seawater Filter, Check and Cleaning

The seawater filter is auxiliary equipment.

If the water where the boat is used has a lot of contaminants, seaweed, etc. the filter should be checked more frequently than stated in the maintenance schedule, Otherwise there is a risk that the filter may be blocked resulting engine overheating.

⚠ WARNING!
Risk of water entry. Close the seawater cocks before doing any work on the seawater system.

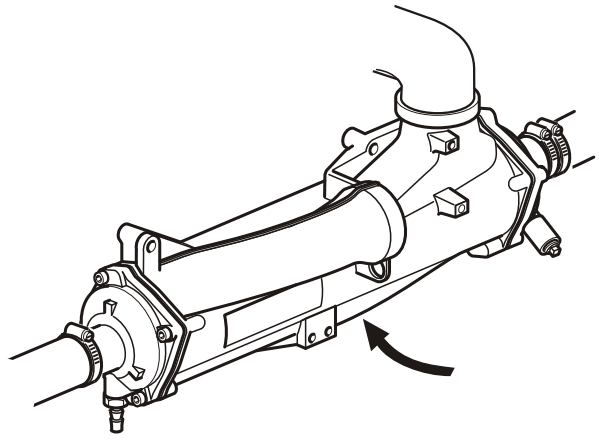
1 Close the sea cock.

2 Remove the cover (**1**) and lift out the insert.

3 Clean the insert and the housing (**2**).

4 Install the parts as illustrated. Inspect the gaskets. Replace as necessary.

5 Open the sea cock and check for leaks.


P0004923

Intake Manifold, Checking the Drain Hole

Water can condense in the charge air cooler during operation. The condensate is drained via a hole in the charge air cooler. Check that the drain hole is not blocked.

IMPORTANT:
If a large amount of water flows out of the drain hole, from the inlet manifold, the charge air cooler must be removed and proof tested.

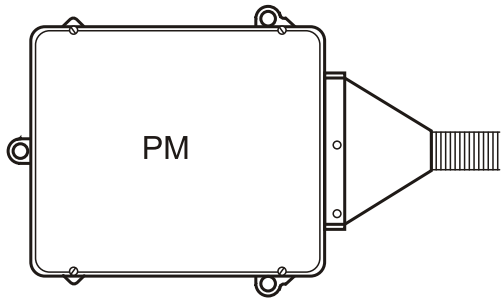
This task must be performed by an authorized workshop.

Electrical System

The engine is equipped with a 2-pole electrical system and an alternator. System voltage is 24V.

⚠ 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.

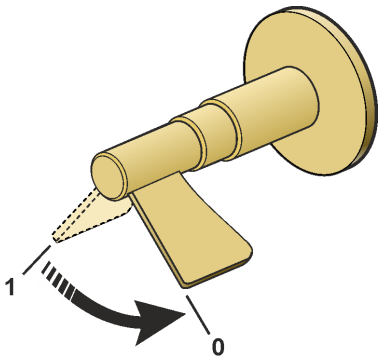
Power Module



P0006350

The power module supplies power to the EMS and the MCC control system. The power module (PM) protects the system from high current with a built in over current protection.
The status of the fuse functions are shown in the MCU menu. Should an automatic fuse blow, repair the fault and restart the system to reset the fuse.

Main switch



P0002576

IMPORTANT:
Never disconnect the current using the main switches when the engine is running or by disconnecting the battery cables.
The alternator and electronics could be damaged.

The main switches must never be switched off before the engine has stopped. If the circuit between the alternator and the battery is disconnected when the engine is running, the alternator and electronics may be damaged. For the same reason, the charging circuits must never be re-connected with the engine running.

Electrical Connections

Check that electrical connections are dry, free from oxide, and that they are securely tightened.

P0002107

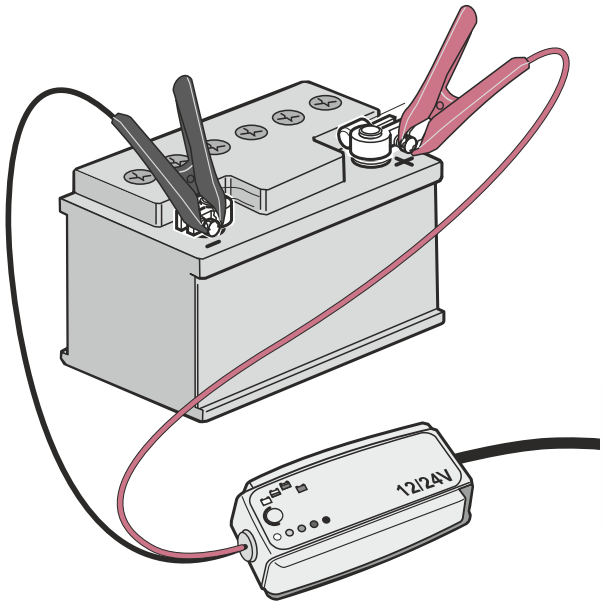
Battery

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

⚠ WARNING!
Battery electrolyte is a corrosive acid and should be handled with care. If you spill or splash electrolyte on any part of the body, immediately flush the exposed area with liberal amounts of water and seek medical attention as soon as possible.

⚠ WARNING!
Ventilate the engine compartment before working on batteries or battery connections.

IMPORTANT:
Batteries can be damaged if they are left discharged, and can also freeze and burst easier in cold weather. If the engine is not going to be used for a longer period of time, the batteries should be fully charged, trickle charged if possible.

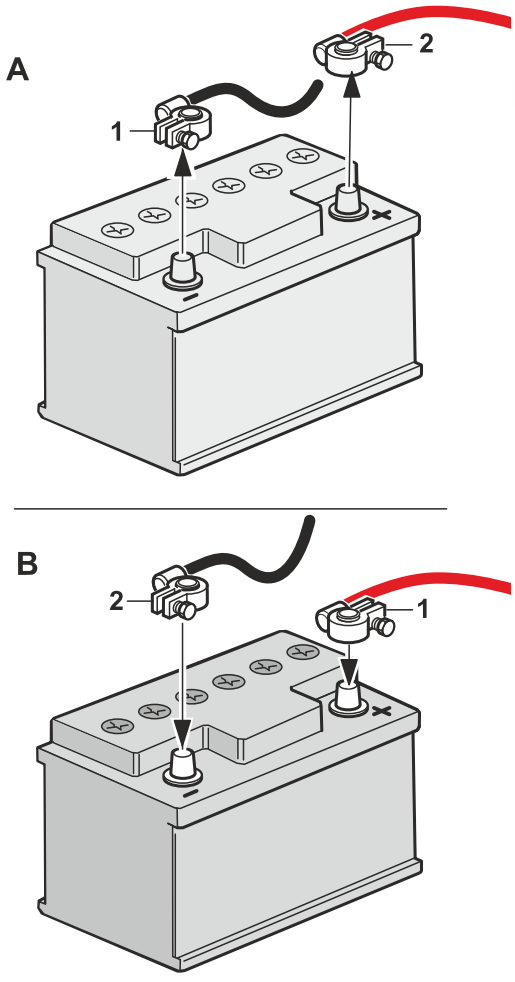


P0022892

Maintenance

It is important to always follow the battery manufacture's recommendation and instruction when replacing and charging batteries. Depending on battery type, the instructions for maintenance and charging may vary.
Modern batteries are normally maintenance free, but there are some actions that are recommended to increase the battery service life and avoid accidents:

- Keep the batteries clean and dry. Contamination and oxide on the batteries and battery poles can result in stray currents, voltage drop and discharge, especially in wet weather.
- Remove oxidation from the battery poles and terminals, using a brass brush.
- Tighten the terminals securely and grease them with terminal grease or petroleum jelly. Loose battery connections may cause damage to the engine's electrical system.
- Charge the battery regularly. A battery that is kept fully loaded has a maximum service life. The easiest way to check if a battery needs charging is to use a voltmeter.



P0022893

Replacing Battery

IMPORTANT:
Make sure that the new battery fulfills the specifications in *Technical Data*. Read the information supplied with the battery before you begin the installation.

IMPORTANT:
Do not disconnect the batteries with the engine running.
Sensitive electrical components can be immediately damaged.

⚠ WARNING!
Never confuse the positive and negative poles on the batteries. Risk of arcing and explosion.

Disconnecting (A)

1 Untighten the nut and remove the – cable (black).

2 Untighten the nut and remove the + cable (red).

Remove the battery.

Connecting (B)

Place the new battery.

1 Connect the + cable (red) to the + pole on the battery and tighten the nut.

2 Connect the – cable (black) to the – pole on the battery and tighten the nut.

NOTICE! Hand in the old battery to a re-cycling station.

Electrical Welding

Remove the positive and negative cables from the batteries, then disconnect all cables connected to the alternator, EMS, power module and MCC.

Always connect the welder ground clamp to the component to be welded, and as close as possible to the weld site. The clamp must never be connected to the engine or in such a way that current can pass through a bearing.

IMPORTANT:
After finished welding, re-connect the EVC connector and the alternator terminals before connecting the battery cables.

Storage

The engine and other equipment must be laid up to prevent damage if they are not used for two months or more. It is important that this is done in the correct manner, and nothing is forgotten. For this reason, we have compiled a check list of the most important points.
Before the engine is taken out of service for a long period of time, an authorized Volvo Penta workshop should check it over. Have any faults and deficiencies attended to, so that the equipment is in order, ready for the next start.

⚠ CAUTION!
Read the chapter on Maintenance in the Operator`s Manual before starting work. It contains instructions on how to carry out maintenance and service operations in a safe and technical correct manner.

⚠ WARNING!
Conservations oils can be flammable and dangerous to inhale. Ensure good ventilation. Use a protective face mask when spraying.

IMPORTANT:
When cleaning with a high pressure washer, make sure to never aim the water jet at seals, rubber hoses or electrical components.

P0002089

- **For up to 8 month’s stoppage:**
  Change the oil and oil filter on the engine, then warm it up afterwards.
  More than 8 month's stoppage:
  Conserve the lubrication and fuel systems with conservation oil. Please refer section *Storage, page 87*.
- Check that the coolant offers sufficient freeze protection. Top up as necessary.
  Alternatively, you can drain the coolant (also drain the coolant filter).
- Drain any water and contamination from the fuel filters and fuel tank. Fill the fuel tank completely, to avoid condensation.
- Disconnect the battery cables, clean and charge the batteries. Trickle charge the batteries while the equipment is in storage. A poorly charged battery can freeze and burst.
- Clean the outside of the engine. Do not use a high pressure washer for engine cleaning. Touch up paint damage with Volvo Penta original paint.
- Check and rust-proof any control cables.
- Put a note on the engine with the date, type of conservation and the conservation oil used.
- Cover over the air filter, exhaust pipe and engine if necessary.

Conservation of the lubrication and fuel systems for more than 8 months' stoppage:

- Drain the engine oil and fill up with conservation oil (1) to just over the MIN marking on the dipstick.
- Connect the fuel suction and return hoses to a 1/3 full jerrican containing conservation oil [1] and 2/3 diesel fuel.
- Vent the fuel system.
- Start the engine and run at a fast idle until about 2 liters (0.6 US gals) of the fluid in the jerrican have been used.
  Stop the engine and connect the ordinary fuel pipes.
- Drain the engine's conservation oil.
- Follow the other instructions on the previous page.

1) Conservation oils are sold by oil companies.

Bringing Out of Storage

- Remove any covers from the engine, air filter and exhaust pipe.
- Put the correct grade of oil into the engine, if necessary, refer to *Technical Data, page 89*.
  Install a new oil filter if the filter was not changed during conservation.
- Install new fuel filters and vent the fuel system.
- Check the drive belt(s).
- Check the condition of all rubber hoses, and retighten the hose clamps.
- Close the drain taps and install any drainplugs.
- Check the coolant level. Top up as necessary.
- Connect the fully charged batteries.
- Start the engine and warm it up at fast idle with no loading.
- Check that no oil, fuel or coolant leakage occurs.

Technical Data

Product sales designation	**D9 MG HE**	**D9 MG RC**	**D9 MG KC**
Product designation	D9A2A-MG	D9A2A-MG	D9A2A-MG
Power, prime/stand-by	239 kW @ 1500 265 kW @ 1800	227 kW @ 1500 244 kW @ 1800	239 kW @ 1500 265 kW@ 1800
No. of cylinders	6	6	6
Bore	120 mm	120 mm	120 mm
Stroke	138 mm	138 mm	138 mm
Displacement	9,4 dm^3	9,4 dm^3	9,4 dm^3
Compression ratio	20,2:1	20,2:1	20,2:1
Engine, dry weight	1150 kg (1)	1165 kg (2)	1125 kg

1) engine with heat exchanger

2) engine with radiator

Lubrication System

Oil capacity including oil filters, approx.,	
no engine inclination	46 liters (12.2 US gallons)
volume difference MIN – MAX	12 liters (3.2 US gallons)
Oil pressure, hot engine,	
at normal running rpm (1100 rpm or higher)	450–760 kPa (65.2–100.2 PSI)
at idling rpm	min. 300 kPa (43.5 PSI)

Oil Grade and Oil Change Interval

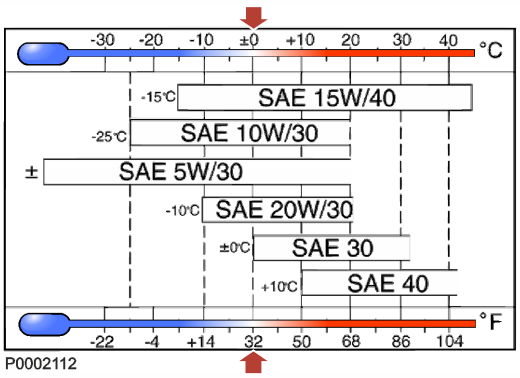
Oil quality (1)	**Sulfur content in fuel, by weight**		
	up to 0,5%	0,5–1,0%	more than 1,0% (2)
	Oil change interval, reached first in operation:		
VDS-3	**500** hours or 12 months	**200** hours or 12 months	**100** hours or 12 months

1) Lowest recommended oil grade. Engine oil with higher oil grade is always possible to use.

2) If sulphur content is more than 1.0 per cent by weight, use oil with TBN over 15.

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

TBN = Total Base Number
VDS = Volvo Drain Specification



Select the viscosity according to the table.

The temperature values refer to stable ambient temperatures.

* SAE 5W/30 refers to synthetic or semi-synthetic oils.

Fuel quality requirements for diesel engines

General requirements
Volvo Penta diesel engines are certified for compliance with emission legislations with the diesel test fuels specified by law. These fuels correspond with diesel fuel standards EN 590, ASTM D975 and JIS K2204 and paraffinic diesel fuel standard EN 15940. Volvo Penta guarantees compliance with emission legislation and fulfillment of expected lifetime as long as the specified restrictions are followed.

It is the responsibility of the fuel suppliers to always ensure that their fuels meet relevant requirements and are fit for their intended purpose. Their responsibility includes any use of additives for proper engine performance and function.
Special requirements are placed on cold-flow properties, that is, temperature limit values of fuel filterability during operation in winter conditions.

Restrictions for specified diesel fuels

- **Max density for ASTM D975 No 2–D: 860 kg/m^3**
  Insufficient density reduces the power and increases the fuel consumption. Excessive density endangers the durability and function of the fuel injection equipment.
- **Max lubricity (wsd 1.4) for JIS K 2204: 460 µm**
  Sufficient fuel lubricity is essential to protect the fuel injection system against excessive wear.

Restrictions for other diesel fuels
Volvo Penta also approves the use of other diesel fuels as long as the here specified restrictions are followed. However Volvo Penta does not guarantee compliance with emission legislation or fulfillment of expected lifetime with these other diesel fuels.

NOTICE! Operators must check permission for usage of these fuels according to regional, national or local regulations.

- **Min cetane number: 40**
  An insufficient cetane number (“ignitability”) leads to poor startability and increased exhaust emissions.
- **Max density at 15°C: 860 kg/m^3**
  Insufficient density reduces the power and increases the fuel consumption. Excessive density endangers the durability and function of the fuel injection equipment.
- **Viscosity between 1.9 to 4.6 mm/s^2 at 40°C:**
  Insufficient viscosity reduces the power and increases the fuel consumption. Excessive viscosity endangers the durability and function of the fuel injection equipment.
- **Max lubricity (wsd 1.4): 520 µm**
  Sufficient fuel lubricity is essential to protect the fuel injection system against excessive wear.
- **Max FAME (biodiesel) content: 10% (V/V)**
  FAME is blended into diesel fuel.
- **Max sulfur content: 5000 mg/kg**

Paraffinic fuels - HVO and GTL
Paraffinic diesel fuels (“Synthetic Diesel”) have higher cetane numbers and lower densities than diesel fuels. HVO (Hydrotreated Vegetable Oils) is renewable paraffinic fuels. GTL (Gas-To-Liquid) is fossil paraffinic fuels. Volvo Penta approves the use of paraffinic diesel fuels that complies with standard EN 15940. The fuel guarantees compliance with emission legislation and fulfills the expected lifetime as long as the service requirements are followed. Volvo Penta also approves the use of fuel blends between these paraffinic fuels and diesel fuels that comply with the quality requirements.

Service requirements HVO and GTL
When shifting from diesel fuel to paraffinic fuel, the fuel hoses and sealings must be replaced.

Cooling System

Freshwater system capacity including heat exchanger	approx. 39 liters (10.3 US gals)

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P0002463

Coolant, Mixing

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

IMPORTANT:
Always use the same type of coolant that is already in the engine.
Different types of coolant must not be mixed with each other.
Risk of reduced cooling function and performance by clogging and isolation.

Coolant shall be based on Organic Acid Technology (OAT).

Follow the mixing recommendation on the product.

The coolant should be mixed with distilled, deionized water. For Volvo Penta specified water requirements; refer to *Water Quality*.

NOTICE! Always use “Ready Mixed” coolant if water quality cannot be determined or if it does not fulfill ASTM D4985.

NOTICE! Never mix more than 60% concentrated coolant with water. A greater concentration provides reduced cooling effect with the risk for overheating and reduced freeze protection.

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

Electrical System

System voltage	24V/12V
AC generator,	
voltage/max. amperage	28V/80A
output, approx.	2240W
Alternative generator equipment (accessory):	
voltage/max. amperage	14V/115A
output, approx.	1610W
Battery capacity	2 connected in series 12V, max. 180 Ah
Battery electrolyte density at +25°C (77°F):	
fully charged battery	1.28 g/cm^3 = 0.0462 lb/in^3 (1.24 g/cm^3 = 0.0448 lb/in^3)*
battery recharged at	1.24 g/cm^3 = 0.0448 lb/in^3 (1.20 g/cm^3 = 0.0434 lb/in^3)*

NOTICE! * Applies to batteries with tropical acid.

Identification Numbers

Warranty decal (A)

Product designation .....
Product number .....
Serial number .....

A

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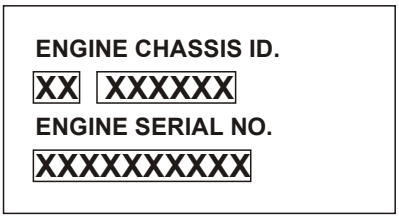
Serial number and CHASSIS ID (B)

Chassis ID .....
Serial number .....

B



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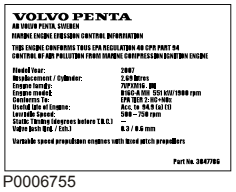
Certification label (C)

C



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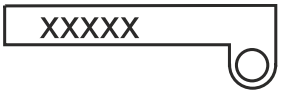
D



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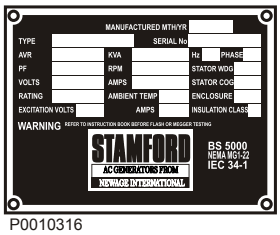
Certification plate (classified genset) (D)

Product designation .....
Product number .....

Generator plate (E)

Product designation .....
Serial number .....
Product number .....

E



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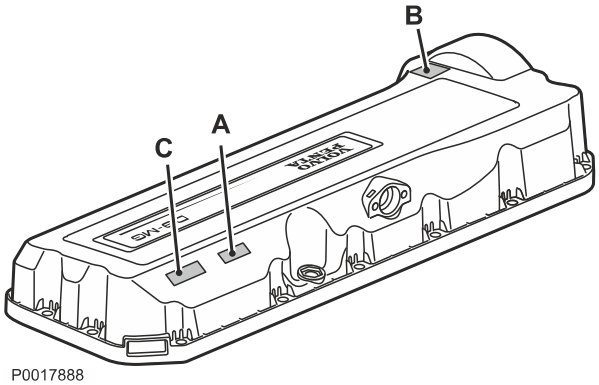

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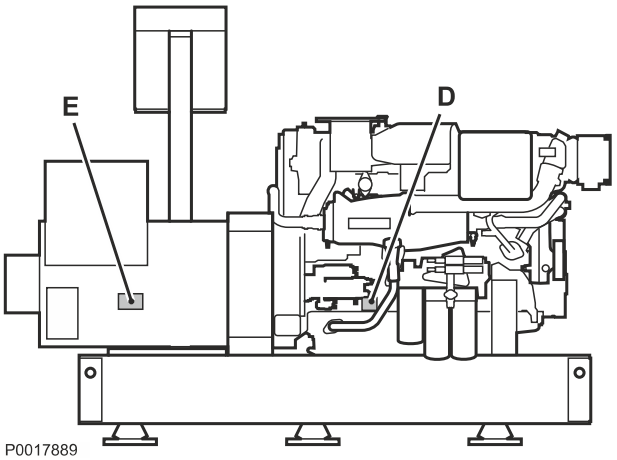

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ENG This Operator's Manual may be ordered in a different language free of charge up to 12 months after delivery, via internet.

http://manual.volvopenta.com/coupon/

If internet access isn't possible, please contact your Volvo Penta dealer.

GER Diese Betriebsanleitung kann bis zu 12 Monate nachder Lieferung über Internet kostenlos in einer anderen Sprache bestellt werden.

http://manual.volvopenta.com/coupon/

Wenn Sie keinen Internet-Zugriff haben, kontaktieren Sie bitte Ihren Volvo Penta-Händler.

FRE Ce manuel d'utilisation peut être commandé gratuitement sur Internet en différentes langues, jusqu'à 12 mois après la date de livraison.

http://manual.volvopenta.com/coupon/

Veuillez contacter votre Distributeur Volvo Penta si vous avez un problème d'accès à l'Internet.

SPA El presente libro de instrucciones puede solicitarse en otro idioma diferente, libre de cargo, hasta 12 meses después de la entrega, mediante internet.

http://manual.volvopenta.com/coupon/

Si no se tiene acceso a internet, contacten al su concesionario Volvo Penta.

ITA Il manuale per l'operatore può essere ordinato tramiteInternet, in varie lingue e per consegna gratuita, entro 12 mesi dalla consegna del prodotto

http://manual.volvopenta.com/coupon/

Se l'accesso a Internet risulta impossibile, contattare la concessionaria Volvo Penta.

SWE Denna instruktionsbok kan beställas via internet på ett annat språk gratis i upp till 12 månader efter leverans.

http://manual.volvopenta.com/coupon/

Kontakta din Volvo Penta-återförsäljare om du inte har tillgång till internet.

TUR Bu Kullanım Kılavuzu, teslimden 12 ay sonrasına kadar İnternet yoluyla ücretsiz olarak farklı bir dilde sipariş edilebilir.

http://manual.volvopenta.com/coupon/

İnternet mümkün değilse, lütfen Volvo Penta yetkili satıcınızla tmasa geçin.

CHI 本操作手册可通过互联网以不同的言进行订购，交付后可免费使用达12 个月。

http://manual.volvopenta.com/coupon/

如果无法访问互联网，请与沃尔沃遍达经销商联系。

BZS Este Manual de operador pode ser encomendado em um idioma diferente, gratuitamente, até 12 meses após a entrega, via internet.

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Caso o acesso à internet não for possível, contatar seu distribuidor Volvo Penta.

DUT Dit instructieboek kan gratis via internet in een a dere taal worden besteld tot 12 maanden na aflevering.

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Als toegang tot het internet niet mogelijk is, neem dan contact op met uw Volvo Penta dealer.

DAN Denne instruktionsbog kan bestilles gratis på et andet sprog via Internettet i op til 12 måneder efter leveringen.

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Hvis det ikke er muligt at bestille via Internettet, bedes du kontakte din Volvo Penta forhandler.

FIN Tämä käyttöohjekirja on tilattavissa Internetin kautta veloituksetta eri kielillä 12 kuukauden ajan toimituksen jälkeen.

http://manual.volvopenta.com/coupon/

Jos sinulla ei ole Internet-yhteyttä, ota yhteys lähimpään Volvo Penta jälleenmyyjään.

POR Este Manual do Operador pode ser encomendad em idiomas diferentes isento de custos até 12 meses após entrega, via internet.

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Se não for possível aceder à internet, contacte o seu concessionário Volvo Penta.

GRC Το παρόν Βιβλίο Χρήσης μπορεί να παραγγελθεί δωρεάν σε άλλη γλώσσα μέχρι 12 μήνες μετά την παράδοση,μέσω διαδικτύου.

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Εάν δεν είναι δυνατή η πρόσβαση στο ιαδίκτυο,παρακαλούμε επικοινωνήστε με το δικό σας αντιπρόσωπο της Volvo Penta.

RUS Данное руководство по эксплуатации можно бесплатно заказать на другом языке по Интернету в течение 12 месяцев после доставки.

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Если доступ к Интернету отсутствует, обратитесь к своему дилеру компании Volvo Penta.

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ARA

من الممكن طلب دليل المشغل بلغة أخرى مجانًا عبر الإنترنت لفترة تصل إلى ١٢ شهرًا من بعد التسليم.

/http:// manual.volvopenta.com/coupon

إذا كان الوصول إلى الإنترنت غير متاح، فالرجاء الاتصال بوكيل Volvo Penta.

VOLVO PENTA

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