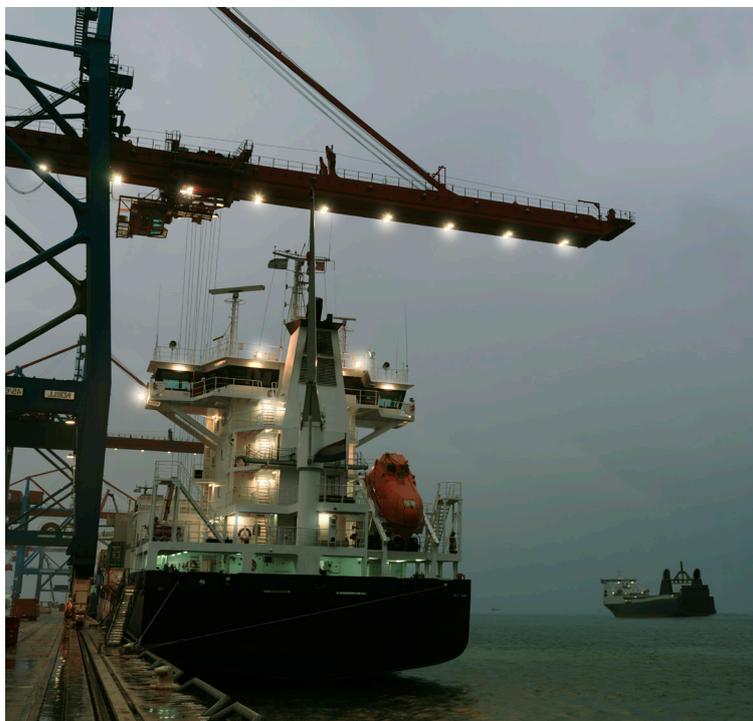


# OPERATOR'S MANUAL D16/GENSET





## **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](http://www.P65warnings.ca.gov/marine)

[www.p65warnings.ca.gov/products/diesel](http://www.p65warnings.ca.gov/products/diesel)

# Table of Content

<b>Foreword</b> .....	3
<b>Safety Information</b> .....	4
<b>Introduction</b> .....	13
About this Manual .....	13
Warranty .....	14
Running in the engine .....	14
Fuel, oils and coolant .....	14
Maintenance and replacement parts .....	15
Excessive strain on a product and components .....	15
Environmental care .....	16
Recording engine data .....	16
Certified Engines .....	17
Volvo Penta Dealer Network .....	18
Volvo Penta Action Service .....	18
<b>Instruments and Controls</b> .....	19
<b>Marine Commercial Control System (MCC)</b> .....	19
MCC system, Overview .....	20
Menus .....	23
Settings .....	24
Alarms .....	26
<b>Shutdown Unit (SDU)</b> .....	27
SDU Indications .....	28
<b>Starting</b> .....	29
<b>Before Starting</b> .....	29
<b>Starting the Engine</b> .....	29
<b>Operation</b> .....	31
<b>Reading the Instruments</b> .....	31
<b>Alarms</b> .....	31
<b>Maneuvering</b> .....	32
<b>Engine Shutdown</b> .....	33
<b>Before Engine Shutdown</b> .....	33
<b>Stop the Engine</b> .....	33
<b>After Engine Shutdown</b> .....	34
Operation Break .....	35
Cold Weather Precautions .....	35
<b>Fault handling</b> .....	36
Acknowledge message .....	36
Alarm List .....	37
<b>Fault Tracing</b> .....	39
<b>Fault Code Register</b> .....	41
<b>In Case of Emergency</b> .....	46
<b>Starting Using Auxiliary Batteries</b> .....	47
<b>Maintenance Schedule</b> .....	48
<b>Maintenance</b> .....	49
<b>Engine, General</b> .....	55
Air Filter, Check and Replace .....	55
Drive belt, check and change .....	56
<b>Lubrication System</b> .....	57
Oil level, checking and topping up .....	57
Engine Oil, Change .....	58

Oil Filter/By-pass Filter, Change .....	59
Switchable oil filters .....	60
<b>Fuel System</b> .....	61
Engine Fuel Filter Replacement .....	62
Fuel system, bleeding .....	64
Fuel pre-filter .....	65
<b>Freshwater System</b> .....	66
Coolant Level, Checking and Topping Up .....	67
Coolant, Draining .....	68
Freshwater system, Flushing .....	68
<b>Seawater System</b> .....	69
Seawater System, Draining .....	69
Anodes, Check and Change .....	70
Impeller, Check and Change .....	71
Seawater Filter, Check and Cleaning .....	72
Intake Manifold, Checking the Drain Hole .....	72
<b>Electrical System</b> .....	72
Power Module .....	72
Main switch .....	73
Electrical Connections .....	73
Battery .....	74
Electrical Welding .....	76
<b>Storage</b> .....	77
<b>Bringing Out of Storage</b> .....	78
<b>Technical Data</b> .....	79
Viscosity .....	79
Coolant, Mixing .....	81
<b>Identification Numbers</b> .....	83
<b>Index</b> .....	85

# Foreword

## Welcome!

Volvo Penta engines are designed to fulfill Volvo's core values; quality, safety and environmental care. After more than 100 years as an engine manufacturer, 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 your 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](http://www.volvopenta.com).

**Information about your closest Volvo Penta dealer and other useful news and information can be found at [www.volvopenta.com](http://www.volvopenta.com) and by following Volvo Penta on Facebook.**

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



[www.facebook.com/volvopenta](http://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

### **▲ 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.



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## 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

### ⚠ 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.



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## 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.

## 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, stay close to the engine.



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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.

D16C-A MG



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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.

## 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.

### 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!



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### 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

### ⚠ 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).



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## 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.

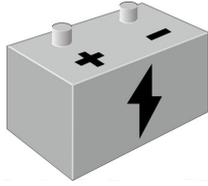
## Safe handling of batteries

### ⚠ 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

**IMPORTANT:**

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



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### 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 have 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 79*. The designation is stated on the engine plate, refer to *Technical Data, page 83*.

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 and Emission Control System Warranty Statement.

Volvo Penta warranty terms and conditions can be found via <http://manual.volvopenta.com/coupon/>. Use the publication number (at the bottom of each page) of this the manual as reference number.

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, other viscosity and quality may cause malfunctions, increased fuel consumption and possibly shorten the life of the engine.

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

Make sure to always use suitable and correctly mixed coolant.

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

## Maintenance and replacement parts

Volvo Penta engines are designed for maximum reliability and long life and built to withstand a demanding environment. The engines are also 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](http://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.

## 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](http://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](http://www.volvopenta.com).



# Instruments and Controls

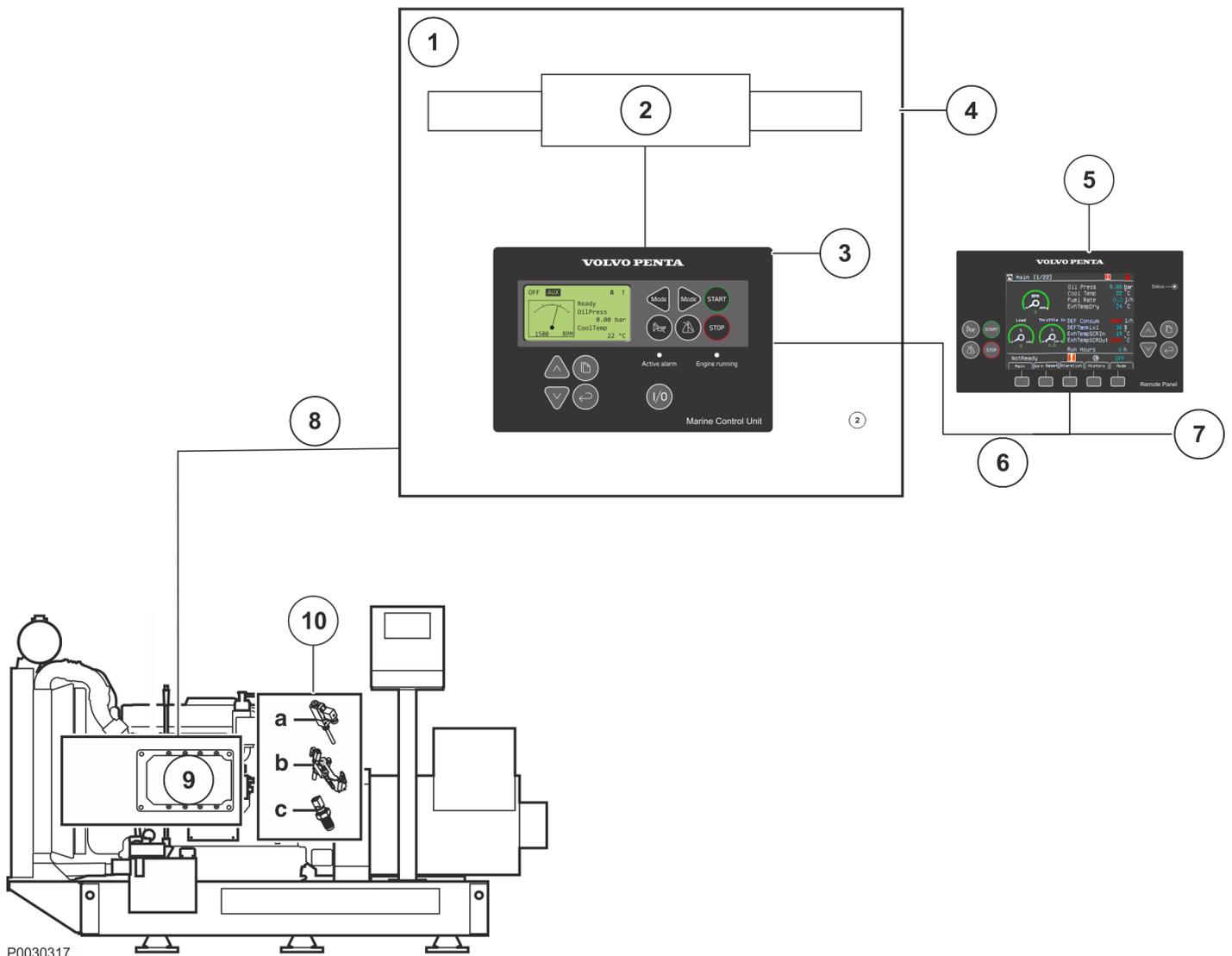
## Marine Commercial Control System (MCC)

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.

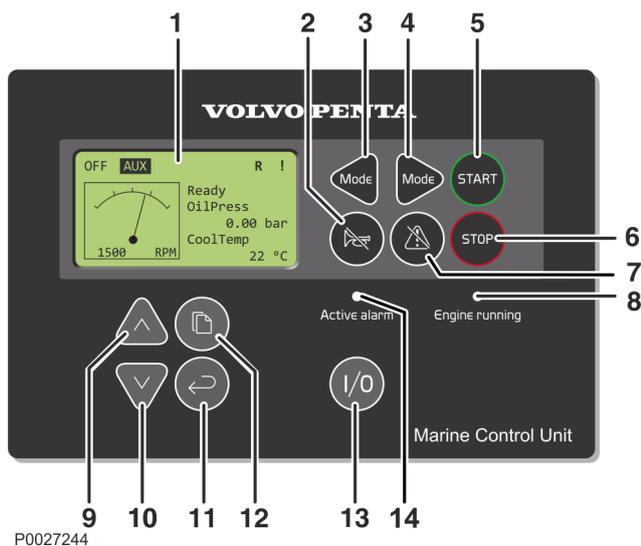
The SDU manages automatic engine shutdown should the engine show critically low oil pressure (including reverse gear) or high coolant temperature. It also has overspeed protection. Electronic systems in the vicinity of the engine comprise the engine management system (EMS) and a power management unit (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



P0030317

- 1 Connection box, engine room
- 2 Relay board – RB16 (16 relays)
- 3 MCU
- 4 External connections: Switch inputs, outputs, Modbus RS-232, Comap CAN2, CAN/J1939
- 5 Remote panel
- 6 Comap CAN2
- 7 Other Comap equipment
- 8 Data bus: CAN/J1939 and J11708/1587
- 9 EMS
- 10 Shutdown Senders & Switches
  - a Oil pressure switch
  - b Coolant temperature switch
  - c RPM sender

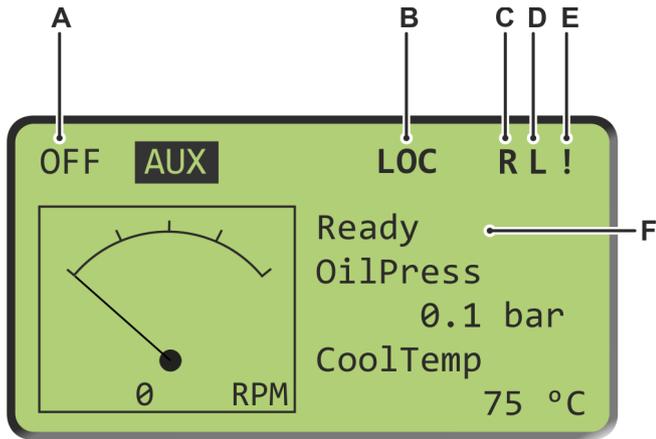


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## MCU panel

The MCU, Marine Control Unit, controls the engine and shows engine information and alarms.

- 1 Display
- 2 Acknowledgement of audible alarms
- 3 Changing modes, switching to OFF
- 4 Changing modes, switching to AUX/EME/HBR
- 5 Start button
- 6 Stop button
- 7 Acknowledge selection, acknowledge alarm
- 8 Green lamp; indicates engine is running
- 9 Up button; selecting and increasing
- 10 Down button; selecting and decreasing
- 11 Enter; confirming selection
- 12 Page; switching windows between Measurement (engine data), Adjustment and History.
- 13 I/O button; varied function depending on installation. Can be set to any function when installing.
- 14 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.



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### Display

- A Highlighted text indicates engine mode; in operation or start mode (AUX/EME/HBR), or OFF).
- B **LOC**: local mode. The engine can only be controlled from the main panel.
- C **R**: a remote connection – a remote panel – is on line.
- D **L**: locked. The main panel is locked and the remote 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.

## Menus

The system has four menus:

- Main Page
- Monitoring Page
- Settings Page
- History Page

### Main Page

Browse with the Page button (1) to the main menu (Main).

Browse between windows using the up/down buttons.

### Monitoring Page

- 1 Browse with the Page button (1) to the engine data menu (Monitoring page).
- 2 Browse in the engine data menu with the up/down buttons.

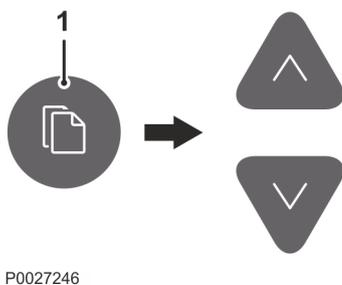
### Settings Page

The review and changing of setpoints is carried out in the Settings page.

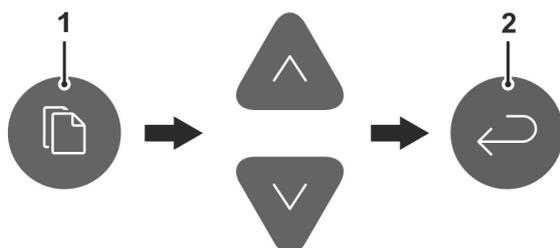
- 1 Browse with the Page button (1) to the Settings page.
- 2 Browse between the different setpoints using the up/down buttons.
- 3 Press Enter (2) to confirm the selection.
- 4 Browse with the up/down buttons to the desired setpoint. Setpoints marked with an asterisk (\*) are password protected. Press 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 (2) to confirm the selection. To finish without any change press the Page button (1). Press the Page button (1) to select setpoint group.

### History Page

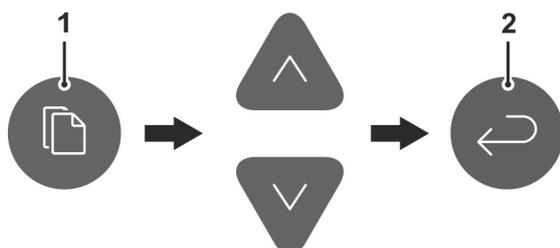
- 1 Browse to the History page using the Page button (1).
- 2 Browse with the up/down buttons to the desired event.
- 3 Press Enter (2) to see more detailed information about the event. Continue to press Enter to see all information about the event. When all information is shown the first image is visible again. Browse in the window using the up/down buttons.
- 4 Exit the menu with the Page button (1).



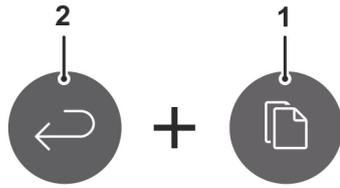
P0027246



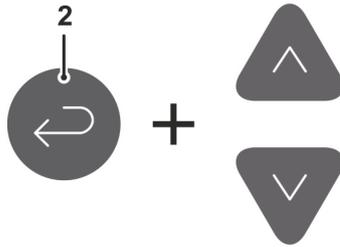
P0027247



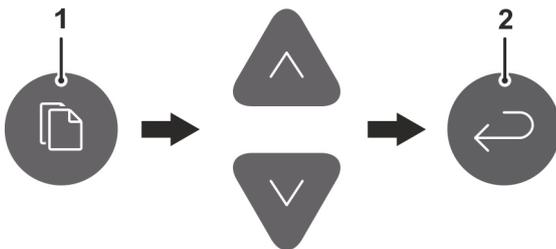
P0027247



P0027249



P0027248



P0027247

## 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 (2) and hold it down and press the Page button (1) 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 (2) and hold it down; adjust backlighting with the up/down buttons.

Contrast is adjusted in the main menu. Press the Enter button (2) 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.

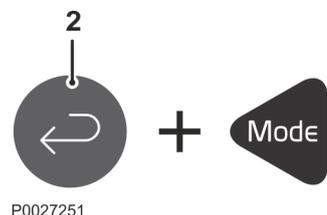
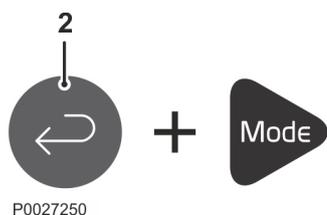
- 1 Press the Enter button (2) and hold it down to reach the info menu. Press the Page button (1).
- 2 Browse using the up/down buttons.
- 3 Press Enter (2) to select the language and close the menu.

### 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 (2) to confirm the selection.
- 3 Browse using the up/down buttons to “Enter Password” where 0 is shown. Press Enter (2) to confirm the selection.
- 4 Exit the menu by pressing Page (1).

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



Engine Hours	336 h
Fuel Used	100 L
NumSuccStarts	30
NumUnscStarts	3
MomAvgFICon L	20 /nm
Service time	3640 h

P0027255

## 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 (2) and the right Mode button.

Exit mode by pressing Enter (2) and the left Mode button.

### Operations mode (AUX/PRP/EME/HBR)

In operations mode (AUX/PRP/EME/HBR) 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<sup>(1)</sup>
- 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; Comap InternetBridge hardware and adaptation of software required.

## Alarms

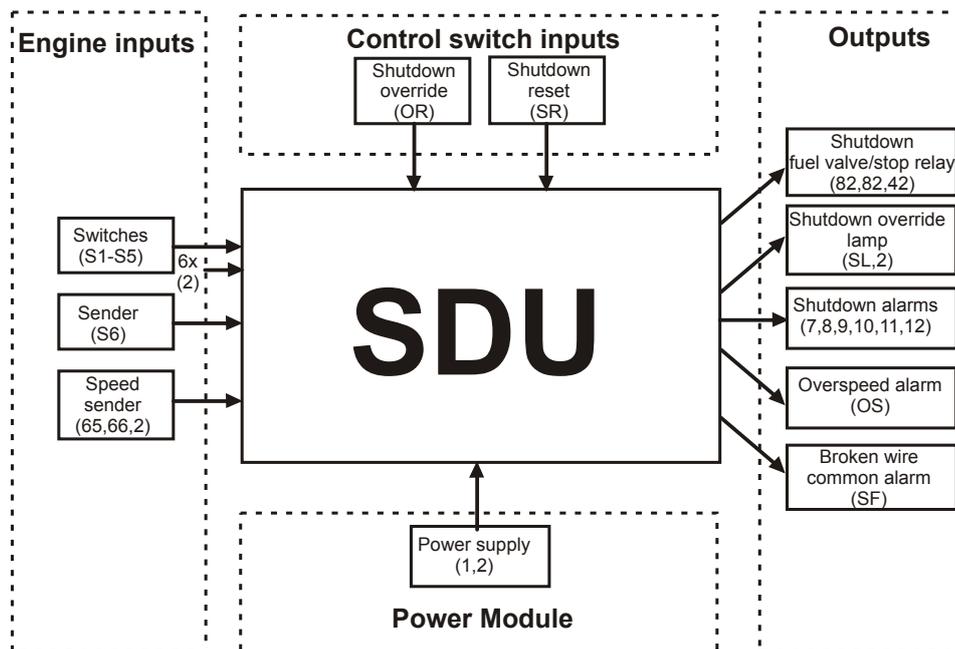


P0027254

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 36* chapter.

## Shutdown Unit (SDU)



P0008401

**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.

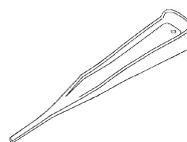
### Run detection

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.

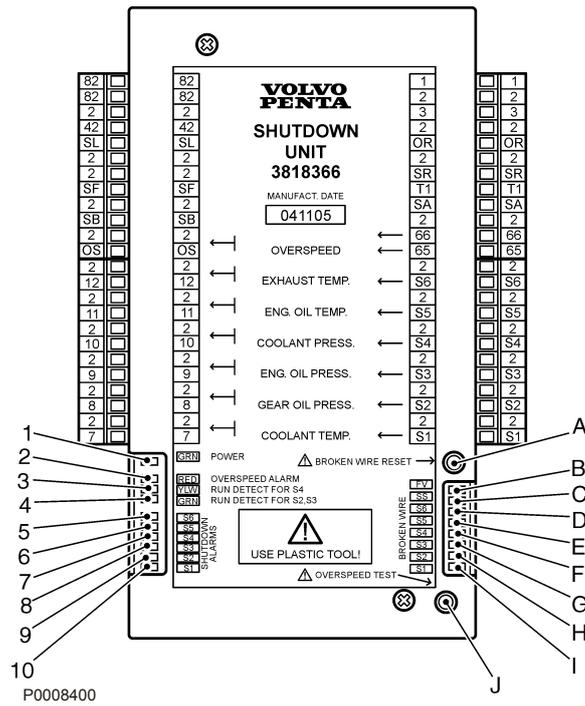
Yellow LED indicates broken wire. Reset alarm on button "Broken wire reset", see *SDU control panel*.



P0008415

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

## SDU Indications



- |                                |  |
|--------------------------------|--|
| 1 Green – Power                | A Broken wire reset button                   |
| 2 Red – Overspeed Alarm        | B Yellow – Fuel valve wire detected          |
| 3 Yellow – Run detection S4    | C Yellow – Speed sender Broken wire detected |
| 4 Green – Run detection S2, S3 | D Yellow – S6 Broken wire detected           |
| 5 Red – S6 Shutdown active     | E Yellow – S5 Broken wire detected           |
| 6 Red – S5 Shutdown active     | F Yellow – S4 Broken wire detected           |
| 7 Red – S4 Shutdown active     | G Yellow – S3 Broken wire detected           |
| 8 Red – S3 Shutdown active     | H Yellow – S2 Broken wire detected           |
| 9 Red – S2 Shutdown active     | I Yellow – S1 Broken wire detected           |
| 10 Red – S1 Shutdown active    | 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

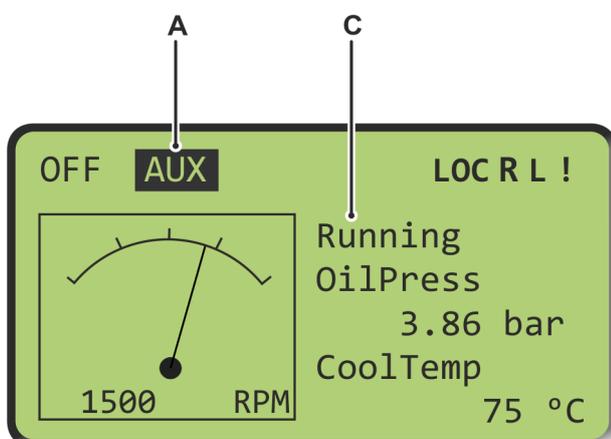
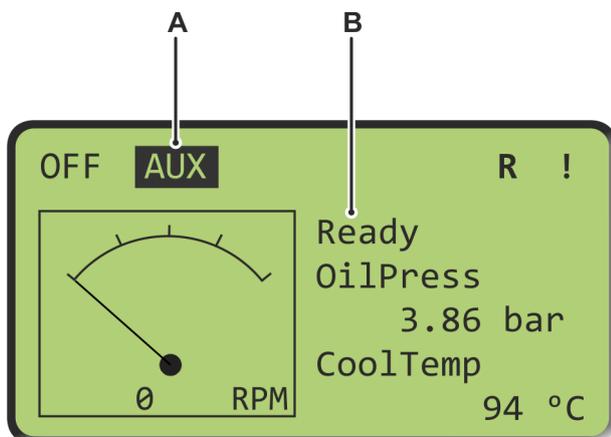
- Engine and engine room. General inspection
- Checking Engine Oil Level.
- Check the coolant level.
- Fuel Tank (sludge trap), Drain.
- Fuel Filters, Drain.
- Fuel pre-filter, draining water / contamination.

## Starting the Engine

- 1 In the main menu, browse to start mode (AUX/EME/HBR) (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.



P0027285

### **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 registered, please refer to section *Fault handling, page 36* for further information and recommended 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.

# 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.



P0027307

- 1 Acknowledge the audible alarm by pressing the Horn Reset button (1).
- 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 Acknowledge button (2) to acknowledge all alarms.  
Take the necessary action; refer to the *Fault handling, page 36* section for further information.

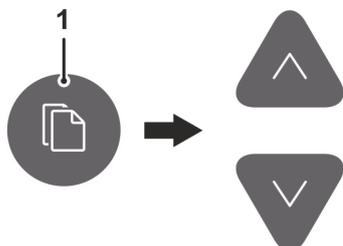
Alarm notations remain in the alarm list until they have been acknowledged and rendered "inactive" (fault remedied).

## Maneuvering

### Running data

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

- 1 Browse with the Page button (1) to the engine data menu (Monitoring page).
- 2 Use the up/down buttons to select the desired engine data.



P0027246

# 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.

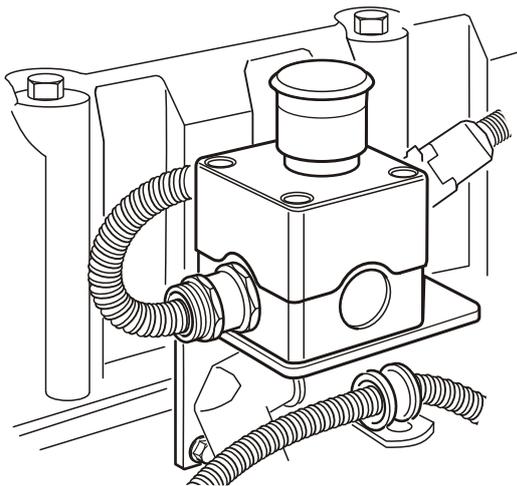
## Stop the Engine

- 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".

### Emergency stop

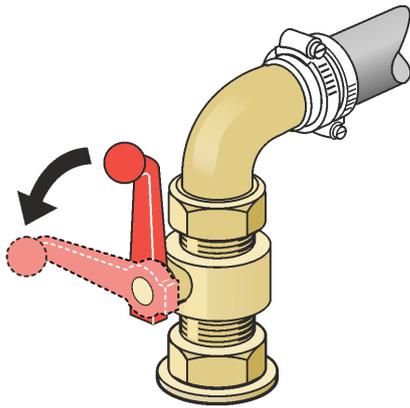
If a fault occurs that prevents you stopping the engine in the normal way, you can stop it by pressing the emergency button.

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.



P0005904

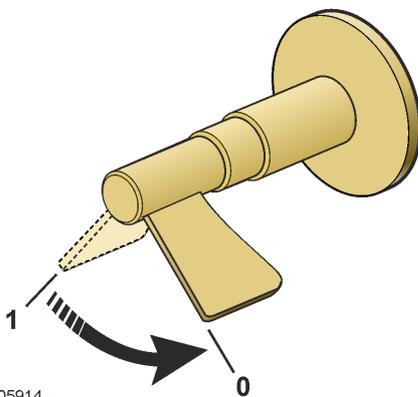
## After Engine Shutdown



- Check the engine and engine bay for leakages.
- Close the fuel tap.
- Close the sea cock where fitted.
- 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 power switch before any long stoppage.

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

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



P0005914

## Operation Break

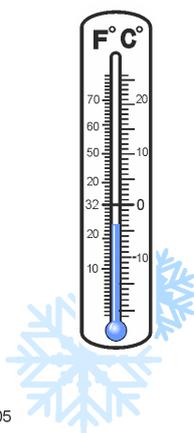
If the boat is not used, but left in the water, the engine must be warmed up at least once every fortnight. This prevents corrosion damage in the engine.

If you expect the boat to be unused for two months or more, it must be inhibited, please refer to *Storage, page 77*.

## Cold Weather Precautions

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 66* and *Seawater System, Draining, page 69* respectively for more detailed information.

Check the charge status of the battery. A poorly-charged battery can freeze and burst.



P0005905

# Fault handling

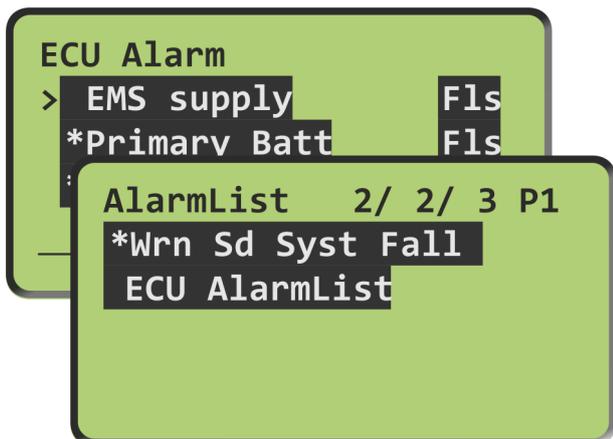
Despite regular maintenance according to the maintenance schedule and perfect operation conditions, faults that need to be attended to during travel, may occur. This chapter describes some possible alarms and fault handling. Note that the content of this chapter does not provide full coverage of the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

## Acknowledge message

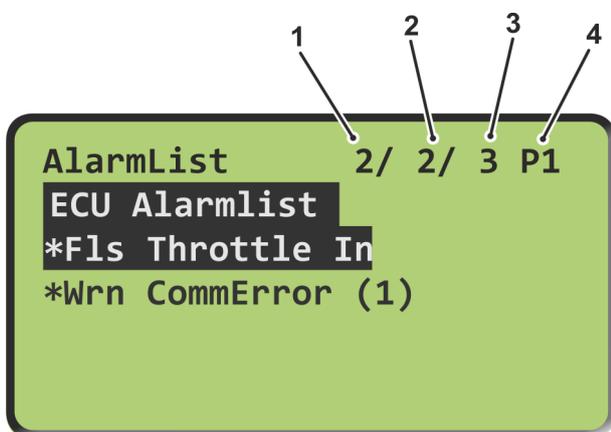
The Acknowledge button (1) acknowledges all alarms. Alarms that are not active disappear from the list.



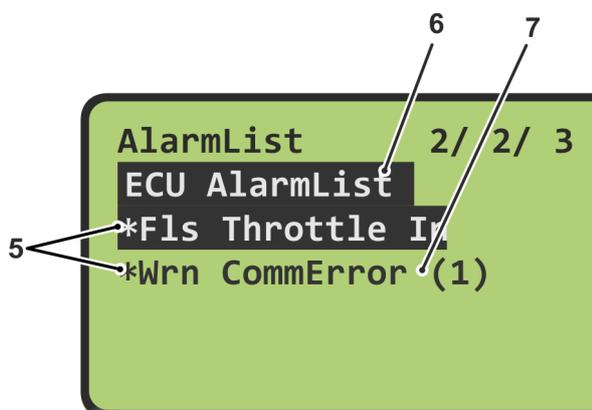
P0027280



P0030320



P0027282



P0027283

## Alarm List

The alarm list and ECU alarm are the two first windows from the main menu.

From the main menu press the arrow up button once to reach the alarm list and twice for the ECU alarm list.

In the remote panel: Press Alarm list button.

### Alarm List (Alarmlist)

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.

At position (7) the number in parentheses shows in which ECU the fault code is. (1=EMS J1939, 2=EMS and Power module J1587)

### 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

- Unacknowledged alarms are marked with \* (5)
- Active alarms are indicated by a black background (6)
- Inactive alarms are displayed without a black background (7)



P0030325



P0027284

### 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.

SP5394: Specific faultcode.

OC16: (Occurrence) in this case 16 times.

FM4: FMI (failure mode indicator) Indicate the type of failure.

E2: Which control unit. (1=EMS J1939, 2=EMS and Power module J1587)

For more information about fault code and a complete list look in the workshop manual.

### Alarm list and history

#### Abbreviations in alarm list and history

Abbreviation	Meaning
Wrn	Warning
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.

<b>Symptoms and possible causes</b>	
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 56*.
- Check battery fluid level. Refer to *Battery, page 74*.

## Coolant Level Wrn

---

Low coolant level.

- Check for coolant leakage.  
Check coolant level., Refer to *Coolant Level, Checking and Topping Up, page 67*.

## Crankcase Press Wrn

---

Crankcase pressure too high Engine power is reduced.

- Check that the crankcase ventilation is not blocked.

## EMS supply Fls

---

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 *Coolant Level, Checking and Topping Up, page 67*
- Check that the seawater filter is not blocked., Refer to *Seawater Filter, Check and Cleaning, page 72*
- Check the impeller in the seawater pump., Refer to *Impeller, Check and Change, page 71*
- 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 57*.
- 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 57*.
- 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 56*.  
Check battery fluid level. Refer to *Battery, page 74*.
- 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 57*.  
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 62*
- Check for fuel leakage.

---

## 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.

---

## 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 62*
- 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 57*
- 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 *Coolant Level, Checking and Topping Up, page 67*.
- Check that the seawater filter is not blocked., Refer to *Seawater Filter, Check and Cleaning, page 72*.
- Check the impeller in the seawater pump., Refer to *Impeller, Check and Change, page 71*.

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 72*
- Check the impeller in the sea water pump. Refer to *Impeller, Check and Change, page 71.*
- 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 56.*  
Check battery fluid level. Refer to *Battery, page 74.*
- 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 57.*  
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 56.*  
Check battery fluid level. Refer to *Battery, page 74.*
- 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 57.*  
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 FIs**

---

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](http://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](http://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.

# Maintenance

This chapter contains general technical information and instructions on how the common maintenance items that must be carried out. Read through the instructions carefully before starting work.

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.

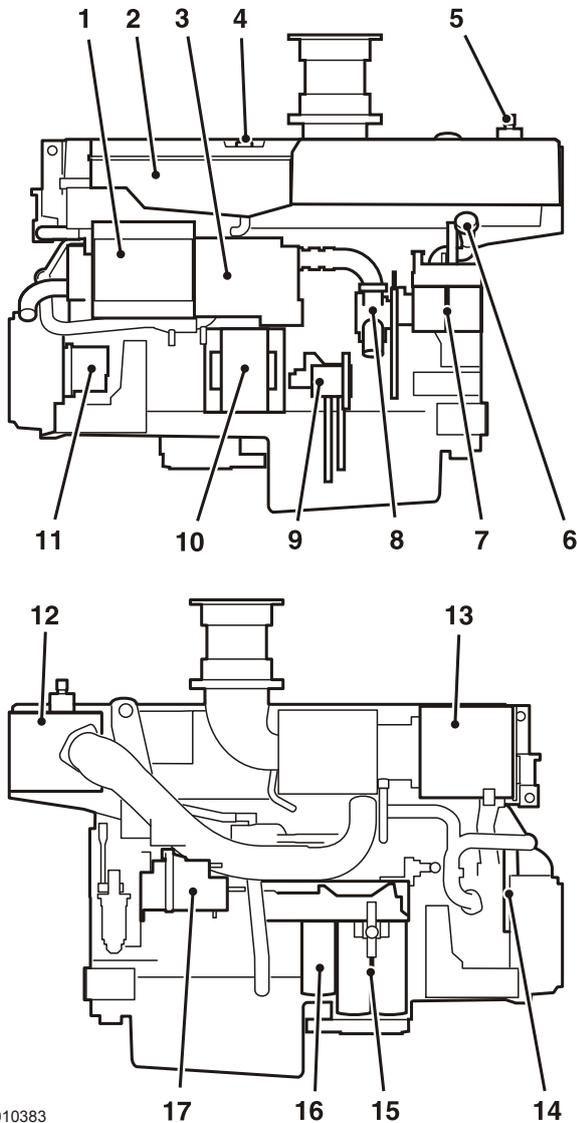
Volvo Penta recommend that all servicing with the engine running should be undertaken by an authorized Volvo Penta workshop. The intervals when maintenance items must be carried are indicated in the *Maintenance Schedule*.

## **⚠ 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**. The manual is available for download at [www.volvopenta.com](http://www.volvopenta.com).

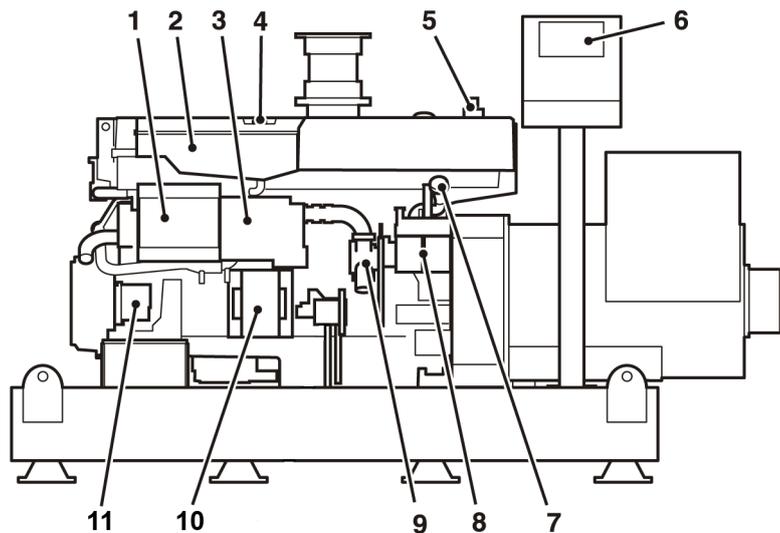
## D16 HE



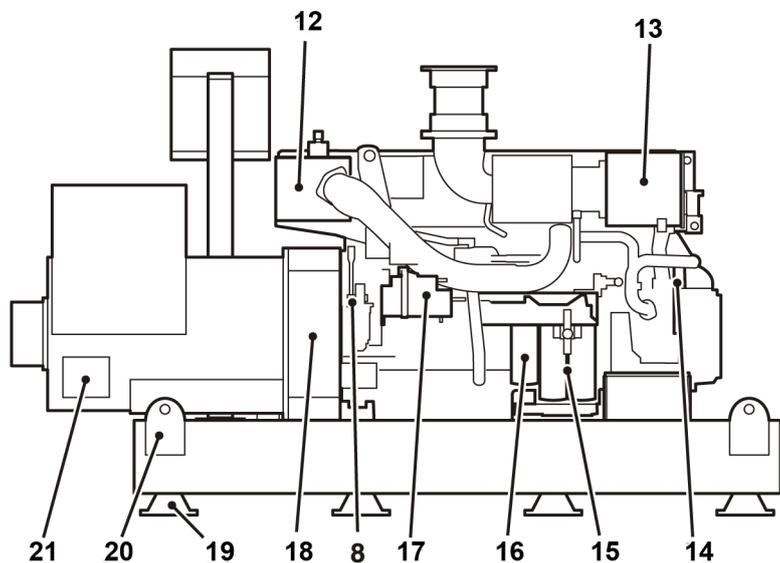
- 1 Electrical connection box with SD reset
- 2 Expansion tank
- 3 Heat exchanger
- 4 Coolant filler cap
- 5 Auxiliary stop
- 6 Oil filler cap, engine
- 7 Switchable fuel filters
- 8 Seawater Pump
- 9 Fuel Shut-off Valve
- 10 Engine Control Unit
- 11 Alternator
- 12 Charge air cooler
- 13 Air Filter
- 14 Fresh water pump
- 15 Oil filter
- 16 By-pass filter for engine oil
- 17 Starter motor

P0010383

### D16 MG HE Marine genset

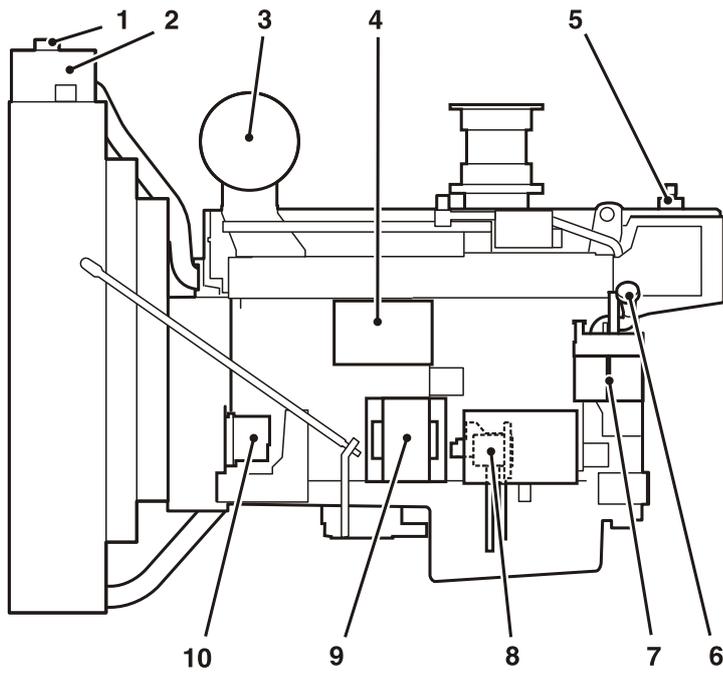


- 1 Electrical connection box with SD reset
- 2 Expansion tank
- 3 Heat exchanger
- 4 Coolant filler cap
- 5 Auxiliary stop
- 6 MCU connection box with panel
- 7 Oil filler cap, engine
- 8 Switchable fuel filters
- 9 Seawater Pump
- 10 Fuel Shut-off Valve
- 11 Engine Control Unit

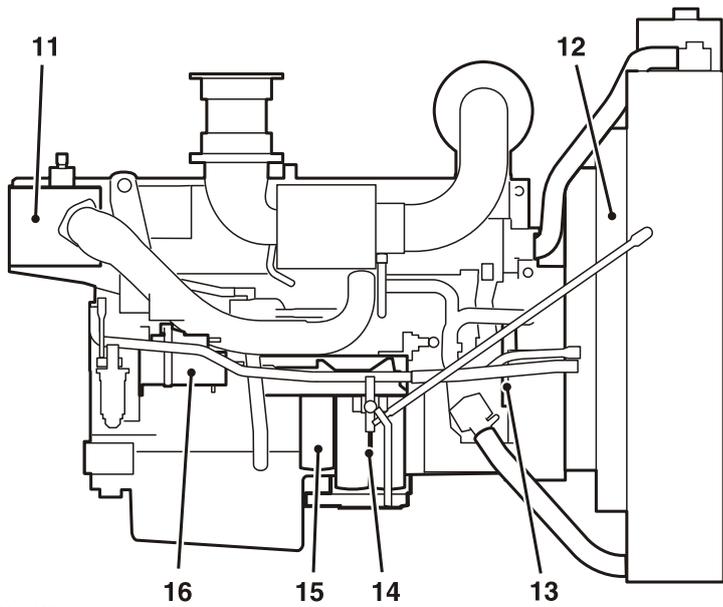


- 12 Alternator
- 13 Charge air cooler
- 14 Air Filter
- 15 Fresh water pump
- 16 Oil filter
- 17 By-pass filter for engine oil
- 18 Starter motor
- 19 Air outlet generator
- 20 Flexible engine mounting
- 21 Lifting eye \*4
- 22 Air inlet generator

P0010384

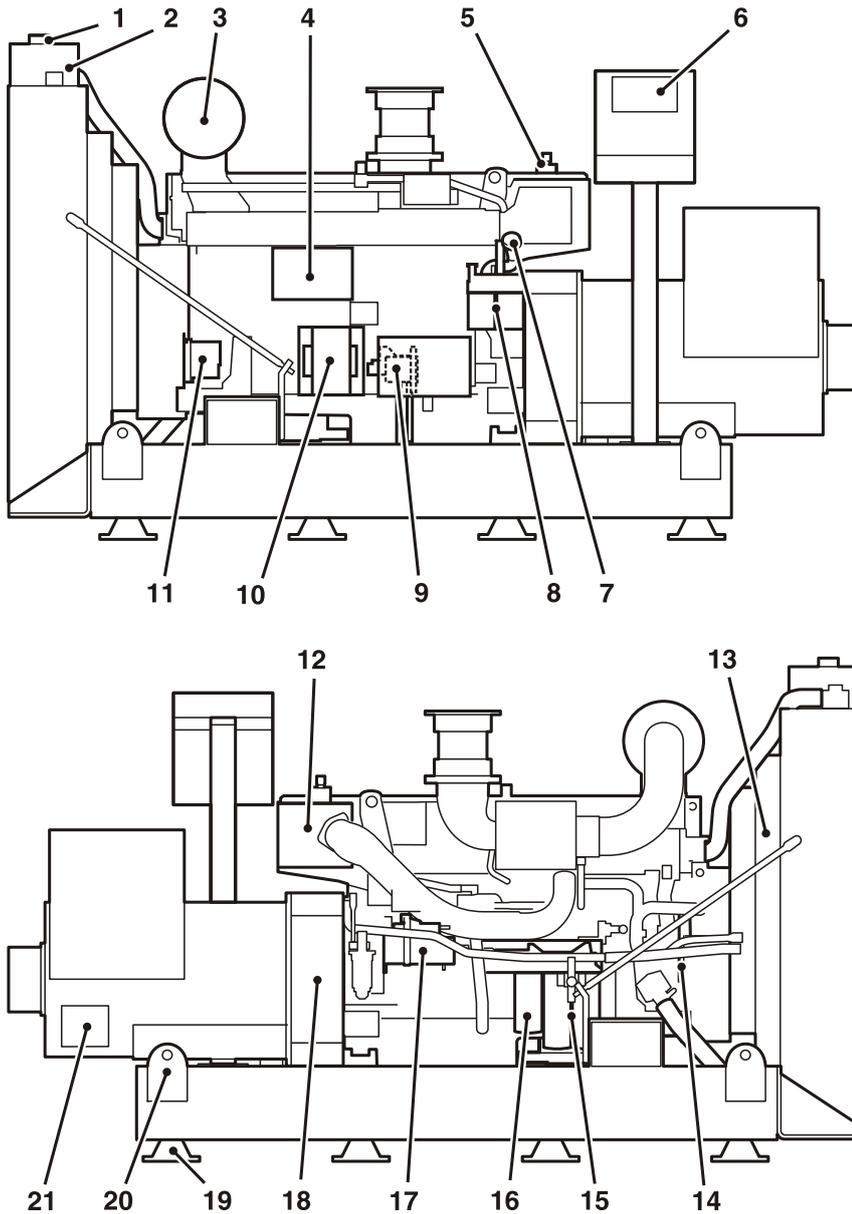
**D16 MG RC Genset engine**

- 1 Coolant filler cap
- 2 Expansion tank
- 3 Air Filter
- 4 Electrical connection box with SD reset
- 5 Auxiliary stop
- 6 Oil filler cap, engine
- 7 Switchable fuel filters
- 8 Fuel Shut-off Valve
- 9 Engine Control Unit
- 10 Alternator
- 11 Charge air cooler
- 12 Radiator
- 13 Fresh water pump
- 14 Oil filter
- 15 By-pass filter for engine oil
- 16 Starter motor



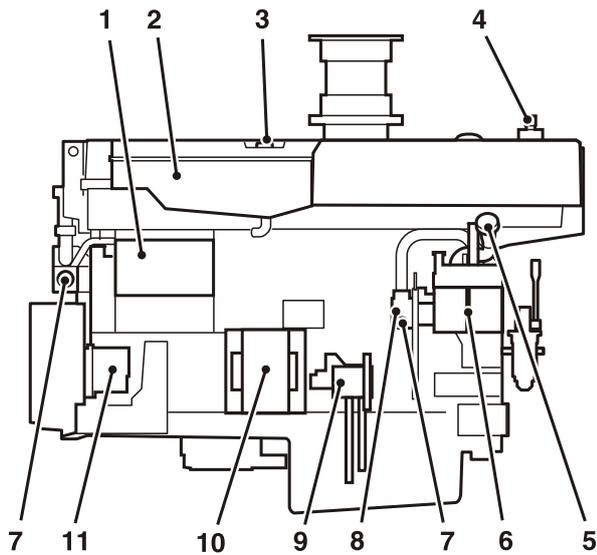
P0010385

### D16 MG RC Marine genset

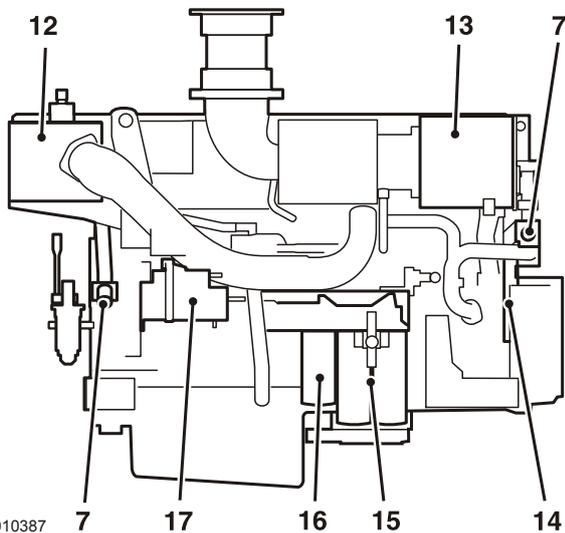


- 1 Coolant filler cap
- 2 Expansion tank
- 3 Air Filter
- 4 Electrical connection box with SD reset
- 5 Auxiliary stop
- 6 MCU connection box with panel
- 7 Oil filler cap, engine
- 8 Switchable fuel filters
- 9 Fuel Shut-off Valve
- 10 Engine Control Unit
- 11 Alternator
- 12 Charge air cooler
- 13 Radiator
- 14 Fresh water pump
- 15 Oil filter
- 16 By-pass filter for engine oil
- 17 Starter motor
- 18 Air outlet generator
- 19 Flexible engine mounting
- 20 Lifting eye \*4
- 21 Air inlet generator

P0010386

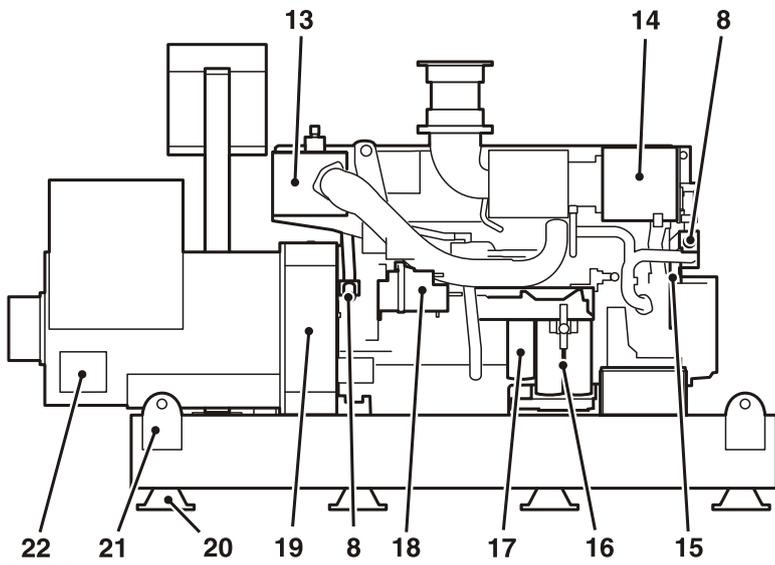
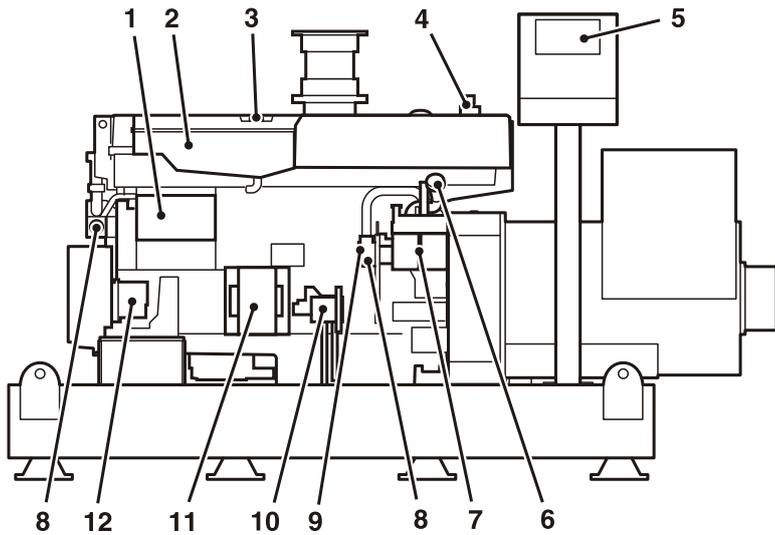
**D16 MG KC Genset engine**

- 1 Electrical connection box with SD reset
- 2 Expansion tank
- 3 Coolant filler cap
- 4 Auxiliary stop
- 5 Oil filler cap, engine
- 6 Switchable fuel filters
- 7 Keel cooling connections
- 8 Seawater Pump
- 9 Fuel Shut-off Valve
- 10 Engine Control Unit
- 11 Alternator
- 12 Charge air cooler
- 13 Air Filter
- 14 Fresh water pump
- 15 Oil filter
- 16 By-pass filter for engine oil
- 17 Starter motor



P0010387

### D16 MG KC Marine genset



P0010388

- 1 Electrical connection box with SD reset
- 2 Expansion tank
- 3 Coolant filler cap
- 4 Auxiliary stop
- 5 MCU connection box with panel
- 6 Oil filler cap, engine
- 7 Switchable fuel filters
- 8 Keel cooling connections
- 9 Seawater Pump
- 10 Fuel Shut-off Valve
- 11 Engine Control Unit
- 12 Alternator
- 13 Charge air cooler
- 14 Air Filter
- 15 Fresh water pump
- 16 Oil filter
- 17 By-pass filter for engine oil
- 18 Starter motor
- 19 Air outlet generator
- 20 Flexible engine mounting
- 21 Lifting eye \*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.

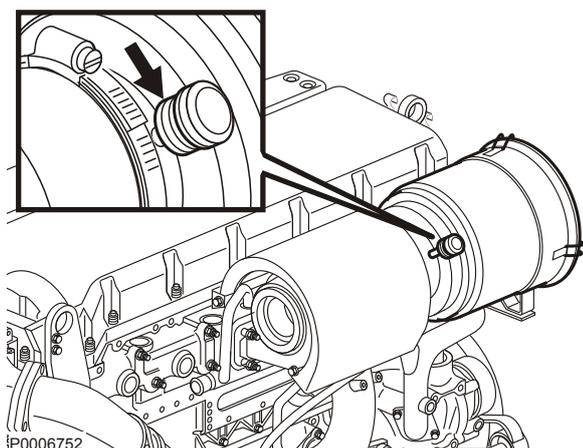
Never direct the jet from a high-pressure washer at seals, rubber hoses or electrical components. Never use the high pressure setting for engine cleaning.

### Air Filter, Check and Replace

- 1 Check the air filter indicator. If indicator is all **red** after the engine is stopped, change filter.
- 2 Undo the clamps and remove the lid from the filter housing.
- 3 Remove the old filter. Be careful to ensure that no contamination gets into the engine.
- 4 Install a new air filter and tighten the lid.
- 5 Reinststate the pressure drop indicator by pressing in the indicator button.

#### **IMPORTANT:**

Scrap the old filter; it may not be cleaned.



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## Drive belt, check and change

### **⚠ WARNING!**

Stop the engine before doing any maintenance work.

### General

Check belts after operation while they are still hot. It should be possible to depress an alternator belt or drive belt around 3–4 mm (0.012–0.016") between pulleys.

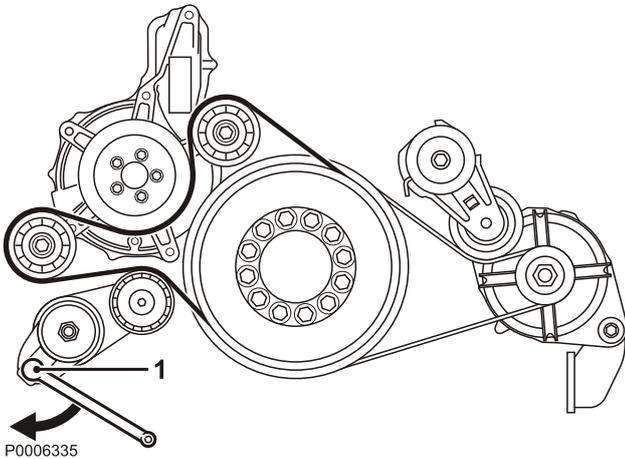
### **IMPORTANT:**

Always replace a belt that appears worn or is cracked. Belts working in tandem must be replaced simultaneously.

Both the alternator belts and drive belt have automatic belt tensioners and should not need adjusting.

### Drive belt, water pump, replacement

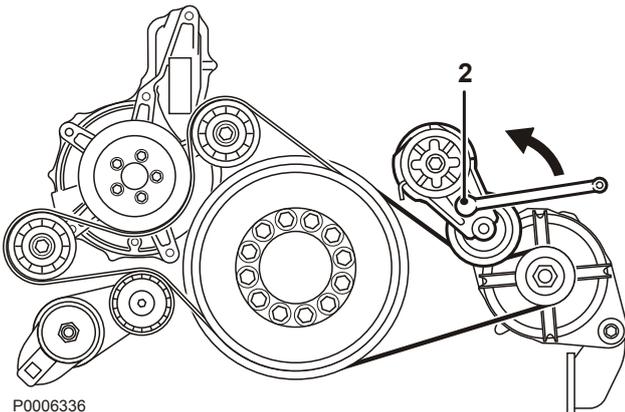
- 1 Switch off the main switch(es) and check that the engine is not connected to system power.
- 2 Remove the belt cover.
- 3 Use a 1/2 inch socket to lower the belt tensioner (1) and release the belt.
- 4 Remove the drive belt.
- 5 Check that the pulleys are clean and undamaged.
- 6 Lower the belt tensioner (1) and install the new drive belts.
- 7 Install the belt guards.
- 8 Start the engine and do a function check.



P0006335

### Alternator belt, replacement

- 1 Switch off the main switch(es) and check that the engine is not connected to system power.
- 2 Remove the belt cover.
- 3 Remove the water pump drive belt (refer to the *Water pump drive belt, replacement* section).
- 4 Use a 1/2 inch socket to raise the belt tensioner (2) and release the alternator belt.
- 5 Remove the alternator belt.
- 6 Check that the pulleys are clean and undamaged.
- 7 Raise the belt tensioner (2) and install the new alternator belt.
- 8 Re-install the water pump drive belt.
- 9 Install the belt guards.
- 10 Start the engine and do a function check.



P0006336



P0002089

## Lubrication System

Oil change intervals can vary depending on oil quality, refer to *Technical Data, page 79*.

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 79*, the oil change interval can under certain conditions be increased. To see if the engine complies, Volvo Penta oil analysis need to be performed. Contact your Volvo Penta dealer for further information.

## Oil level, checking and topping up

Check the oil level with the engine shut down and in a horizontal level.

The oil level must be within the marked range on the dipstick.

There is a low level alarm installed as standard, but make sure to check the oil level anyway every once in a while.

Fill lubrication oil through the filler opening on the side of the engine. Wait a few minutes to allow the oil to run into the oil sump then make sure you have filled to the right level. After filling oil, secure filler cap.

### **IMPORTANT:**

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

## Engine Oil, Change

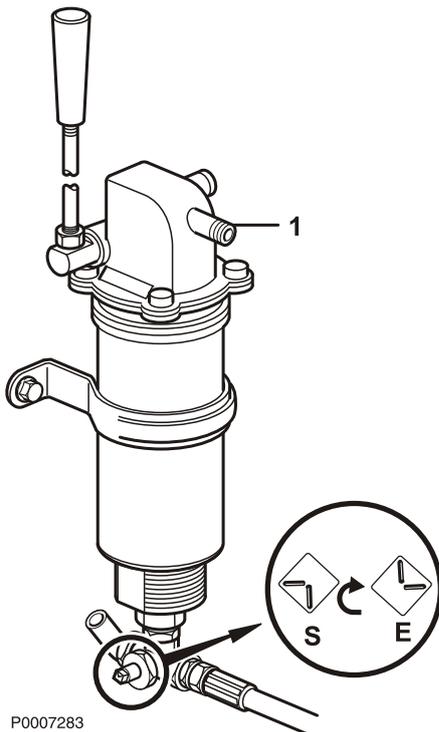
Always follow the recommended oil change interval. Use an oil drain pump (optional) to pump the oil out of the oil pan.

**⚠ WARNING!**

Hot oil and hot surfaces can cause burns.

**⚠ WARNING!**

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



- 1 Run the engine until warm so that the oil is easier to pump. Then stop the engine.
- 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 the section *Oil Filter/By-pass Filter, Change, page 59*.
- 5 Close the tap (S). Refill with new oil to the correct level.

**IMPORTANT:**

Only use oil of recommend quality and viscosity.

Refer to *Technical Data, page 79* for oil quantity and quality and viscosity.

- 6 Start the engine and let it idle. Check the oil pressure. Check that no leaks are present at the filters.
- 7 Stop the engine. Wait a few minutes before checking the oil level. Top up as needed.

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

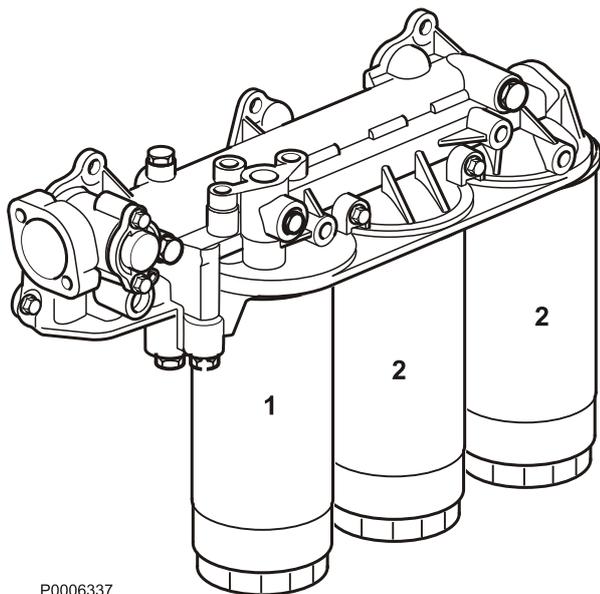
## Oil Filter/By-pass Filter, Change

Change the oil filters and by-pass filter at every oil change.

Remember to bring the old filters to an authorized recycling station.

### **▲ WARNING!**

Hot oil and hot surfaces can cause burns.

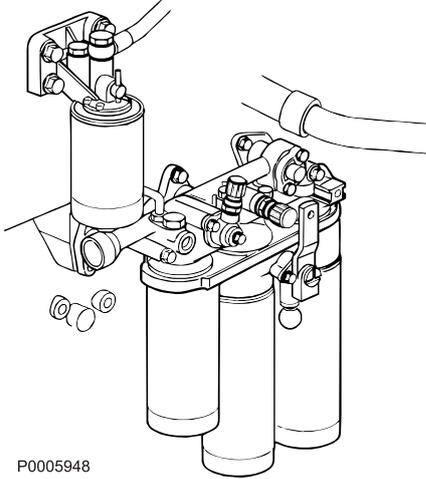


- 1 Put a suitable vessel underneath the filters to avoid oil spill.
- 2 Clean the filter bracket.
- 3 Unscrew the bypass filter (1) and the oil filters (2) with a suitable filter wrench.
- 4 Make sure the seal's mating surfaces on the filter brackets are clean.
- 5 Lightly oil the rubber seal of the new filters.
- 6 Mount the new filters by hand until the gasket is in contact with the sealing surface. Then tighten the filters another 3/4 to 1 turn.
- 7 Start the engine (idle) and make sure that no leakages occur. Check the oil level once 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.



- 1 Clean the filter holder.
- 2 Disconnect the left filter by turning the handle to the right position. Pull down on the knob below the handle to release the handle.
- 3 Unscrew the left 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 to the left closed position and replace the right oil filter in the same way.
- 8 Put the handle in the operating position (straight up).
- 9 If necessary, top up the system at the first stop. Refer to section *Engine Oil, Change*, page 58.

## Fuel System

Only use the grades of fuel recommended in the fuel specification, refer to *Technical Data, page 80*. Always observe the greatest cleanliness during refueling and work on the fuel system.

All work on the 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

#### Single and switchable filters

- 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.

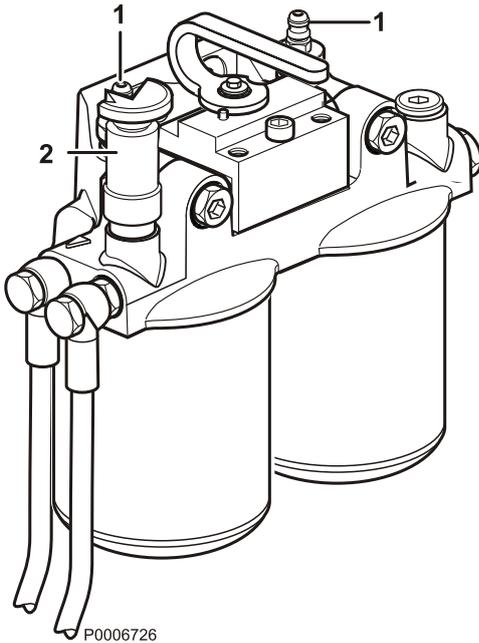
#### **CAUTION!**

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

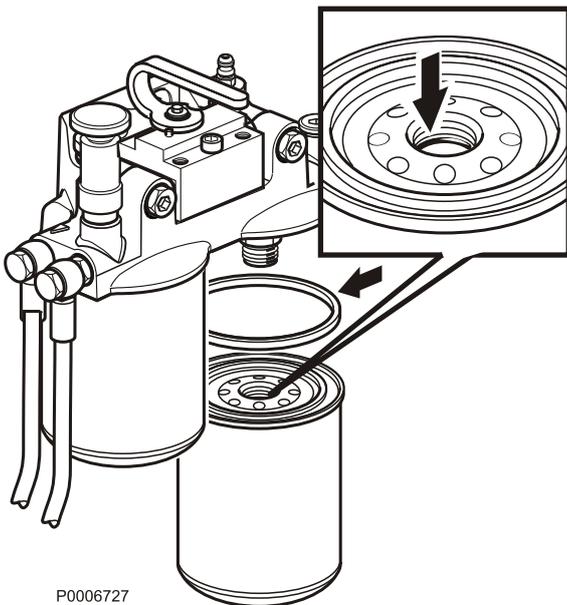
- 3 Relieve pressure inside the filter by opening the bleeding nipple (1).
- 4 Unscrew the filter, use a filter wrench if needed.
- 5 Clean the sealing surface on the filter bracket. Make sure the new filter is absolutely clean and that the sealing surfaces are undamaged. Moisten the seals with engine oil, 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.

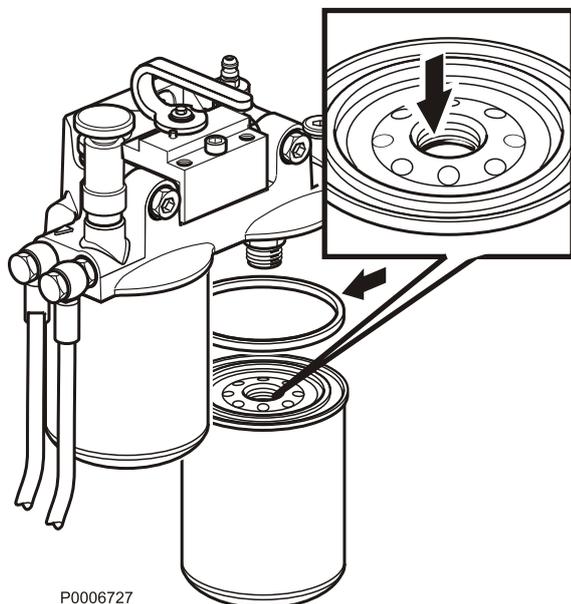
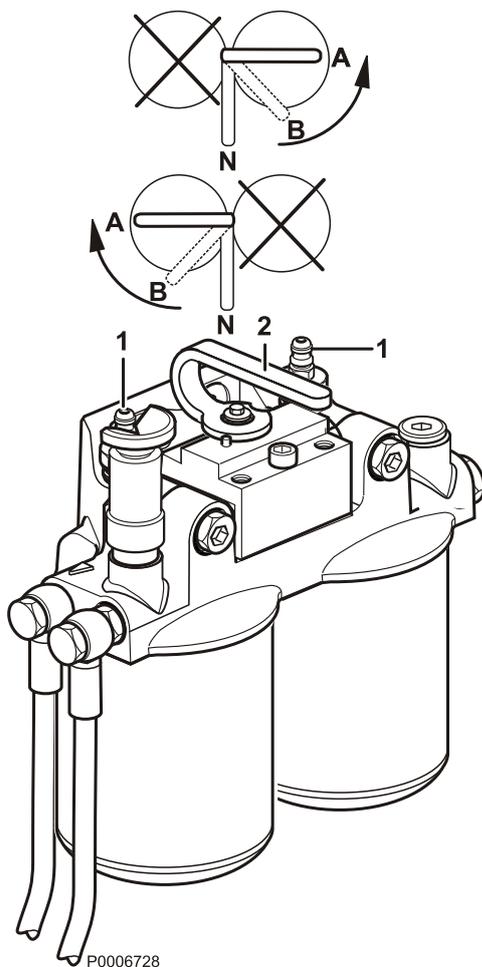
- 6 Screw the new filter on by hand until the seal just touches the mating surface. Then tighten a further 3/4 turn.
- 7 Open the fuel valve/valves.
- 8 Open the bleeding nipple (2) and work the pump until air-free fuel flows out. Tighten the bleeding nipple while fuel is flowing out.
- 9 Remove the hose and put the protective cap back on the nipple.
- 10 Start the engine and check for leakages.



P0006726



P0006727



## Running engine

### **⚠ WARNING!**

Hot fuel can cause burns.

### Switchable filters only

- 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 Make sure the new filter is absolutely clean and that the sealing surfaces are undamaged. Moisten the seals with engine oil, including the inner rubber seal on the inside of the threaded hole in the center of the filter.
- 5 Screw the new filter on by hand until the seal just touches the mating surface. Then tighten a further 3/4 turn.
- 6 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.
- 7 Remove the hose and put the protective cap back on the nipple.
- 8 Repeat the procedure with the other filter.
- 9 Turn the handle to normal operating position (N). Check for leakages.

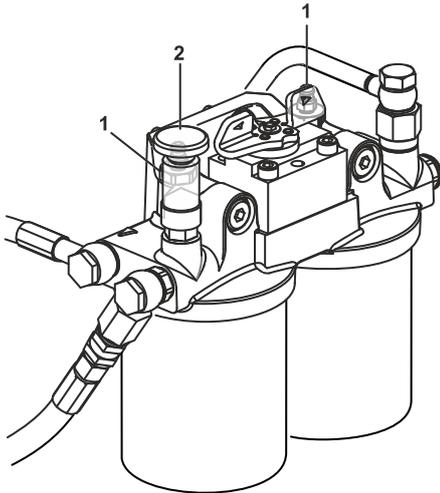
## Fuel system, bleeding

The fuel system must be vented after a filter change, e.g. if the fuel tank has been run dry or after a long-term stoppage.

### Stopped engine

#### Change-over filter

- 1 Place a suitable container underneath the fuel filter.
- 2 Remove the protective cap from the venting nipple (1) on the filter holder. Connect a transparent hose to the nipple and lead it to the recovery container.
- 3 Open the venting nipple and pump fuel with the hand pump (2) until the fuel is free from bubbles. Close and tighten the venting nipple while fuel is running out.
- 4 Remove the hose and fit the protective cap back onto the venting nipple.
- 5 Run the engine at idle for a few minutes to remove any remaining air from the system. Then close the venting nipple (1) on the engine and check that it does not leak.



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## Fuel pre-filter

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

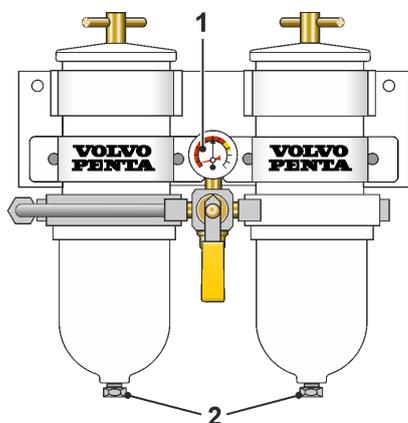
### Checks

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.



p0004926

### Draining

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



P0013077

## Freshwater System

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](http://volvopenta.com).

### **Coolant, Mixing**

It is extremely important that the system is filled with the correct coolant concentration; refer to *Technical Data, page 81*.

The coolant should be mixed with distilled, deionized water. For Volvo Penta specified water requirements; refer to *Technical Data, page 81*.

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

## Coolant Level, Checking and Topping Up

### Check

The coolant level should be about 5 cm (2") below the pressure cap sealing plane in the expansion tank. There is a low coolant level alarm installed as standard, but make sure to check the coolant level anyway every once in a while.

If a separate expansion tank is installed, the coolant level must be between the MAX and MIN markings.

### Topping up

#### **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.

Fill the freshwater system with coolant to the correct level through the filler opening in the expansion tank. For correct level, refer to section *Check*. Fill slowly so that evacuated air is able to pass the filler opening. For coolant specification, refer to *Maintenance, page 66*.

### Filling when the system is empty

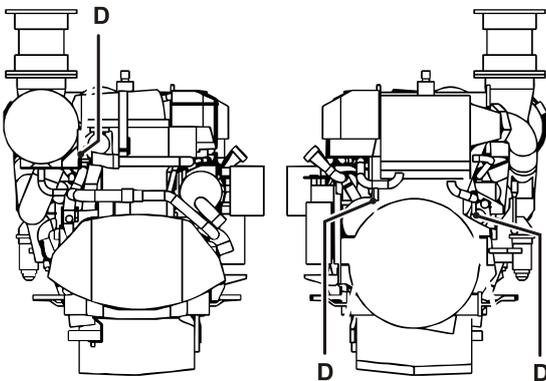
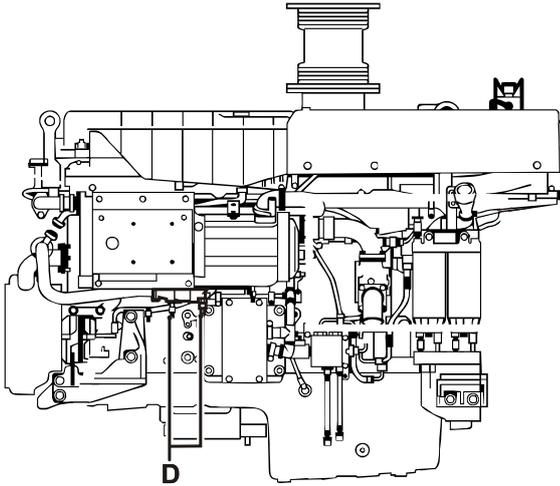
- 1 Make sure that systems connected to the cooling system are ventilated, e.g. heater, water heater.
- 2 Fill the system with coolant through the filler opening in the expansion tank. Fill slowly allowing air to bleed from the filler opening. For correct level, refer to section *Check*.
- 3 Start the engine and let it idle for about 1 hour.

#### **IMPORTANT:**

Never run the engine under full load before the system has been bled and topped up.

- 4 Check air vents for leakage.
- 5 Stop the engine and allow it to cool. Check the coolant level and top up if needed.

## Coolant, Draining



P0006735

- 1 Remove the filler cap from the expansion tank.
- 2 Connect a suitable hose to each drain point (D). Open the drains and allow the coolant to drain off into a suitable vessel.

**IMPORTANT:**

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

- 3 Continue with all the drain points until all have been opened and all coolant has been drained off.
- 4 Drain all other systems connected to the freshwater system, e.g. heater, water heater, etc.
- 5 Close all drains.

## 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 68*.
- 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 *Coolant Level, Checking and Topping Up, page 67*.

## 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!**

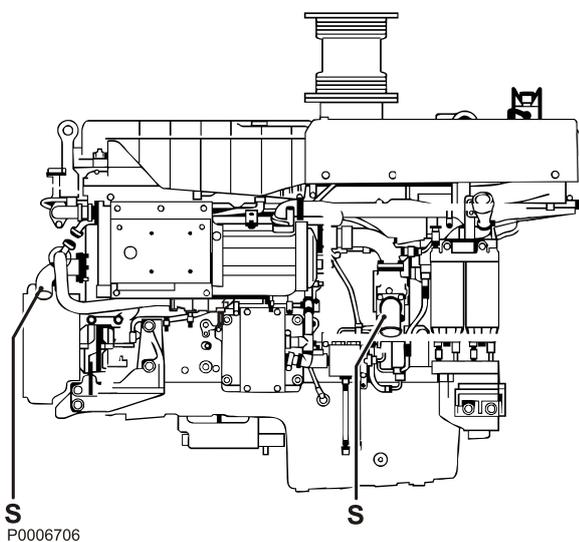
Risk of water entry. Close and drain the raw water system before starting any work on the system.

## Seawater System, Draining

- 1 Close the raw water in- and outlet cocks.
- 2 Connect a suitable hose to each drain point (**S**).  
Open the drains and allow the raw water to drain off into a suitable vessel.

### **IMPORTANT:**

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



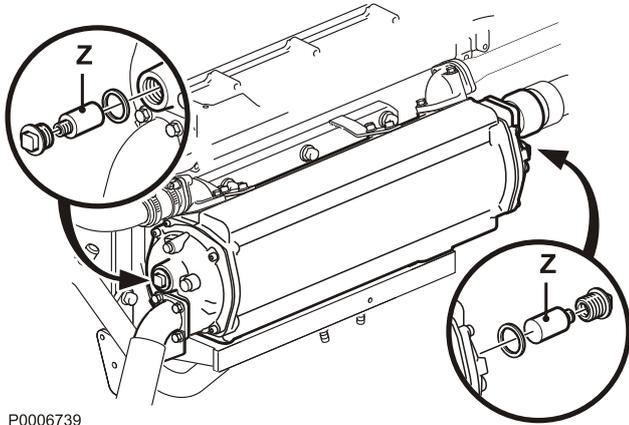
S  
P0006706

D16C-A MG

## Anodes, Check and Change

### **⚠ WARNING!**

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



P0006739

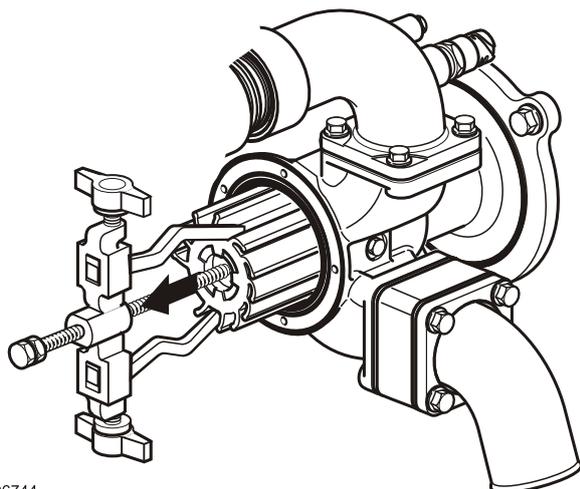
- 1 Close the seawater tap.
- 2 Open the heat exchanger drain tap (1) and drain off the seawater.
- 3 Remove the zinc anodes (Z) (2 pcs.) from the heat exchanger.  
Check that the O-ring is in good condition, otherwise change it.
- 4 Check the zinc anodes and change them if they have been consumed below 1/3 of their original size. If not, clean the zinc anodes with emery cloth to remove the oxide layer before re-installing them.

### **IMPORTANT:**

Use emery paper. Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.

- 5 Install the zinc anodes. When installing, make sure there is good metallic contact between the anode and the casting.
- 6 Close the drain tap (1).
- 7 Open the sea cock before starting the engine.
- 8 Check that there are no leaks.

D16C-A MG



P0006744

## 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 universal impeller puller.
- 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 (counter 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.

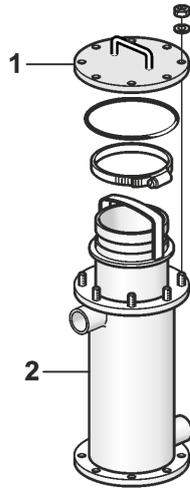
## Seawater Filter, Check and Cleaning

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.



P0003016

- 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.

## Intake Manifold, Checking the Drain Hole

Steam can be formed during operation. Drain the steam via a hole in the bottom of the charge air cooler. Check that the hole is not blocked.

**⚠ CAUTION!**

Burn hazard! Steam may evaporate through the drain hole.

**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.

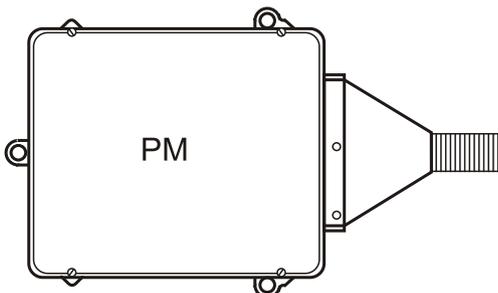
This work should be carried out by an authorized workshop.

## Electrical System

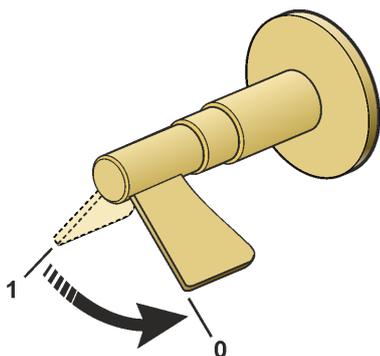
### Power Module

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.



P0006350



P0002576

## Main switch

### **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!

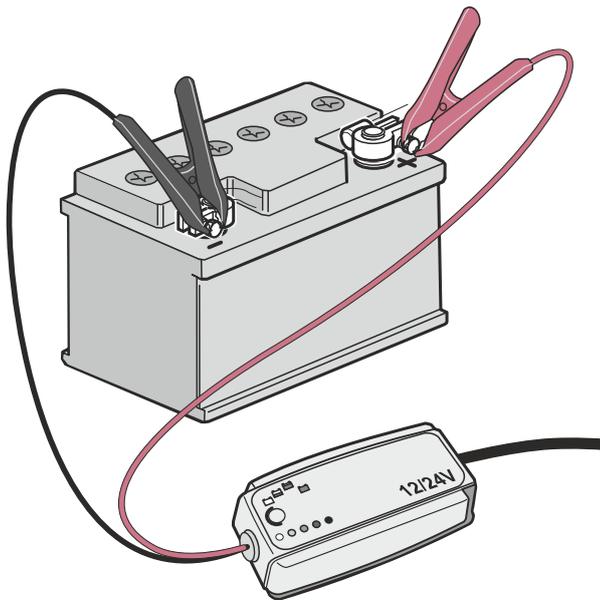
Battery electrolyte is a corrosive acid and should be handled with care. If you spill or splash electrolyte on any part of the body, immediately flush the exposed area with liberal amounts of water and seek medical attention as soon as possible.

### ⚠ 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 manufacturer'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.

## 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.

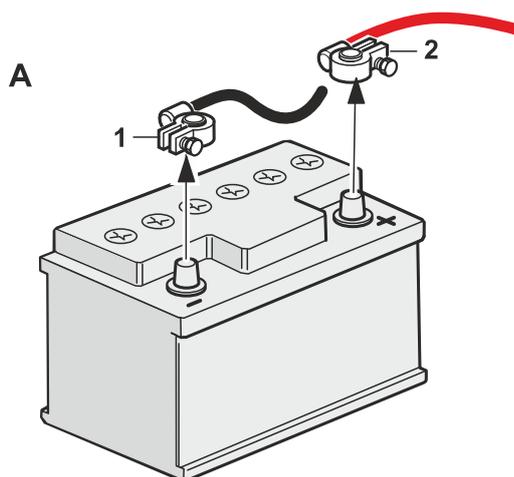
### IMPORTANT:

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).

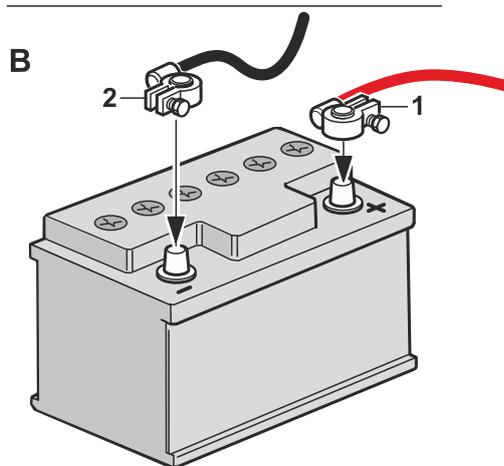
Remove the battery.

### 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.



P0022893

## 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 is 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 78*.
- 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 <sup>(1)</sup> 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 <sup>1</sup> 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 quality and viscosity of oil into the engine, if necessary, refer to *Technical Data, page 79*. 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

## Engine

Product sales designation	D16 MG HE	D16 MG KC	D16 MG RC
Product designation	D16C-A D16C-D	D16C-A D16C-D	D16C-A D16C-D
Power, prime/stand-by	450/495 kW @1500 479/527 kW @1500 500/550 kW @1800 532/585 kW @1800	450/495 kW @1500 479/527 kW @1500 500/550 kW @1800 532/585 kW @1800	433/476 kW @1500 460/508 kW @1500 470/517 kW @1800 498/551 kW @1800
No. of cylinders	6	6	6
Bore	144 mm	144 mm	144 mm
Stroke	165 mm	165 mm	165 mm
Displacement	16,12 dm <sup>3</sup>	16,12 dm <sup>3</sup>	16,12 dm <sup>3</sup>
Compression ratio	17,5:1	17,5:1	17,5:1
Engine, dry weight	1770 kg	1716 kg	1945 kg

## Lubrication System

Oil capacity incl. oil filters, approx.	
no inclination	55 liters (14.5 US gals)
volume difference MIN – MAX	10 liters (2.6 US gals)

## Oil quality and oil change interval

VDS-3, VDS-4, VDS4.5	<b>500</b> hours or 12 months
----------------------	-------------------------------

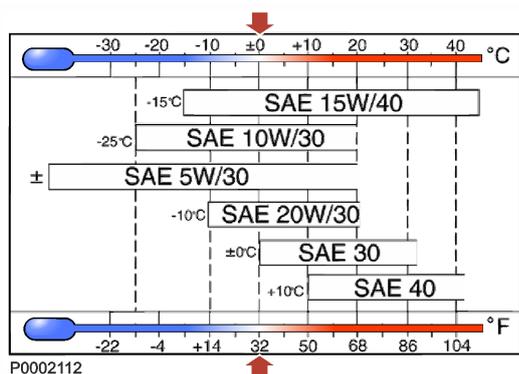
## VDS (Volvo Drain Specification)

## Viscosity

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 engines will be compliance with emission legislation, if the engine is maintained according to service instructions and used according to intended purpose.

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<sup>3</sup>**  
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<sup>3</sup>**  
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<sup>2</sup> 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.

## Freshwater System

	D16 MG HE	D16 MG RC	D16 MG KC
Engine, incl. heat exchanger	56 liters		
Engine Radiator		38 liters 95 liters	38 liters



P0013077



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 <sub>2</sub> /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 <sub>Mn</sub> (acc. ISO8467)	<15 mg KMnO <sub>4</sub> /l

## Electrical System

<b>System voltage</b>	24 V
<b>AC alternator</b>	
voltage/max. amperage	28 V / 110 A
output, approx.	2240 W
<b>Battery electrolyte density at +25°C (77°F)</b>	
fully charged battery	1.28 g/cm <sup>3</sup> = 0.0462 lb/in <sup>3</sup>
battery recharged at	1.13 g/cm <sup>3</sup> = 0.0408 lb/in <sup>3</sup>

# Identification Numbers

## Engine (A)

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

## Engine plate (B)

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

## Warranty decal (C)

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

## Serial number and CHASSIS ID (D)

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

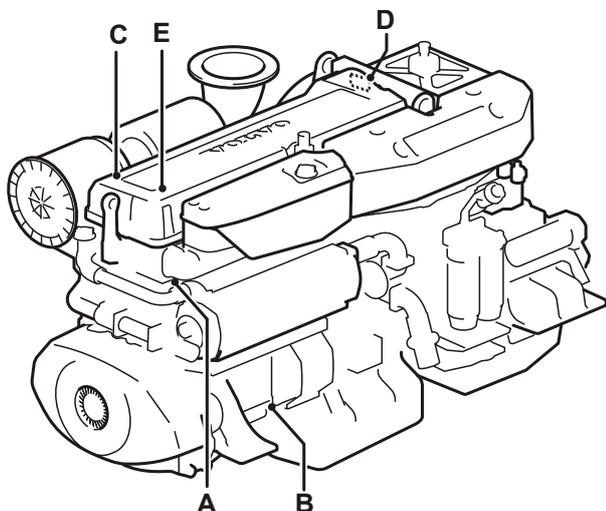
## Certification label (E)

## Certification plate (classified genset) (F)

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

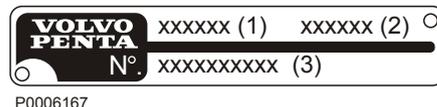
## Generator plate (G)

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



Stamped in engine block

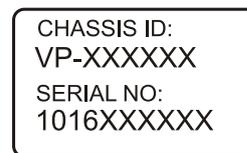
## B



## C



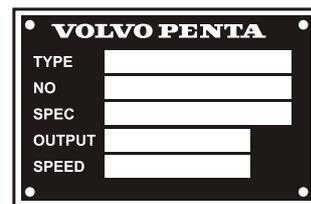
## D



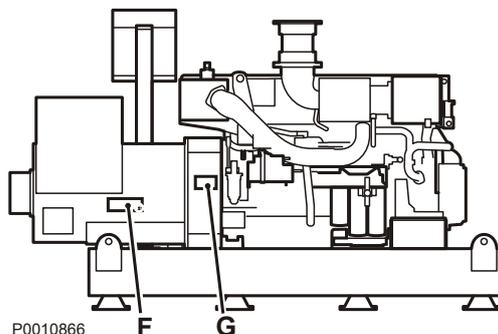
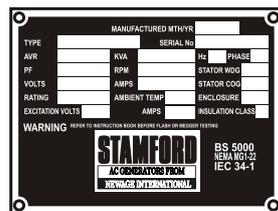
## E



## F



## G





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<b>A</b>		<b>R</b>	
About this Manual.....	13	Reading the Instruments.....	31
Acknowledge message.....	36	Recording engine data.....	16
After Engine Shutdown.....	34	Running in the engine.....	14
Air Filter, Check and Replace.....	55	<b>S</b>	
Alarm List.....	37	SDU Indications.....	28
Alarms.....	26, 31	Seawater Filter, Check and Cleaning.....	72
Anodes, Check and Change.....	70	Seawater System.....	69
<b>B</b>		Seawater System, Draining.....	69
Battery.....	74	Settings.....	24
Before Engine Shutdown.....	33	Shutdown Unit (SDU).....	27
Before Starting.....	29	Starting the Engine.....	29
Bringing Out of Storage.....	78	Starting Using Auxiliary Batteries.....	47
<b>C</b>		Stop the Engine.....	33
Certified Engines.....	17	Switchable oil filters.....	60
Cold Weather Precautions.....	35	<b>V</b>	
Coolant Level, Checking and Topping Up.....	67	Viscosity.....	79
Coolant, Draining.....	68	Volvo Penta Action Service.....	18
<b>D</b>		Volvo Penta Dealer Network.....	18
Drive belt, check and change.....	56	<b>W</b>	
<b>E</b>		Warranty.....	14
Electrical Connections.....	73		
Electrical System.....	72		
Electrical Welding.....	76		
Engine Fuel Filter Replacement.....	62		
Engine Oil, Change.....	58		
Engine, General.....	55		
Environmental care.....	16		
Excessive strain on a product and components.....	15		
<b>F</b>			
Fault Tracing.....	39		
Freshwater System.....	66		
Freshwater system, Flushing.....	68		
Fuel pre-filter.....	65		
Fuel System.....	61		
Fuel system, bleeding.....	64		
Fuel, oils and coolant.....	14		
<b>I</b>			
Identification Numbers.....	83		
Impeller, Check and Change.....	71		
Intake Manifold, Checking the Drain Hole.....	72		
<b>L</b>			
Lubrication System.....	57		
<b>M</b>			
Main switch.....	73		
Maintenance and replacement parts.....	15		
Maneuvering.....	32		
Marine Commercial Control System (MCC).....	19		
MCC system, Overview.....	20		
Menus.....	23		
<b>O</b>			
Oil Filter/By-pass Filter, Change.....	59		
Oil level, checking and topping up.....	57		
Operation Break.....	35		
<b>P</b>			
Power Module.....	72		



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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 nach der 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 tramite Internet, 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.

**DUT**

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

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

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.

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

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 encomendada 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.

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

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.

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

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

**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.

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

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

**JPN**

このオペレーターズ マニュアルの他言語版が、発行後最高12か月間、インターネットより無料で発注可能です。

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

インターネットにアクセスできない場合は、担当のボルボペンタディーラーまでご連絡ください。

**VOLVO  
PENTA**

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