

OPERATOR'S MANUAL

D12 MG Genset Engine

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Foreword

Thank you for purchasing this Volvo Penta Marine Auxiliary Engine.

The Operator's Manual contains operation instructions and maintenance and inspection information. In order to ensure safety and bring out the maximum performance of the engine, do not operate it until you have read and fully understood the contents of this manual. Also do not operate the engine unless in compliance with local regulations.

For information on genset and/or generator specific items refer to generator information supplied by genset builder and/or generator manufacturer. In case of contradictions, the information in this Volvo Penta Operator's Manual overrules any information given in the documentation provided by the generator manufacturer. Do not hesitate to consult your Volvo Penta dealer.

Failure to follow the instructions and cautions in this manual may result in serious accidents.

* Keep this manual at hand for easy reference.

* If this manual is damaged or misplaced, immediately order a new one from your dealer.

All information and illustrations in this manual are based on the specifications that were available at the time of printing. This manual does not cover all available variants of accessories and options.

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Safety Information

Read this chapter thoroughly. It concerns your safety. This section describes how safety information is presented in this manual and on the product. It also includes a summary of basic safety regulations for operation and maintenance of the engine.


This Operator's Manual is only valid for the auxiliary engine built in the Volvo Penta factory. Make sure you are in possession of the right operator's manual before reading on. If this is not the case, please get in touch with your Volvo Penta dealer.


If operations are performed incorrectly it could result in personal injury or damage to property or the engine. Read the Operator's Manual carefully before operating or servicing the engine. For safety information on genset operation and maintenance of the generator, refer to the documentation provided by the genset builder. If anything is unclear please contact your Volvo Penta dealer for assistance.




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

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

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

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

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

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

Safety regulations during engine operation

The new engine

Read instruction manuals and other information accompanying the new vessel thoroughly. Accustom yourself with handling the engine, controls and other equipment in a safe and correct manner.

Remember that when operating a vessel, you have a legal responsibility to be aware of and follow regulations concerning traffic and safety at sea. Inform yourself of the regulations applicable to your vessel and the waters you're in by getting in touch with the relevant authorities or marine safety organization.

Accidents and other incidents

Sea rescue statistics show that deficient maintenance of vessels and engines together with defective safety equipment often causes accidents and other incidents at sea.

Make sure your vessel and engine are maintained in accordance with directions in the instruction manuals and that the safety equipment on board is in good working order.

Daily inspection

Make a habit of visually inspecting the engine and engine room before starting and after stopping the engine. This will help you to quickly detect any fuel, coolant or oil leaks and any other abnormalities that have occurred or are about to occur.

Maneuvering

Avoid violent and rapid rudder movement and gear shifting. There is a risk of the passengers falling down or falling overboard. A rotating propeller can cause serious injury. Make sure there is nobody in the water before engaging forward/reverse. Never run close to bathers or in places where you have reason to believe there are people in the water.

Filling fuel

There is a risk of fire and explosion when filling fuel. Smoking is prohibited and the engine must be turned off. Never overfill the tank. Close the filler cap securely. Use only fuel recommended in the operators manual. The incorrect grade of fuel can disturb operation or cause breakdown. This can also lead to the control rod jamming on diesel engines, which will cause the engine to overspeed and risk damaging machinery and causing personal injury.

Combustible environment

Due to the risk of fire and/or explosion, do not start or continue to run the engine if there is a suspected leak or discharge of combustible media, e.g. fuel oil or LPG, in the engine surroundings.

Carbon monoxide poisoning

When a vessel is moving forward, it will cause a certain vacuum to form behind the vessel. In unfortunate circumstances, the suction from this vacuum can be so great that the exhaust gases from the vessel are drawn into the bridge or cabin and cause carbon monoxide poisoning. This problem is most prevalent on high, wide vessels with abrupt stern. Other factors that can increase the effect of the suction are wind conditions, load distribution, swells, trim, open hatches and portholes, etc. Most modern vessels, however, are designed in such a way that this problem is very rare. If suction should arise anyway, do not open hatches or portholes at the fore of the vessel. Surprisingly, this will otherwise increase the suction. Try changing speed, trim, or load distribution instead. Get in touch with your Volvo Penta dealer for help in obtaining the best solution for your vessel.

Safety directions for maintenance and service

⚠ Preparations

Knowledge

The operator's manual contains directions for performing normal maintenance and service in a safe and correct manner. Read the directions carefully before starting work. More detailed service literature is available from your Volvo Penta dealer. Never perform a task unless you are absolutely sure how it is to be carried out; call your Volvo Penta dealer for assistance instead.

Stop the engine

Stop the engine before opening or dismantling the engine hatch/hood. Maintenance and service must be carried out with the engine stationary unless stated otherwise in the instructions. Prevent inadvertent start of the engine by removing the starter key and turning off the power with the main switch, locking it in the off position. Place warning signs stating that service is in progress in every position from which the engine can be started. Working on or approaching a running engine is a safety hazard. Loose clothing, hair, fingers or a dropped tool can be caught in rotating parts and cause serious bodily injury. Volvo Penta recommend leaving all work requiring the engine to be running to an authorized Volvo Penta dealer.

Lifting the engine

Always use the lifting eyes mounted on the engine when lifting the engine. Always make sure lifting equipment is in good condition and constructed for the lift (engine weight together with possible reverse gear and extra equipment). Use an adjustable lifting boom to ensure safe handling when lifting the engine. All chains and wires must run parallel with each other and as much at right angle as possible to the top of the engine. Note that any extra equipment mounted on the engine can change the center of gravity. Special lifting devices may be required to obtain the right balance and safe handling. Never perform service on an engine suspended only from a lifting device.

⚠ IMPORTANT! Engine must only be lifted horizontally.

Before starting

Refit all guards and covers that have been removed before starting the engine. Make sure there are no tools or other objects left on the engine. A turbocharged engine must never be started without the air filter fitted. The rotating compressor wheel in the turbocharger can cause severe personal injury.

There is also a risk of foreign objects being drawn in and causing mechanical damage.

⚠ Fire and explosion

Fuel and lubricants

All fuels, most lubricants, and many chemicals are flammable substances. Always read and follow the directions on the packaging. Work performed on the fuel system must be done on a cold engine. Fuel leaks and spills on hot surfaces or electrical components can cause fires.

Keep oil- and fuel drenched rags and other hazardous materials where they are safe in case of fire. Oil drenched rags can selfignite in certain conditions. Never smoke when refueling, topping up with oil or when in the vicinity of the fuel station or the engine room.

Non-original parts

Components in fuel, lubrication, ignition and electrical systems on Volvo Penta engines are designed and manufactured to minimize the risk of explosion and fire in compliance with existing legislation.

The use of non-original parts can result in explosion or fire.

Batteries

Batteries contain and generate oxyhydrogen gas, especially when charging. Oxyhydrogen is easily ignited and extremely explosive. Smoking, open flames and sparks must never occur in, or close to, the batteries or battery compartment. A faulty battery connection or jumper cable can generate sparks that can cause the battery to explode.

Start spray

Never use start spray or similar start help. Explosions can occur in the intake manifold. Risk for personal injury.

⚠ Hot surfaces and fluids

At operating temperature, the engine and its components are hot. A hot engine always involves risk for burn injuries. Take care with hot surfaces. E.g.: exhaust manifold, turbocharger, oil pan, charge air pipe, starting heater, hot coolant and warm lubricant in pipes and hoses.

⚠ WARNING! Do not open the crankcase covers while the engine is still hot.

⚠ Carbon monoxide poisoning

Start the engine in well-ventilated spaces only. When running in confined spaces, the exhaust gases and crankcase gases must be evacuated.

⚠ Chemicals

Most chemicals such as glycol, anti-corrosion agent, preservatives, degreasing agent, etc., are hazardous to health. Always read and follow the directions on the packaging.

Certain chemicals such as preservatives are flammable and harmful to inhale. Provide good ventilation and use breathing protection when spraying. Always read and follow the directions on the packaging. Store chemicals and other hazardous materials out of reach of children. Leave left over or used chemicals to a destruction plant.

⚠ Cooling system

There is a risk of water entering when working on the seawater system. Therefore, stop the engine and close the seawater cock before starting work.

Avoid opening the coolant filler cap when the engine is warm. Steam or hot coolant may spurt out and cause burn injuries.

If the filler cap, coolant pipe, cock, etc., must nevertheless be opened or dismantled while the engine is warm, the filler cap must be opened carefully to release the pressure before removing it completely and starting work. Note that the coolant can still be hot and cause burn injuries.

⚠ Lubricating system

Hot oil can cause burn injuries. Avoid skin contact with warm oil. Make sure the lubricating system is depressurized before starting work. Never start or run the engine with the oil filler cap removed or there will be a risk of the oil being thrown out.

⚠ Fuel system

Always protect your hands when carrying out leak detection.

Escaping fluids under pressure can pierce bodily tissue and cause serious injury. Risk of blood poisoning. Always cover any electric component if it is located under the fuel filter. Otherwise it might be damaged by fuel spills.

⚠ Electrical system

Turn off the power before commencing work on the electrical system, the engine must be stopped and the powered turned off with the main switch/switches. Shore power to the engine heater, battery charger or other extra equipment fitted to the engine must be disconnected.

Batteries

Batteries contain a highly corrosive electrolyte. Protect your eyes, skin and clothing when charging and handling batteries. Always use protective goggles and gloves.

In case of splashes on the skin, wash with soap and plenty of water. In case of splashes in the eyes, rinse immediately with plenty of water and call a doctor.

Avoid burns and crushing or cutting!

At operating temperature, the engine coolant is hot and under pressure. Steam can cause personal injury. Check the coolant level only after the engine has been stopped and the coolant filler cap has cooled enough to touch with your hand. Never adjust the V-belts while the engine is running.

Service batteries carefully!

If you spill electrolyte on yourself, flush skin immediately with lots of water. Apply baking soda to help neutralize the acid. If electrolyte gets in your eyes, rinse immediately with large amounts of water then contact a doctor at once.

Handle antifreeze carefully!

Antifreeze contains alkali. Avoid contact with skin and eyes to prevent personal injury. Dispose of drained antifreeze coolant according to local regulations. For disposal, consult your dealer.

Dress properly for the job!

Wear protective devices - hard hat, face shield, safety shoes, goggles, heavy gloves, ear protectors, etc. - for your own safety.

Recommended fuel, lubrication oil and coolant!

Use of any other fuel oil, lubrication oil or coolant than the recommended can cause engine damage and reduce engine service life.

Perform all recommended inspections!

Perform pre-start inspection and periodic inspection on items listed in this manual. Failure to follow this recommendation can cause serious engine damage.

Introduction

This operator's manual has been produced to give you the greatest benefit of your Volvo Penta auxiliary engine. It contains the information necessary to handle and maintain your engine in a safe and correct manner. We would like you to read this operator's manual thoroughly and learn how to handle the engine, controls and other equipment in a safe manner before starting the engine.

Keep the operator's manual within reach at all times.

Care of the environment

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

As a manufacturer of marine engines Volvo Penta has a special responsibility. That is why care of the environment is a core value in our product development. Volvo Penta has a broad range of engines where progress has been made in reducing exhaust emissions, fuel consumption, engine noise, etc. We hope you will take part in preserving these qualities.

Always follow any advice given in the operator's manual concerning fuel grades, operation and maintenance and you will avoid causing unnecessary interference to the environment. Get in touch with your Volvo Penta dealer if you notice any changes such as increased fuel consumption and/or exhaust smoke.

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

Fuel and oil

Use only fuel and lubrication oil grades recommended in the technical data section of this Operator's Manual. Other grades can cause operational problems, increase fuel consumption and have long-range effects on engine service life.

Service and spare parts

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

The worldwide Volvo Penta network of authorized dealers is at your service. They are specialists in Volvo Penta products and stock accessories, original spare parts, test equipment and the special tools required to perform high-quality service and repairs.

Always follow the maintenance intervals specified in the operator's manual and remember to specify the engine number when ordering service and spare parts.

Certified engines

It is essential that owners and operators of emission certified engines, used in areas where exhaust emissions are regulated by law, are aware of the following points:

A certification involves the engine type being checked and approved by applicable authorities. Engine manufacturers guarantee that all engines of the same type correspond with the certified engine.

This puts special demands on the maintenance and service of your engine:

- * Maintenance and service intervals recommended by Volvo Penta must be followed.
- * Only Volvo Penta original spare parts may be used.
- * Service of injector pumps, pump settings and injectors must always be performed by an authorized Volvo Penta service person.
- * The engine must not be modified in any way with the exception of accessories and service kits approved by Volvo Penta for use on the engine.
- * Installation modifications must not be made to the engine exhaust pipe or inlet channels.
- * Sealed sections must not be broken by anyone other than authorized personnel.

Otherwise, general directions concerning running, care and maintenance given in the operator's manual apply.



IMPORTANT! Neglected or deficient maintenance/service and the use of non-original spare parts will entail Volvo Penta renouncing any responsibility for the engine corresponding to the certified version. Volvo Penta will not compensate for damage and/or costs arising from the above.

Warranty

Your new Volvo Penta auxiliary engine is covered by a limited warranty complying with the conditions and instructions given in the Warranty and Service Book.

Note that AB Volvo Penta's responsibility is limited to what is specified in the Warranty and Service Book. Read it carefully as soon as possible after delivery. It contains important information concerning the warranty card, service, maintenance and what the owner is responsible to be aware of, check and perform. AB Volvo Penta will otherwise decline warranty liability completely or fully.

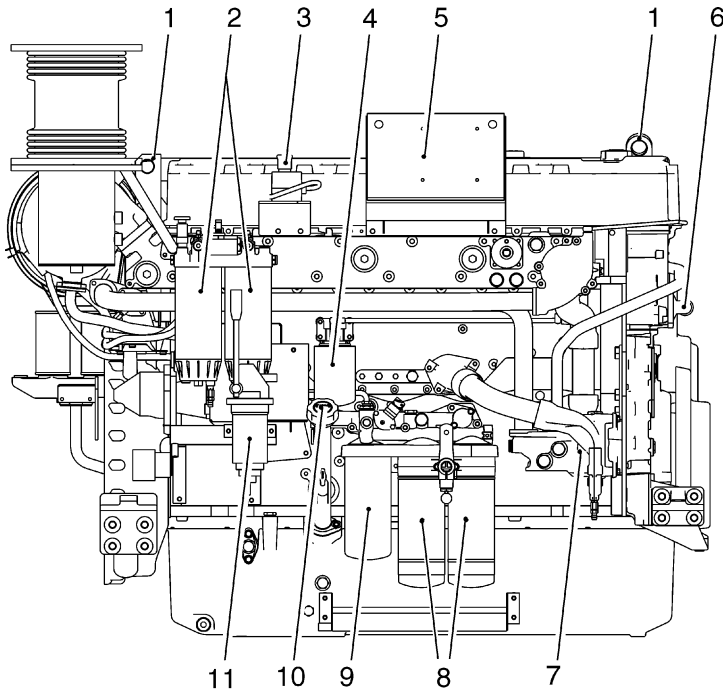
Get in touch with your Volvo Penta dealer if you have not received a Warranty and Service Book or a copy of the warranty card.

Presentation

D12 MG HE Genset engine

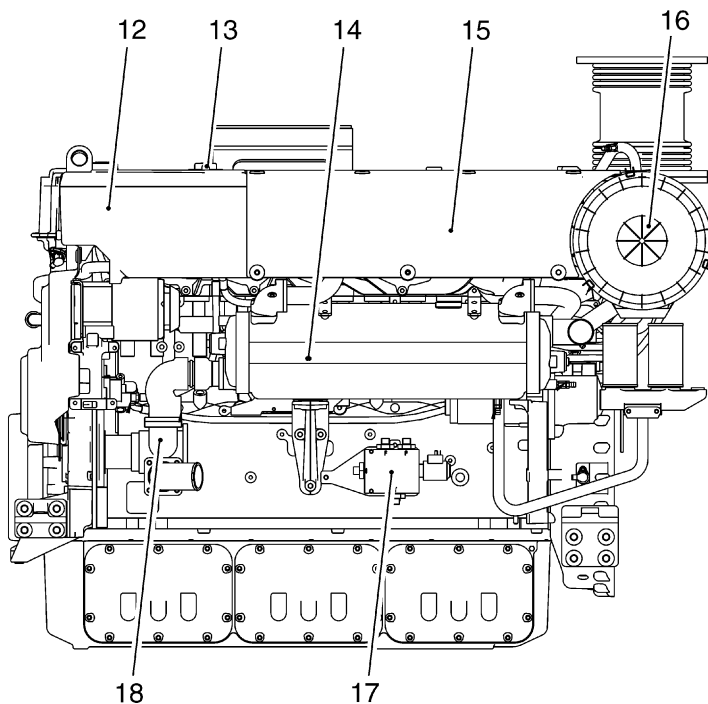
The D12 MG HE is a turbocharged, in-line, direct injection, 6-cylinder, 4-stroke marine engine. It is equipped with an engine mounted heat exchanger suitable for seawater cooling or connection to a central cooling system.

Different starting and control systems are available.



D12 MG HE Genset engine

1. Lifting eyes
2. Switchable fuel filters w. water separator
3. Emergency stop button
4. Coolant filter
5. Electrical connection box
6. Conn. for crankcase ventilation
7. F.W. pump
8. Switchable oil filters (optional)
9. Oil by-pass filter
10. Lubrication oil filling
11. Oil drain pump(optional)

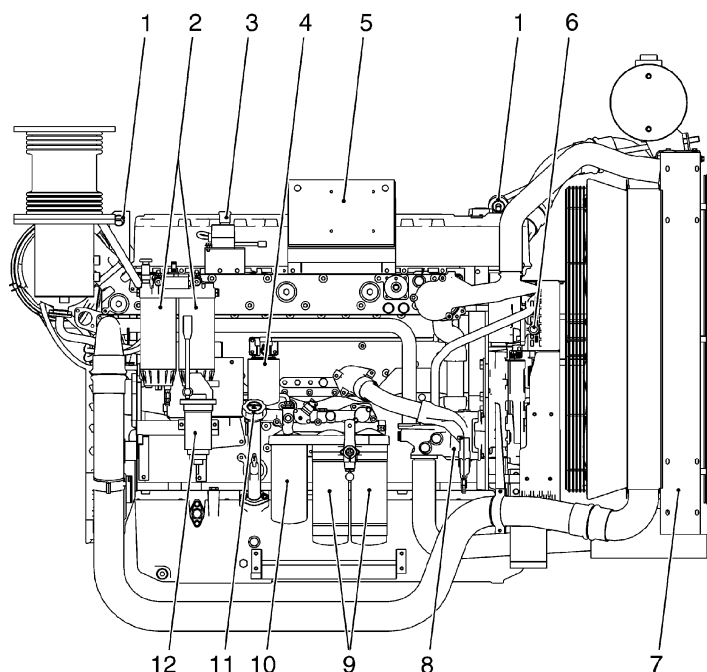


12. Expansion tank
13. Pressure cap expansion tank
14. Heat exchanger
15. Air cooler (beneath the cover)
16. Air filter
17. Fuel shut-off valve
18. Raw water pump

D12 MG RC Genset engine

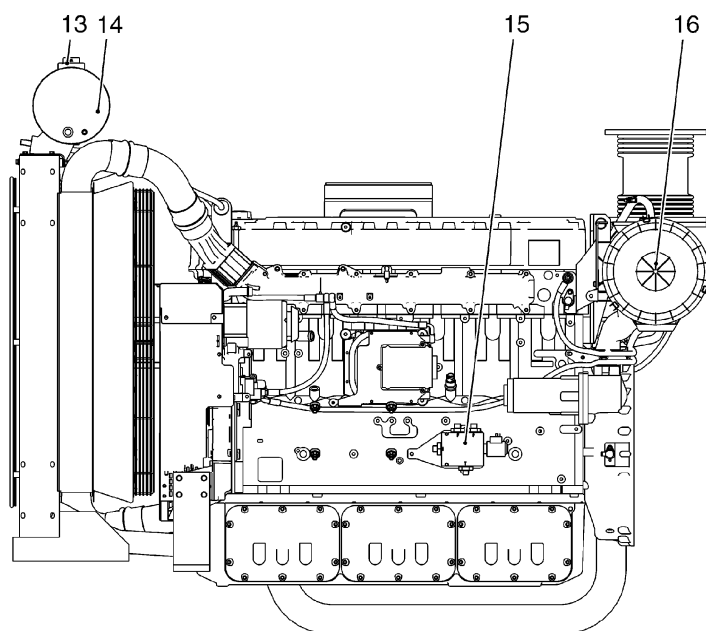
The D12 MG RC is an in-line, direct injection, 6-cylinder, 4-stroke marine engine equipped with radiator cooling.

Different starting and control systems are available.



D12 MG RC Genset engine

1. Lifting eyes
2. Switchable fuel filters w. water separator
3. Emergency stop button
4. Coolant filter
5. Electrical connection box
6. Conn. for crankcase ventilation
7. Radiator
8. F.W. pump
9. Switchable oil filters (optional)
10. Oil by-pass filter
11. Lubrication oil filling
12. Oil drain pump(optional)

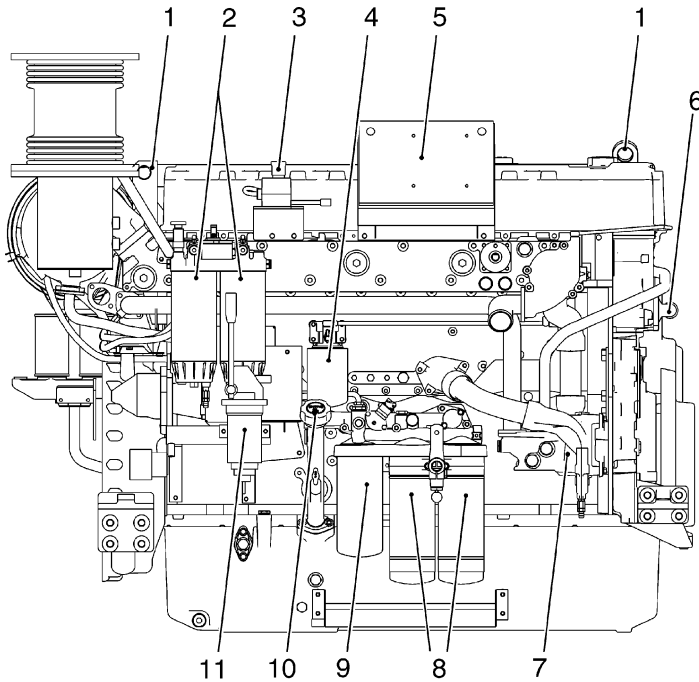


13. Pressure cap expansion tank
14. Expansion tank
15. Fuel shut-off valve
16. Air filter

D12 MG KC Genset engine

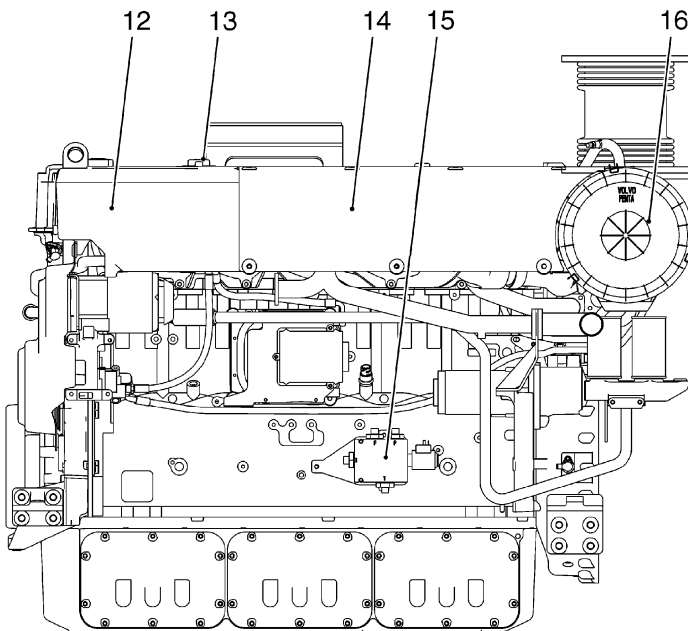
The D12 MG KC is a turbocharged, in-line, direct injection, 6-cylinder, 4-stroke marine engine. It is fitted with connections for keel cooling.

Different starting and control systems are available.



D12 MG KC Genset engine

1. Lifting eyes
2. Switchable fuel filters w. water separator
3. Emergency stop button
4. Coolant filter
5. Electrical connection box
6. Conn. for crankcase ventilation
7. F.W. pump
8. Switchable oil filters (optional)
9. Oil by-pass filter



10. Lubrication oil filling
11. Oil drain pump(optional)
12. Expansion tank
13. Pressure cap
14. Air cooler (beneath the cover)
15. Fuel shut-off valve
16. Air filter


New engine initial service

General

Before starting a new or reconditioned engine for the first time, give it an initial inspection. This to guarantee your own safety as well as the maximum service life of the engine.

External inspection


1. Check the control system for loose terminals.
2. Look for defects on engine parts.
3. Check the following components for loose bolts or nuts:
 - * Plugs and covers of fuel, lubrication and cooling system
 - * Coupling of fuel injection pump and shaft
 - * Mounting brackets
 - * Fuel control link
 - * Turbocharger
 - * Timing gear case
 - * Exhaust manifolds
 - * Cylinder heads
 - * Air-duct connection-hose clamp
4. Check for fuel, oil, coolant and air leaks and repair if needed.
5. Make commissioning report for new or overhauled engine.

 **IMPORTANT!** All covers on the engine must be mounted before attempting to start your engine.

Valves and plugs

Make sure the following valves and plugs are open or closed properly:

Fuel supply valve	Open
Coolant drain cocks	Closed

 **IMPORTANT!** If the coolant drain cocks are not closed the coolant will drain from the engine and this may cause severe damage to the engine.

Electrical wiring

Check for loose or damaged electrical wiring on the engine. If necessary firmly reconnect to terminals or cable-joint portions. Damaged cables must be replaced.

If your engine is reconditioned, make sure the wiring is according to the drawings.

Filling fuel system

Refer to chapter "Maintenance: Fuel system".

Filling lubrication system




Refer to chapter "Maintenance: Lubrication system".

Filling cooling system


Refer to chapter "Maintenance: Cooling system".

Starting

Before starting

-  **WARNING!** Before starting the genset make sure that neither people, nor tools, are in contact with moving parts of the engine or the generator. Notify the people in the vicinity of the genset when starting.
-  **WARNING!** Make sure that you know how to stop the genset before you start it (in case of emergency). If you are starting the genset for the first time, be prepared to stop the engine immediately in case abnormal noise should occur during start up.
-  **IMPORTANT!** If the starter motor has been engaged for the maximum time (30 seconds), it must be allowed to cool down for at least one minute before a new attempt is made at starting.

Warming-up

-  **WARNING!** Do not conduct warm-up operation for an extended period of time. Prolonged warm-up operation causes carbon buildup in the cylinders that leads to imperfect combustion.

NOTE! To warm up the engine operate at no load for a short time and then apply a low load.

NOTE! If the lubrication oil pressure does not increase when you have started the engine, immediately stop the engine and do not restart until the problem has been fixed.

NOTE! Make sure that the cooling water flow is sufficient.



Start using auxiliary batteries

⚠ WARNING! Ventilate well. Batteries generate oxyhydrogen gas, which is extremely flammable and explosive. A short circuit, naked flame or spark can cause a powerful explosion.

Never reverse the polarity of the battery. Risk of sparks and explosion.

1. Make sure the rated voltage of the auxiliary battery is the same as the system voltage of the engine.
2. Connect the red auxiliary cable to the discharged battery's + terminal and then to the auxiliary battery's + terminal.
3. Connect the black jump lead to the auxiliary battery negative terminal and then to a position slightly away from the discharged batteries, for example at the negative cable's connection to the starter motor.

⚠ WARNING! The black auxiliary cable (–) must not come in contact with the positive connection on the starter motor.

4. Start the engine and run at no load for about ten minutes to charge the batteries.

⚠ WARNING! Do not touch the connections while attempting to start; Risk of sparks. Do not bend over the batteries either.

5. Stop the engine. Remove the auxiliary cables in reverse order to connecting.

Marine Commercial Control

This chapter describes functions and operation of the Marine Commercial Control system (MCC) and the MCU (Marine Control Unit).

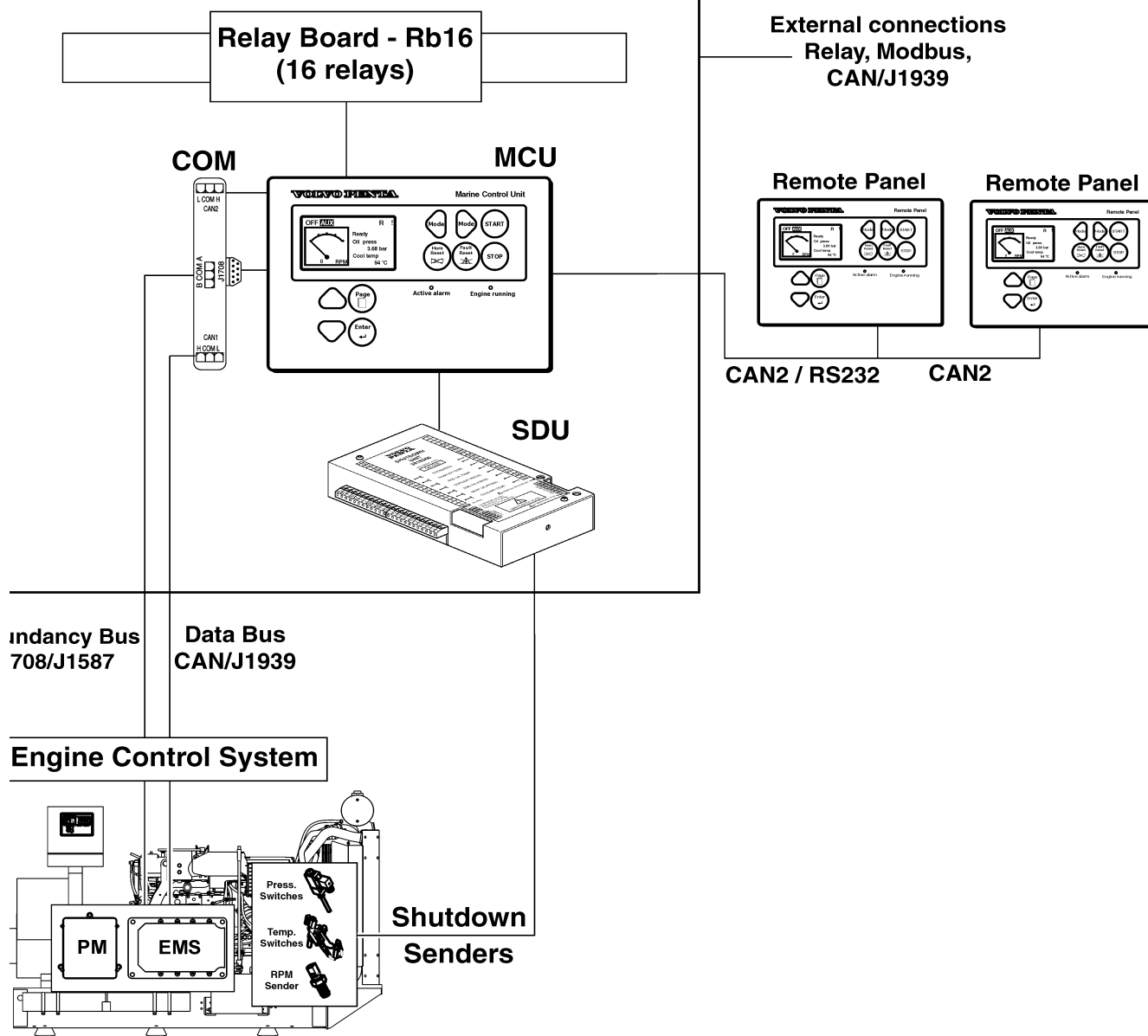
Applications and Modes

The MCC system can be configured for different applications. Auxiliary (AUX), Emergency (EME), Combined (CMB) and Propulsion (PRP). The difference lies in the configuration file for the software and in the connections between the MCU and SDU. In each application the system operate in a number of modes.

Application	Modes	Interface to Start/Stop the engine	Note
Auxiliary	OFF-AUX	Blackout start on terminal Start on terminal Stop on terminal Start button on MCU and RP Stop button on MCU and RP	Blackout start will give the number of start attempts specified in the setpoint "Crank attempts". Default is 3 start attempts, for unlimited, set to zero (0).
Emergency	OFF-EME	Blackout start on terminal Start on terminal Stop on terminal Start button on MCU and RP Stop button on MCU and RP	Blackout start will give the number of start attempts specified in the setpoint "Crank attempts". Default is 3 start attempts, for unlimited, set to zero (0).
Combined	OFF-EME-HRB	In EME Mode Blackout start on terminal Start on terminal Stop on terminal Start button on MCU and RP Stop button on MCU and RP In HRB Mode Start on terminal Stop on terminal Start button on MCU and RP Stop button on MCU and RP	Blackout start will give the number of start attempts specified in the setpoint "Crank attempts". Default is 3 start attempts, for unlimited, set to zero (0). Blackout start inactive. Controller operates like in AUX mode.
Propulsion	OFF-PRP	Start on terminal Stop on terminal Start button on MCU and RP Stop button on MCU and RP	Only on variable speed engines. Blackout start inactive

MCC system overview

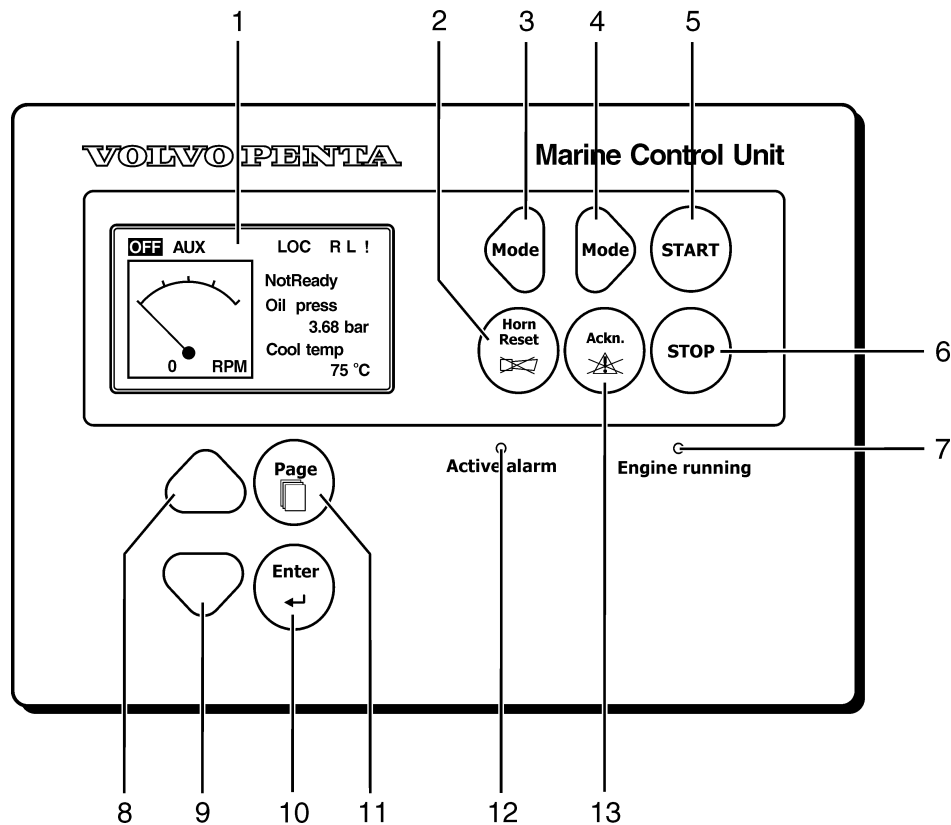
Connection Box, Engine Room



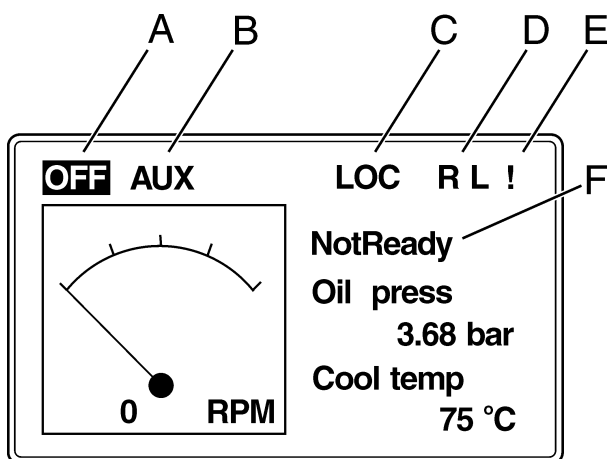
Terminology

MCC	Marine Commercial Control, name of the over all system.
MCU	Marine Control Unit, the central control unit of the system.
SDU	Shutdown Unit, for engine protection. Activates a fuel shut-off valve to shut down the engine. Separated from the engine control system, all functions hard wired.
COM	Communication Module, for J1708/J1587 and CAN2 bus (for RP and other extension modules).
RP	Remote Panel, additional display panel for remote monitoring.
EMS	Engine Management Systemmonitors engine status and handles engine speed and torque governing and overall control of fuel injection and emission control algorithms.
PM	Power Module, handles power distribution and power management. It also monitors power supply and switches to secondary power.

MCU Panel layout

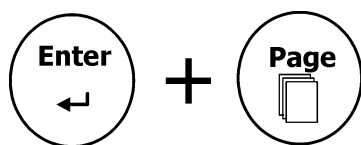


- | | |
|---|---|
| 1. LCD display | 7. LED - Engine running |
| 2. Horn reset (stops sound alarm) | 8. Up button (Select and Increase) |
| 3. Mode Left, toggles modes backwards
[Off - AUX(EME,HRB,PRP)] | 9. Down button (Select and Decrease) |
| 4. Mode Right, toggles modes forwards
[Off - AUX(EME,HRB,PRP)] | 10. Enter (confirmation of selection) |
| 5. Start button | 11. Page, toggles screens
(Measurement - Adjustment - History) |
| 6. Stop button | 12. LED - Active alarm |
| | 13. Acknowledge button |



Display

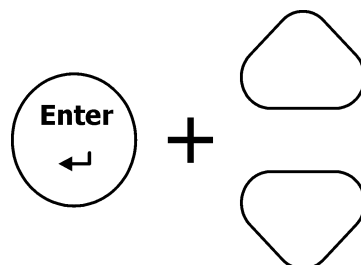
- A. Highlighted indicates OFF-mode
- B. Highlighted indicates operational mode
AUX (EME, HRB or PRP)
- C. Indicates Local mode
- D. R - Remote connection
(Slave Panel or PC Software)
- L - Access lock
- ! - Active alarm
- F. Engine state (NotReady - Ready - Running)



Info

Serial number and software revision

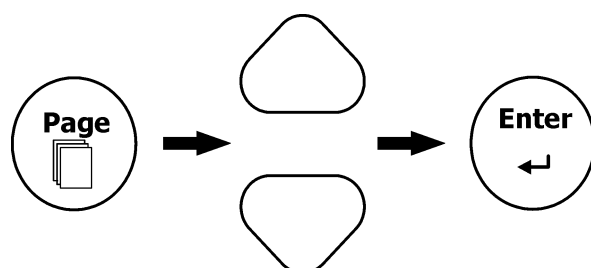
In the main view, push and hold ENTER button and then push PAGE button. Controller INFO screen is displayed for 10 seconds.



MCU adjustments

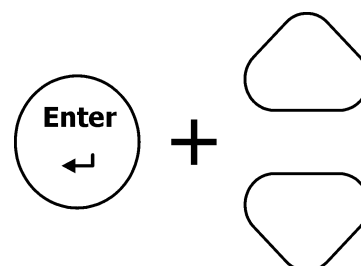
Backlight - INFO view

In the INFO view, push and hold the ENTER button. Adjust the brightness with UP or DOWN button .



Change language - INFO view

In the INFO view, push PAGE to go to Language screen. Use Up and Down buttons to select language and push ENTER button to confirm selection and exit window.



Contrast - MAIN view

In the MAIN view, push and hold the ENTER button and adjust the contrast by pushing the DOWN or UP buttons.

Enter password

Password is a 4 digit code.

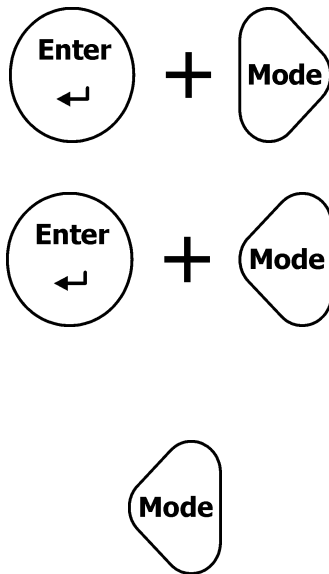
1. Select Adjustment view (C1).
2. Select PASSWORD (C1) with UP or DOWN buttons. Confirm with ENTER button.
3. Select ENTER PASSWORD (C2) with UP or DOWN buttons. Confirm with ENTER button.
4. Select digits with UP or DOWN buttons. Confirm with ENTER button.

Switch between primary and secondary speed.

Follow this procedure to switch between primary and secondary speed.

1. Enter password
2. Go to setpoint "Speed select" in the "Basic Settings page" (C3)
3. Push STOP button (approx. 1 s.)
4. Change to new value
5. Push STOP button again (approx. 1 s.)

NOTE! Perform 3. and 4. within 10 seconds of no. 2.



Operational modes

Local mode

In Local Mode the MCU is operational only from the main panel. All external interfaces are disabled.

Local mode is activated by pushing Enter + Mode-Right buttons.

Local mode is deactivated by pushing Enter + Mode-Left buttons.

OFF-mode

OFF mode is available in all applications – AUX, EME HRB and PRP. All inputs are disabled and all outputs are switched off.

NOTE! Engine can not be started and a running engine is stopped when OFF-mode is activated.

Activate OFF-mode by pushing left Mode-button repeatedly until OFF is high-lighted in upper left corner of display.

Menus

There are 4 display menus available:

Main

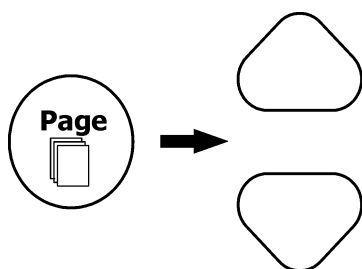
Measurement

Adjustment

History

Main

Push the PAGE button repeatedly to toggle the menu screens. Select MAIN screen. Use Up and Down buttons to toggle the different screens.



Alarm list

ECU (Engine Control Unit) alarm list and Alarm list are the last two screens in the MAIN screen.

Select MAIN screen. Push Up-button (twice for ECU list).

This will list all active alarms (number of alarms indicated in the upper right corner). Highlighted alarms are still active. The other alarms are not active but not yet acknowledged.

NOTE! In case of multiple alarms, scroll alarmlist using ENTER button.

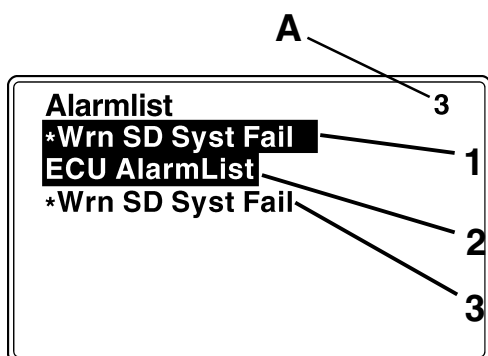
ACKNOWLEDGE button acknowledges all alarms. Non-active alarms then disappear from the list.

Alarm list appears on the screen when a new alarm is set and MAIN screen is active.

NOTE! Alarm list is not activated when you are viewing values, parameters or history.

Three state Alarm list indication

1. Active not acknowledged alarm
2. Active acknowledged alarm
3. Inactive not acknowledged alarm
- A. Number of alarms



Run Hours	336	h
NumSuccStarts	97	
NumUnscStarts	24	
Service time	3640	h

Statistics

Select MAIN screen. Push Up-button three (3) times.

1. Running hours
2. Successful starts (starter RPM>Starting RPM)
3. Unsuccessful starts (MaxCrank time exceeded)
4. Service time (hours to service)

Statistic values can be adjusted from PC software (password protected), contact your Volvo Penta dealer.

Measurement

Push the PAGE button repeatedly to toggle the menu screens. Select MEASUREMENT screen. Use Up and Down buttons to toggle the different screens.

Adjustment

In the adjustment menu it is possible to view and edit setpoints.

1. Push the PAGE button repeatedly to scroll the menu screens. Select ADJUSTMENT screen.
2. Use Up and Down buttons to toggle the different set points group.
3. Press ENTER to confirm.
4. Use Up and Down buttons to select requested set point. Set points marked “*” are password protected.
5. Press ENTER to edit.
6. Up and Down buttons to modify the set point. When Up or Down button is pressed for 2 sec, auto repeat function is activated.
7. Press ENTER to confirm or PAGE to leave without change. Press PAGE to leave selected set points group.

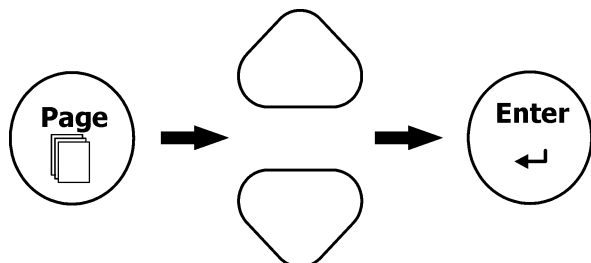
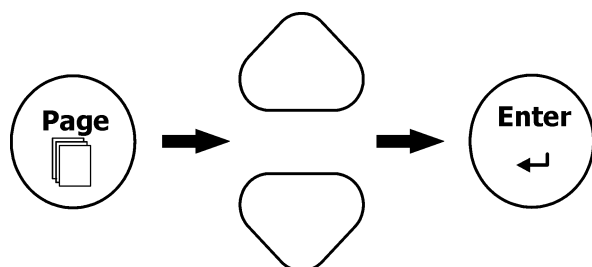
History

1. Push the PAGE button repeatedly to scroll the menu screens. Select the HISTORY screen.
2. Use Up and Down buttons to select the requested record.
3. Use ENTER to select requested screen (record items) within displayed records.

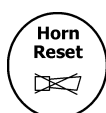
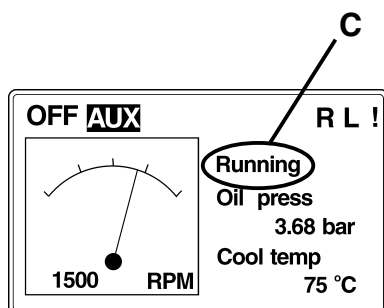
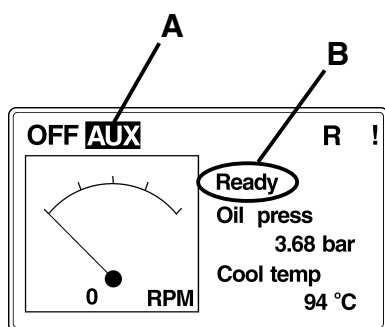
Alarm list and History

Alarm list and History record prefixes

Prefix	Meaning
Wrn	Warning
Alr	Alarm
Sd	Shutdown
Cd	Cooldown
Fls	Sensor fail



No.	Reason
> 0	Fault Reset
- 1	CAN control
- 2	Wrn SDU Syst Fa:
- 3	Wrn SDU Syst Fa:
- 4	Wrn SDU Syst Fa:
- 5	Fault Reset
<hr/>	
25/02/05 12:34:49.6	



Operation

Starting the engine

1. In MAIN menu, select mode of operation (AUX, HRB, EME, PRP), refer to section "Applications & Modes", using MODE button (left or right)(A).
2. Make sure engine status is "Ready"(B).
3. Push START button and the engine state should change to "Running"(C).

Running

Operational data

Monitor engine data not visible in the MAIN screen:

1. Use PAGE button to select MEASUREMENT menu.
2. Use UP and DOWN arrows to select wanted engine data.

Alarms

Alarms are shown in two different screens depending on the origin of the alarm.

Alarms detected by the EMS or PM are shown in the ECU alarm list and alarms generated in the SDU or the MCU are shown in a separate alarm list.

1. Push HORN RESET button to silence the alarm.

To view active alarms:

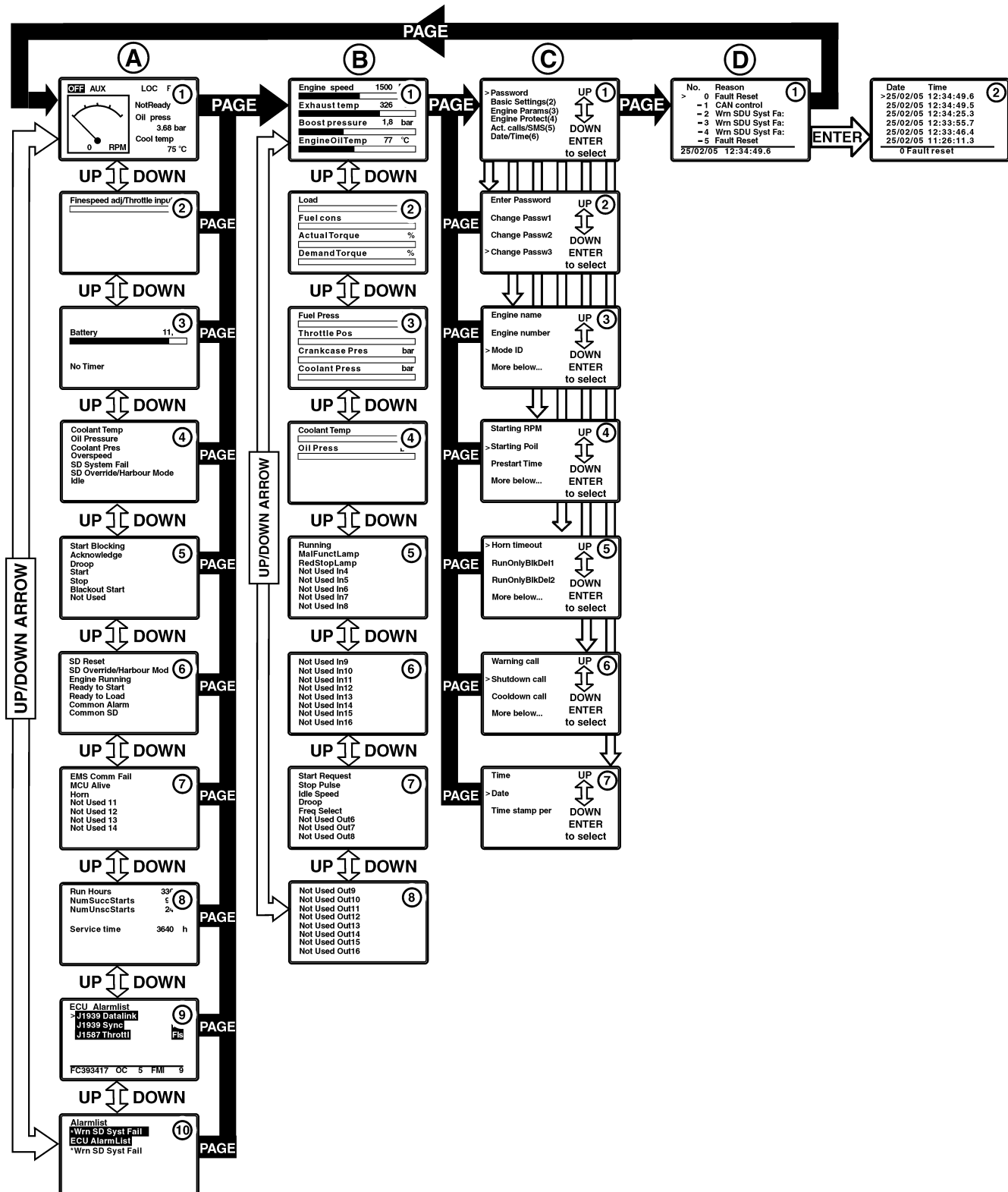
2. In MAIN view, push UP arrow once for SDU/MCU alarm list and twice for ECU alarm list.
3. In case of multiple alarms, scroll alarmlist using ENTER button.
4. Push ACKN. button to acknowledge all alarms.

NOTE! Alarm item will stay in alarm list until acknowledged and made "not active" (fault rectified).

Stopping the engine

1. Push and hold STOP button until the rpm starts decreasing (approx. 1 s).
2. Make sure rpm indication decreases to 0 and engine state returns to "Ready".

MCU menu flow chart



Main page (A)**A1.**

The main page of the system. Most important parameters are shown. Mode change is possible.

A2.

Displays analogue parameters measured by the MCU. In standard configuration only Throttle input (PRP) and Finespeed input (AUX,EME,CMB)

A3.

System voltage information measured by the MCU.

A4. & A5.

Status of MCU 14 digital inputs.

0 - input inactive

1 - input active.

Inverted 0 or 1 indicates alarm due to current status.

NOTE! Pages can be used to verify interface to superior system. Activate signal from superior system and monitor input state change.

A6. & A7.

Pages display status of MCU 14 digital outputs.

0 - input inactive

1 - input active.

A8.

Statistic information. Run hours of the engine, No of successful start, etc.

A9.

Page displays alarms originating from Engine Management System (EMS) and Power Management System (PM). Navigate alarmlist with Enter button.

A10.

Displays alarms from the Shutdown system (SDU) and MCU. Navigate alarmlist with Enter button.

NOTE! Engine cannot be started with active or unacknowledged SD.

Measurement (B)**B1. - B4.**

Pages display monitoring values from (EMS).

B5. & B6.

Used by Volvo Penta service technicians. EMS to MCU CAN-bus information.

B7. & B8.

Used by Volvo Penta service technicians. MCU to EMS CAN-bus information.

Adjustments (C)**C1.**

Menu for change of setpoints. Navigate with up and down arrows - select with Enter.

C2.

Enter and change passwords. Most setpoints are password protected to avoid accidental changing. Password 1 in standard configuration.

C3.

Page for changing basic settings of the systems, e.g governor mode and speed select.

C4.

Page for changing Engine parameters settings. Refer to section "MCU adjustments" for details.

C5.

Page for changing parameters concerning MCU engine protection functionality.

NOTE! In the MCC system engine protection functionality is handled by the SDU. Changing these setpoints will not affect the SDU.

C6.

Changing setpoints concerning MCU telematics functionality.

NOTE! Telematics functionality is not supported by the MCC system.

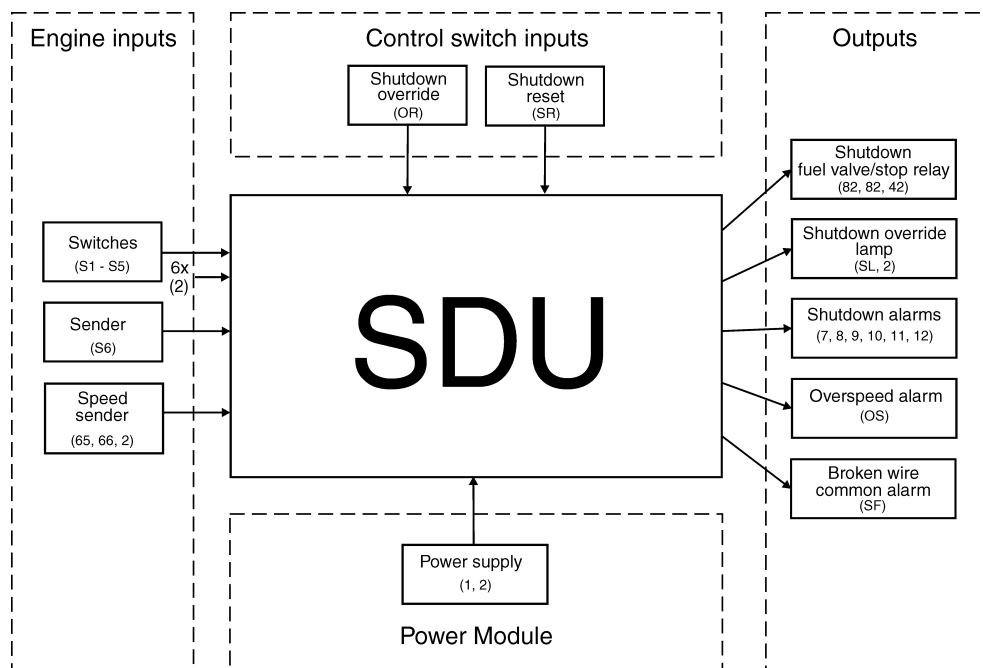
C7.

Page or changing date and time.

History (D)**D1.**

Displays previous actions/alarms. Enter button for further information(D2).

Shutdown system overview



Shutdown unit (SDU)

The SDU has 6 shutdown channels and one over-speed shutdown.

- S1 Cooling water temp
- S2 Lube oil pressure, Marine Gear
- S3 Lube oil pressure, Engine
- S4 Cooling water pressure
- S5 Oil temp (only D12 MH)
- S6 Exhaust temp (only D12 MH)

S1 - S5 has a ~1 second delay: S6 has no delay.
S1 - S6 are enabled or disabled accord. to eng. spec.

Shutdown reset

Activated shutdown must be reset before engine can be restarted. Shutdown reset button on engine connection box or MCU ACKN. button.

NOTE! Shutdown reset button will still show SD alarm in MCU alarm list as not acknowledged alarm.

Acknowledge button on MCU panel will reset shutdown and clear alarm list.

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 Broken wire reset button (A).

NOTE! Use only Volvo Penta tool supplied with SDU for reset (see picture).

Overspeed shutdown

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

Overspeed test

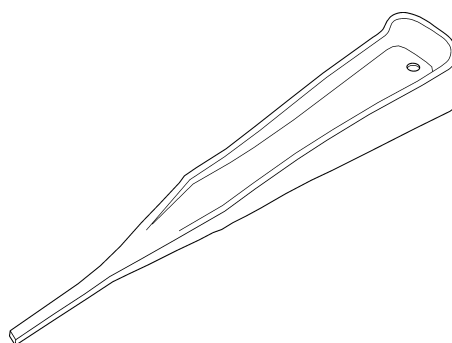
To test the overspeed function push the overspeed test button (inside the SDU). When pushed the overspeed limit drops 25%.

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.

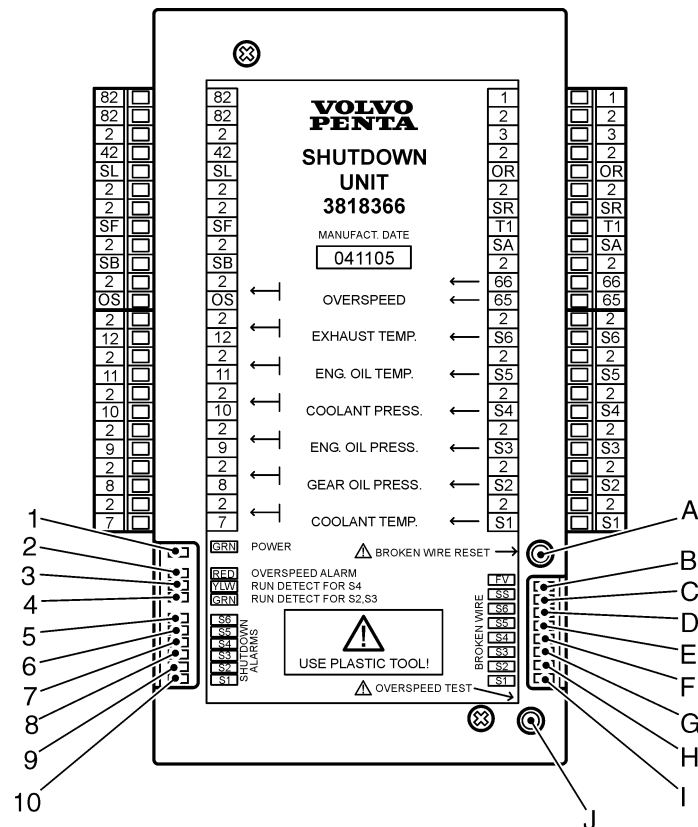
Run detection

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



Tool for broken wire reset

SDU indications





- | | |
|---------------------------------|---|
| 1. Green – Power | A. Broken wire reset button |
| 2. Red – Overspeed Alarm | B. Yellow – Fuel valve Broken 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 |


Operation


General


Learn how to handle the engine, controls and other equipment in a safe and correct manner before starting the engine


 **WARNING!** Stay clear of all rotating and moving parts during operation.

 **IMPORTANT!** Always keep the engine room well ventilated. Insufficient air supply to the engine means imperfect combustion and loss of power.

 **IMPORTANT!** Do not turn OFF the battery switch when the engine is running since this may damage the alternator.

 **WARNING!** A hot engine may cause burns. Beware of hot surfaces. E.g.: exhaust manifold, turbocharger, oil pan, charge air pipe, starting heater, hot coolant and warm lubricant in pipes and hoses.

 **IMPORTANT!** Avoid overloading. This can cause incomplete fuel combustion often indicated by black exhaust, high fuel consumption and carbon deposits in combustion chambers, affecting generator life.

 **IMPORTANT!** Do not push the START button when the engine is running, this may damage the starter.

Applying Load

If possible, do not apply heavy loads until the engine has reached operating temperature.

During load operation make sure that:

1. No engine related alarms occur.
2. There are no visible leaks of fuel, lube oil, coolant or exhaust gas
3. No abnormal noise or vibrations occur.
4. The color of the exhaust gas is normal.
5. Instrument readings are normal, refer to chapter Technical Data.



Start using auxiliary batteries

⚠ WARNING! Ventilate well. Batteries generate oxyhydrogen gas, which is extremely flammable and explosive. A short circuit, naked flame or spark can cause a powerful explosion.

Never reverse the polarity of the battery. Risk of sparks and explosion.

1. Make sure the rated voltage of the auxiliary battery is the same as the system voltage of the engine.
2. Connect the red auxiliary cable to the discharged battery's + terminal and then to the auxiliary battery's + terminal.
3. Connect the black jump lead to the auxiliary battery negative terminal and then to a position slightly away from the discharged batteries, for example at the negative cable's connection to the starter motor.

⚠ WARNING! The black auxiliary cable (–) must not come in contact with the positive connection on the starter motor.

4. Start the engine and run at no load for about ten minutes to charge the batteries.

⚠ WARNING! Do not touch the connections while attempting to start; Risk of sparks. Do not bend over the batteries either.

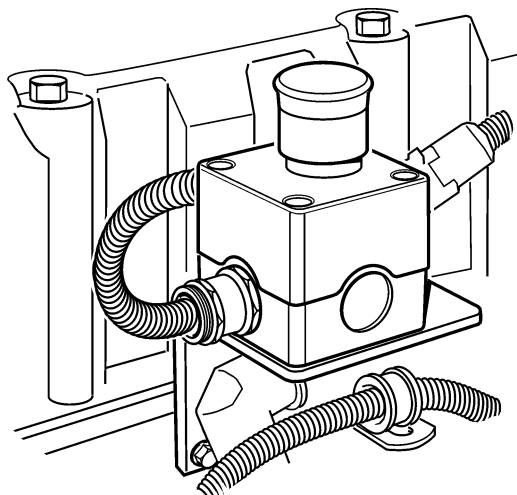
5. Stop the engine. Remove the auxiliary cables in reverse order to connecting.

Stopping

Let the engine run at no load for a couple of minutes before turning it off. This will keep the engine temperature in balance and prevent it from boiling.

⚠ IMPORTANT! The procedure described above is especially important if the engine has been run at heavy loads.

⚠ IMPORTANT! If the engine stops abnormally, try to locate the problem and make the repairs needed before starting again. After starting the engine, make sure it runs properly.



Emergency stop

If the engine can not be stopped by the engine control system, the engine can be stopped as follows:

Push the emergency stop button.

If the engine cannot be stopped with the emergency stop button, shut off the fuel supply or block the air intake to the turbocharger.


NOTE! If the engine has been stopped with the emergency stop button, the button has to be reset (pull it upwards) before the engine can be started again.

After stopping

General


- * Check the engine and engine room for leaks.

- * Close the fuel cock and seawater cock.

 **IMPORTANT!** Do not forget to open the cocks before starting the engine again.


- * Read off the hour counter and carry out preventive maintenance according to the maintenance schedule.


- * Turn off the main switch if the engine is not to be used for a long period.

 **IMPORTANT!** Never turn the power off using the main switch while the engine is running. This can damage the alternator.

Anti-freezing measures


If the engine room cannot be protected from frost, the sea-water system must be drained and the coolant in the fresh-water system must contain sufficient anti-freeze to prevent it from freezing. Refer to chapter Maintenance “Seawater system” and “Freshwater system” respectively.

 **WARNING!** If the seawater system bursts due to freezing, the vessel may sink.

 **IMPORTANT!** If the coolant does not give sufficient anti-freeze protection, it may cause costly damage to the engine. Check the charge of the battery. A poorly charged battery can freeze and break.

Breaks in operation [not using the engine]

During periods out of service, when the boat is in the water, the engine must be run warm once a fortnight. This will prevent the engine from corroding.

 **IMPORTANT!** The engine must be conserved if it is not to be used for longer than two months. Refer to chapter Inhibiting.

Maintenance

Your Volvo Penta engine and associated equipment is designed to provide high operational reliability and long service life. They are constructed to withstand the marine environment while also affecting it as little as possible.

Preventive maintenance in accordance with the maintenance schedule will ensure that it retains these qualities and avoid unnecessary operational disturbances. The following chapters contain general technical information and directions for carrying out the prescribed maintenance points. Read the directions carefully before starting work.

The maintenance schedule shows the standard service intervals. When you think the engine should be serviced more frequently due to particular operating conditions, adjust the intervals accordingly. Appropriate service intervals vary with usage and operating conditions and with fuel, lubricant and coolant used. Due to particular operating conditions the service intervals may be adjusted accordingly. Consult your Volvo Penta dealer.

NOTE! Dust and foreign particles are the most common cause of excessive wear of parts. When disassembling a component, take measures to prevent dust and foreign particles from entering it.

Daily operation records

It is recommended to keep daily operation records. Daily recording is a preventive maintenance program and when comparing values with engine history it will help you recognize conditions, signs or indications of approaching trouble. Daily operation records also make trouble shooting easier and will lessen the down time (to save time and money for servicing).

Maintenance records


Volvo Penta recommends that accurate maintenance records are kept. With accurate maintenance records your Volvo Penta Dealer can help in fine tuning the recommended service intervals to meet the specific operating situation. This should result in a lower engine operation cost.


Fluids


It is also important to keep record of the fluids used in the engine. If brand or type of fuel, lubrication oil or coolant is changed this should be recorded.


Warranty inspection

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

 **WARNING!** Read the safety directions for maintenance and service in the chapter "Safety information" before starting work.

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

 **WARNING!** Working on or approaching a running engine is a safety hazard. Maintenance and service must be carried out with the engine stationary unless stated otherwise in the instructions. Prevent inadvertent start of the engine by disabling the start-button and turning off the power with the main switch, locking it in the off position.

 **WARNING!** Place warning signs stating that service is in progress in every position from which the engine can be started.

 **IMPORTANT!** Handle parts carefully. Use only original Volvo Penta spare parts.

NOTE! When both operating time and calendar time is given, the one occurring first is to apply.

NOTE! For generator related maintenance information, refer to Generator Manufacturers information.

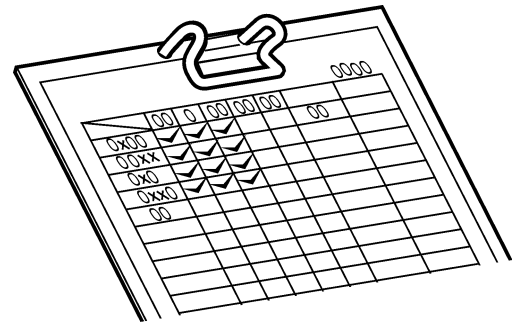
Recommendation of Daily Operation Records

Daily recording is a preventive maintenance program and when comparing values with engine history it will help you recognize conditions, signs or indications of approaching trouble. Daily operation records also make trouble shooting easier and will lessen the down time (to save time and money for servicing).

Items to be recorded

The following items are recommended to be recorded once a day:

1. Operating hours.
2. The amount of lubrication oil and coolant (fresh water) required for refilling. Fuel consumption.
3. Lubrication oil and coolant (fresh water) changes.
4. Lubrication oil pressure and temperature, engine rpm, exhaust temperature, coolant temperature, and charge air temperature and pressure.
5. Rawwater pressure and rawwater temperature before and after heat exchanger. Ambient temperature and engine room temperature at turbo charger inlet.
6. Parts serviced and kinds of service (adjustment, repairs or replacement).
7. Change in operating conditions (for example, "Exhaust smoke turned black," etc.)



MAINTENANCE SCHEDULE D12 MG

Daily before first start

General inspection engine and engine room

Check air filter indicator

Check lubrication oil level

Check coolant level

Check fuel oil level

Check/clean radiator (externally)

Check/drain fuel pre-filter/water separator (refer to note 1)

Drain water from fuel tank

Drain fuel filter

Daily operation records

Weekly

Check starting batteries; electrolyte level/load

Check electrical system for loose terminals/contacts

Check foundation bolts

Check lubrication oil for abnormal smell or waterdilution

Check settings of valves and operate valves to keep them movable

Every 50-500 operating hours or every 12 months

Change lubrication oil (refer to note 3)

Change lubrication oil filters/by-pass filter (refer to note 4)

Every 500 operating hours or every 12 months

Change crankcase breather filter (If applicable)

Check/adjust drive belts

Check/change seawater pump impeller

Check/change zinc anodes

¹⁾ Check the manometer and change filter if necessary.

²⁾ To be carried out at an authorized Volvo Penta workshop.

³⁾ Oil change intervals vary, depending on oil grade and sulphur content of the fuel. Refer to chapter "Technical Data Lubrication oil specification"

⁴⁾ Change oil filters every time the oil is changed.

⁵⁾ Not at the same time as coolant change

Every 1000 operating hours or every 12 months

Check/adjust valve clearances (refer to note 2)
Check/clean heat exchanger/radiator
Check/clean seawater filter
Change fuel pre-filter/water separator filter element
Change coolant filter (refer to note 6)
Change fuel fine filter

Every 2000 operating hours

Check turbocharger (refer to note 2)

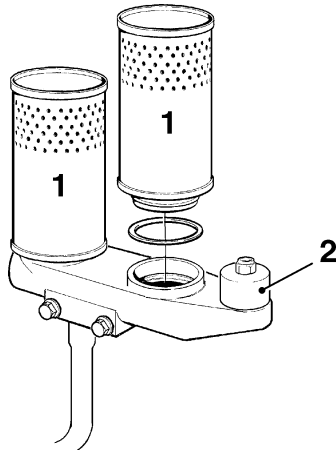
Every 12 months

General inspection of the engine (refer to note 2)
Check/clean charge air cooler (refer to note 2)
Change air filter
Clean and paint the engine

Every 24 months

Check/clean cooling system (refer to note 2)
Change coolant

Engine



Crankcase ventilation filter change

If oil and air begin to find their way out of the over-pressure valve (2), change the filters (1) earlier than recommended.

⚠ IMPORTANT! Change both filters at the same time.

1. Remove the old filters by unscrewing them anti-clockwise.
2. Check the rubber seals, change as necessary. Screw the new filters on by hand.

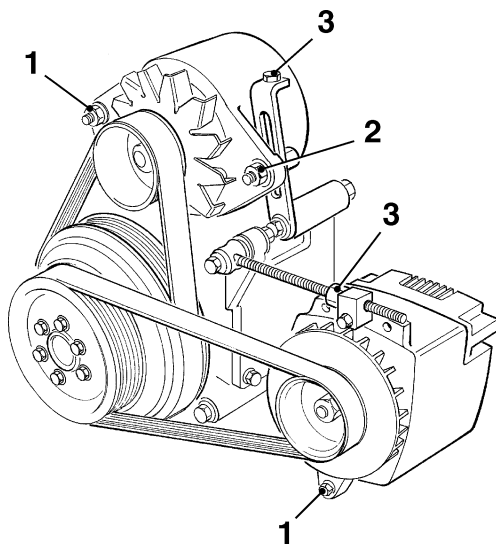
Drive belts. Check/adjust/change

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

General information

Check belt tension and condition regularly. A belt which is too tense can damage the bearings and a belt which is too loose can slip.

⚠ IMPORTANT! Always change a belt which looks worn or cracked (belts which operate in pairs must be changed together).

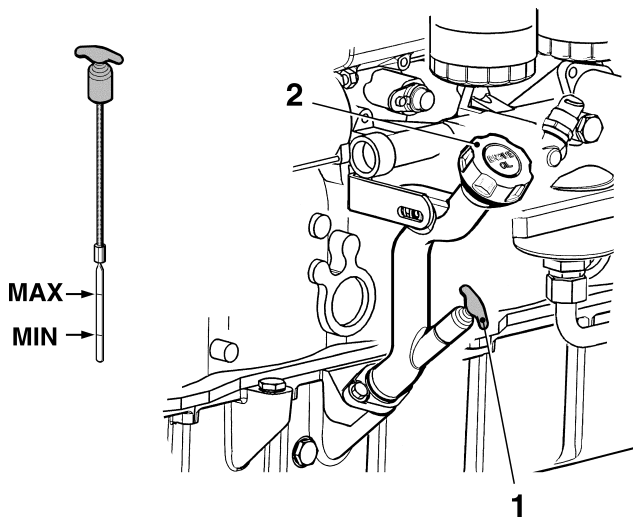


Alternator belt(s)

The standard alternator, plus the extra alternator if installed, are driven by a Poly-Vee belt each, for best function and service life. The belts are tensioned in the same way.

1. Remove the protective cover over the alternator drive belt.
2. Undo the inner fixing screw (1) and the lock screws (2) a couple of turns.
3. Tension the belts with tensioner screw (3). It should be possible to press the belts down about 5 mm (0.2") between the pulleys when the tension is correct.
4. Tighten lock screw (2) and the inner fixing screw (1).
5. Install the protective cover over the alternator drive belt.

Lubrication system



Lubrication oil level check

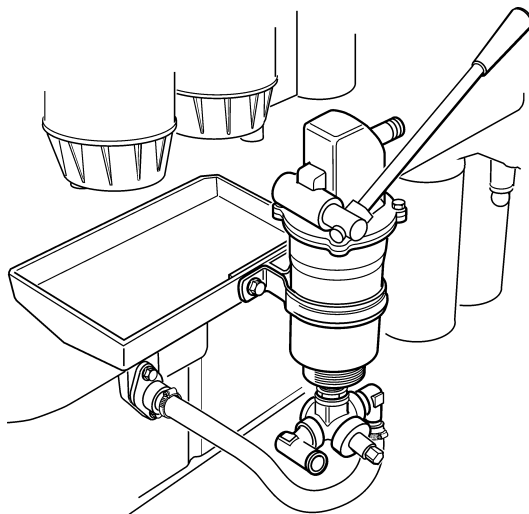
The oil level must be within the marked range on the dipstick(1) and should be checked daily.

Lubrication oil filling

Fill lubrication oil through the filler opening on the side of the engine(2). 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.

⚠ WARNING! Lubrication oil on hot surfaces or electrical components may cause fire. Do not smoke while filling oil or when handling oil containers.

⚠ IMPORTANT! Do not fill above the maximum oil level. Use only oil of the recommended grade (refer to chapter Technical Data).



Lubrication oil change

Always observe the recommended oil change interval. Use the oil drain pump (optional) to drain the oil from the sump.

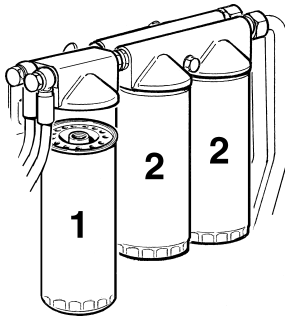
⚠ IMPORTANT! Only use recommended grades of oil (refer to chapter Technical Data).

1. Warm the engine up (this makes it easier to pump the oil from the sump). Then stop the engine.
2. Connect a hose to the outlet pipe of the oil drain pump. Pump the oil out.
3. Change the oil filters and the by-pass filter at every oil change (refer to section oil filter change).
4. Fill up with oil to the correct level.
5. Start the engine and allow it to idle. Check the oil pressure and that there is no leakage by the filters.
6. Stop the engine. Wait a few minutes before you check the oil level. Top up as necessary.

NOTE! Process the old oil and discarded filters in accordance with local regulations.

Filters and by-pass filter change

Change the oil filter (2) and by-pass filter (1) every oil change.

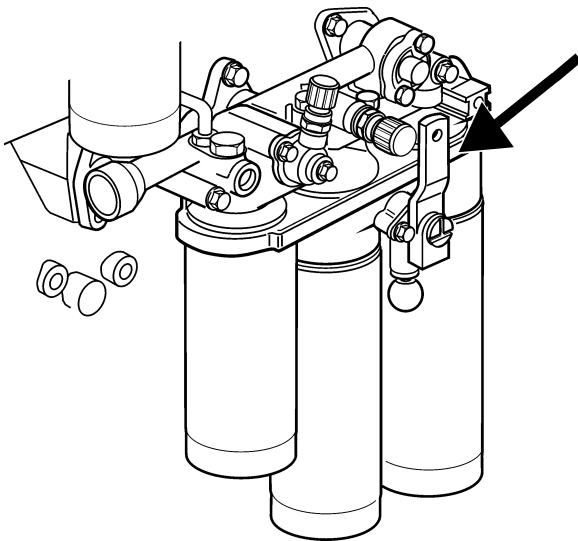


1. Stop the engine.
2. Put a suitable vessel underneath the filters to avoid oil spill. Clean the filter bracket.
3. Unscrew the bypass filter (1) and the oil filters (2) with a suitable filter wrench.
4. Lightly oil the rubber seal of the new filters and make sure its mating surfaces on the filter brackets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

NOTE! Process the discarded oil filters in accordance with local regulations.

Switchable oil filters

⚠ IMPORTANT! Though possible, the switchable filters should not be replaced during engine operation other than in case of an emergency



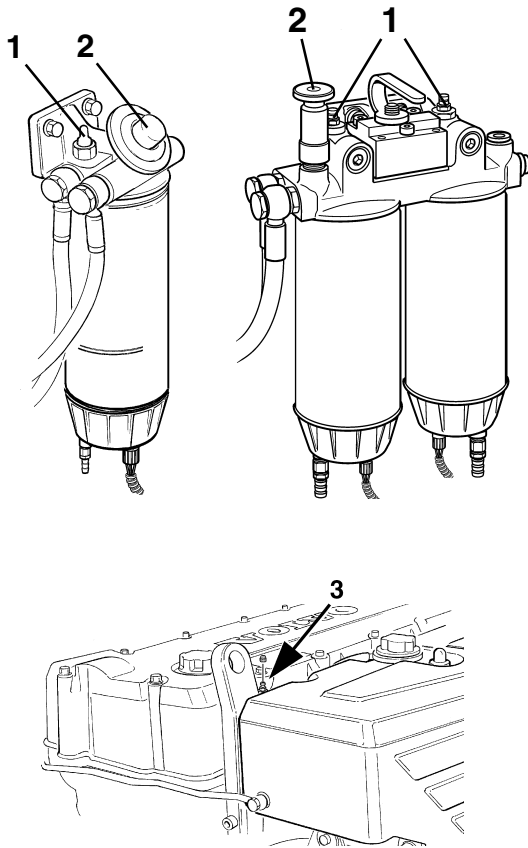
1. Clean the filter bracket.
2. Disconnect the left filter by turning the lever to the right-hand end position. To unlock the lever, pull the knob beneath the lever downwards.
3. Unscrew the left-hand oil filter and discard it. Use a filter wrench if necessary.
4. Check that the mating surfaces on the filter bracket are clean, and that no traces of the seal from the old filter remain.
5. Oil the rubber seal for the new filter.
6. Screw the filter on by hand until the rubber seal just touches the mating surface of the filter bracket. Then tighten the filter a further 3/4 of a turn.
7. Turn the lever to the left-hand end position and change the right-hand oil filter in the same way.
8. Put the lever in operating position (straight up).
9. If necessary, top up the system with lubrication oil at first stop. Refer to section "Lubrication oil change".

Fuel system

⚠ WARNING! Fire hazard. Work on the fuel system should be carried out on a cold engine. Fuel leaks and spills on hot surfaces or electrical components may cause fire.

⚠ WARNING! Hot fuel may cause burns.

⚠ IMPORTANT! All unit injector maintenance must be carried out at an authorized workshop



Fuel system venting

The fuel system must be vented, e.g. after changing fuel filter, if the fuel tank has been run dry and after long stops.

Single filter and Switchable filters

Stationary engine:

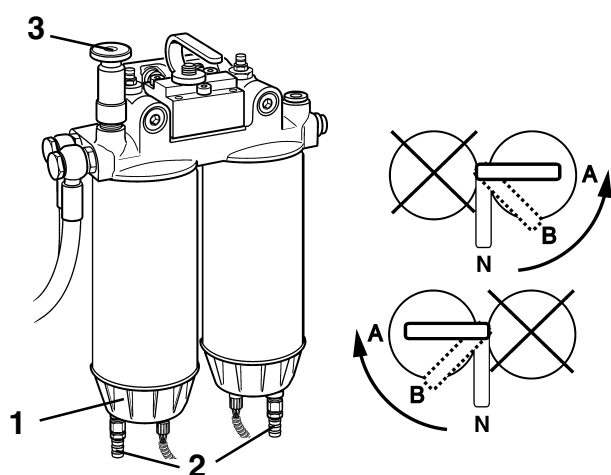
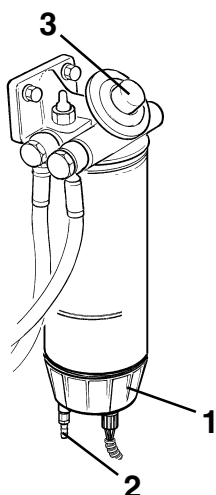
1. Put a suitable vessel underneath the fuel filter.
2. Remove the protective cap from the venting nipple (1) on the filter bracket. Connect a transparent plastic hose to the nipple.
3. Open the venting nipple and pump up fuel with the hand pump (2) until air-free fuel flows out. Tighten the venting nipple while fuel is flowing out. Repeat with second filter.
4. Remove the hose and put the protective cap back on the venting nipple.
5. If the tank has been run dry or the engine, for some reason, has been emptied of fuel, open the venting nipple (3) at the front of the engine block and vent in the same way.
6. Run the engine at idling speed for a couple of minutes to get any remaining air out of the system. Then close the vent (3) on the engine and make sure that there are no leaks.

Fuel filter.

Drain

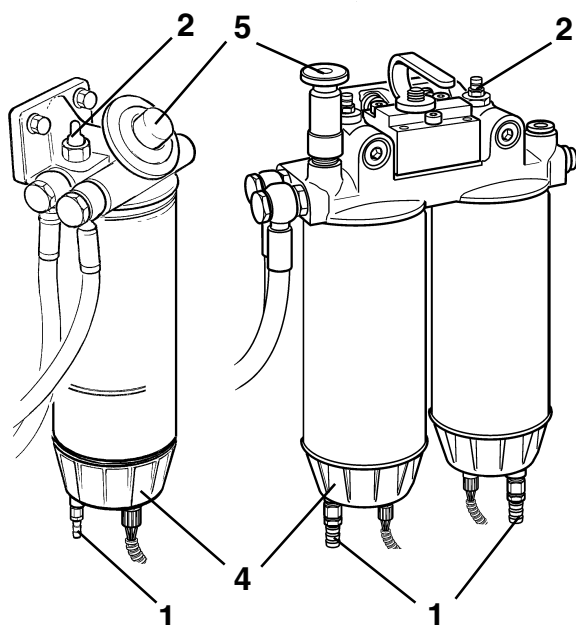
Stationary engine

1. Put a suitable vessel underneath the filter.
2. Drain water and contamination from the water trap (1) through the tap (2) by pumping with the hand pump (3) until clean fuel flows out.



Running engine (switchable filters only)

1. Shut off fuel to the filter to be changed (A).
2. Put a suitable vessel underneath the filter.
3. Open the tap (1) carefully (pressure on the inside, hot fluids might spurt out).
4. Drain water and contamination from the water trap by turning the handle to venting position (B). Tighten the venting nipple when clean fuel flows out.
5. Repeat the procedure with the other filter.
6. Turn the handle to normal operating position (N).



Change the filter elements

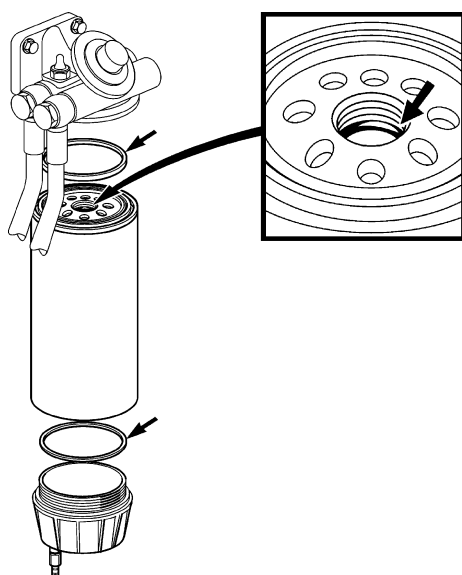
Stationary engine:

(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 he into the vessel.
3. Relieve pressure inside the filter by opening first the drain tap (1) and then the venting nipple (2)

⚠ WARNING! High pressure inside. Open tap with caution, hot fluids may spurt out.

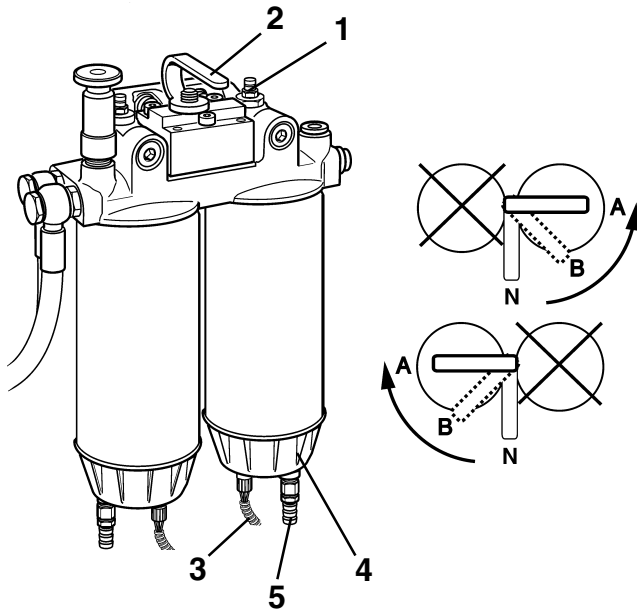
4. Remove the cables from the water trap (4) and unscrew the water trap from the filter.
5. Unscrew the filter, use a filter wrench if needed.



6. 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.

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

7. Screw the new filter on by hand until the seal just touches the mating surface. Then tighten a further 1/2 turn. Reinstall the water trap and the cables, close the drain tap.
8. Open the fuel valve/valves.
9. Open the venting nipple (2) and work the pump (5) until air-free fuel flows out. Tighten the venting nipple while fuel is flowing out.
10. Remove the hose and put the protective cap back on the nipple.
11. Start the engine and check for leakages.



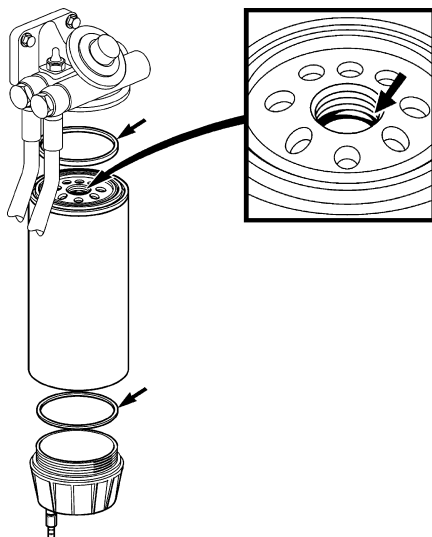
Running engine:

(Switchable filters only)

1. 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 he into the vessel.
2. 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).
3. Remove the cables (3) from the water trap (4) on the shut off filter.
4. Relieve pressure inside the filter by opening first the drain tap (5) and then the venting nipple (1).

⚠ WARNING! High pressure inside. Open tap with caution, hot fluids may spurt out.

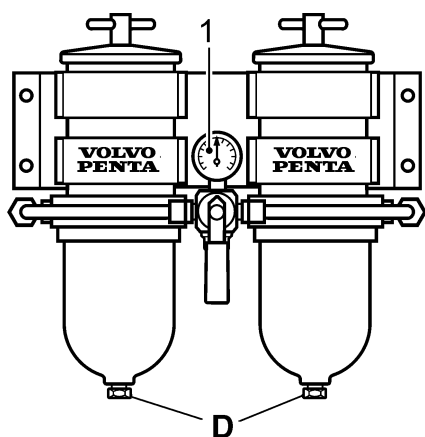
5. Unscrew the water trap (4) and the filter, use a filter wrench if needed.



6. 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.

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

7. Screw the new filter on by hand until the seal just touches the mating surface. Then tighten a further 1/2 turn. Reinstall the water trap and the cables, close the drain tap.
8. Vent by turning the handle (2) to venting position (B). This allows a reduced flow of fuel through the filter and the air is evacuated through the vent. Tighten the venting nipple when air-free fuel flows out.
9. Remove the hose and put the protective cap back on the nipple.
10. Repeat the procedure with the other filter.
11. Turn the handle to normal operating position (N). Check for leakages.



Twin fuel pre-filter/water separator

The twin filter is equipped with a pressure gauge (1). The filter inserts must be changed according to the maintenance schedule or earlier if the pressure gauge indicates a vacuum of 6–10 inHg at no load or 16–20 inHg at full load.

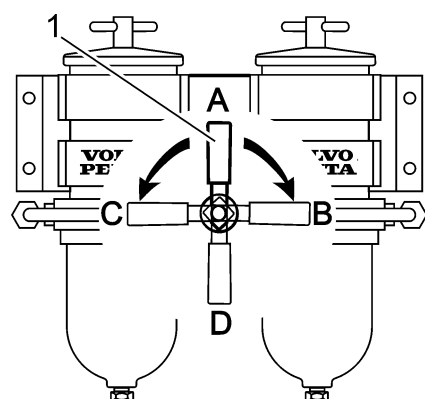
Drain

Place a receptacle under the filter. Drain off water and contaminants through the plug (D).

Valve positions

The flow of the fuel is governed by putting the handle (1) in the following positions:

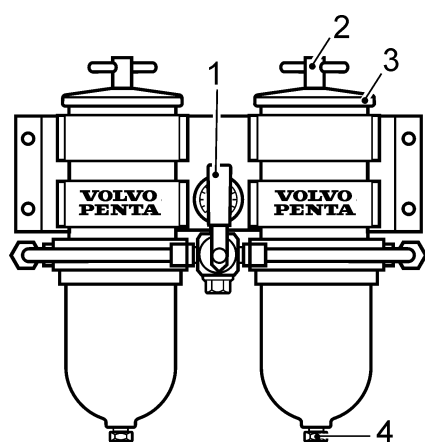
- A: Normal running (both filters connected).
- B: Left filter insert can be changed.
- C: Right filter insert can be changed.
- D: Both filters turned off.



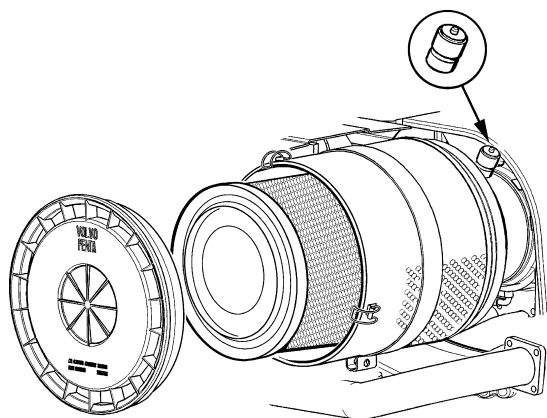
Change the filter elements

If the engine is not running close the fuel cocks on the tank before changing filters. If the engine is running cut off the flow of fuel with the handle (1) on the filter itself.

1. Place a receptacle under the filters and shut off the filter to be changed.
2. Undo the T-bolt (2) and remove the cover (3).
3. Take out the insert carefully while turning it.
4. Drain off water and contaminants through the drain plug (4).
5. Fit a new filter insert and fill the container with clean fuel.
6. Change the gasket on the cover and the O-ring on the T-bolt. Moisten the gasket and O-ring with fuel before assembling.
7. Fit the cover and tighten it by hand.
8. Wipe off any fuel from the heat shield.
9. Change the other filter in the same way.
10. Open the fuel cocks and put the handle in position for normal running. Make sure there are no leaks.



Air Inlet and Exhaust Systems

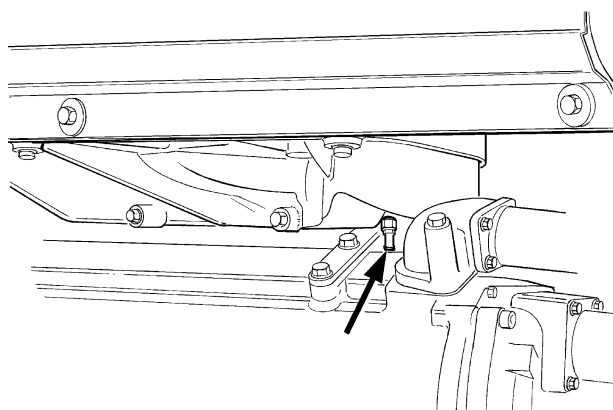


Air filter change

Check the air filter indicator. If indicator is all **red** after the engine is stopped, change filter.

1. Undo the clamps and remove the lid from the filter housing.
2. Remove the old filter. Be careful to ensure that no contamination gets into the engine.
3. Install a new air filter and tighten the lid.
4. Reinstall the pressure drop indicator by pressing in the indicator button.

⚠ IMPORTANT! Scrap the old filter. It must not be cleaned.



Inlet manifold drain hole

Water can condense in the aftercooler during operation. The condensate is drained via a hose connected to a nipple under the rear of the inlet manifold.







Check that the nipple is not blocked.

⚠ WARNING! If a large amount of water flows out of the drain hole, from the inlet manifold, the aftercooler must be removed and proof tested. This must be done by an authorised workshop.

Cooling system

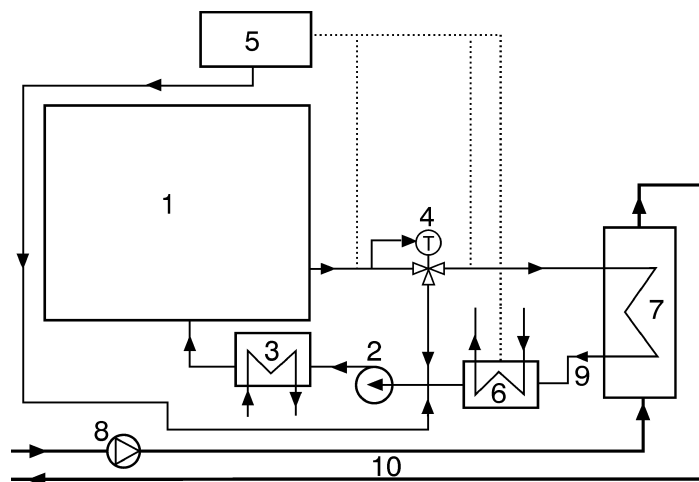
The freshwater system is the internal cooling system of the engine. It is a closed system and shall always be filled with coolant that protects the engine from internal corrosion and frost damage if the climate requires it. Anti-corrosive additives become less efficient with age and the coolant must therefore be changed in accordance with the recommendations in the maintenance schedule.

The Volvo Penta Genset comes with an internal freshwater system connected to an engine mounted heat exchanger, a radiator cooler, or prepared for external cooling, e.g. keel cooling or central cooling.

-  **WARNING!** Never open the pressure cap or drain the cooling system when the engine is warm. Steam or hot fluid may spurt out.
-  **WARNING!** The coolant is dangerous to your health and an environmental hazard. Handle coolant with care and dispose of old coolant in accordance with local regulations.
-  **IMPORTANT!** For coolant specification, refer to chapter “technical data” in the back of this manual.
-  **IMPORTANT!** Check the coolant level on a cold stationary engine.
-  **IMPORTANT!** Coolant to be added should have the same concentration as the coolant in the engine. Do not add plain water.
-  **IMPORTANT!** Certain parts of the system are made of light alloy. Chemical additives must therefore not be used when cleaning the system.

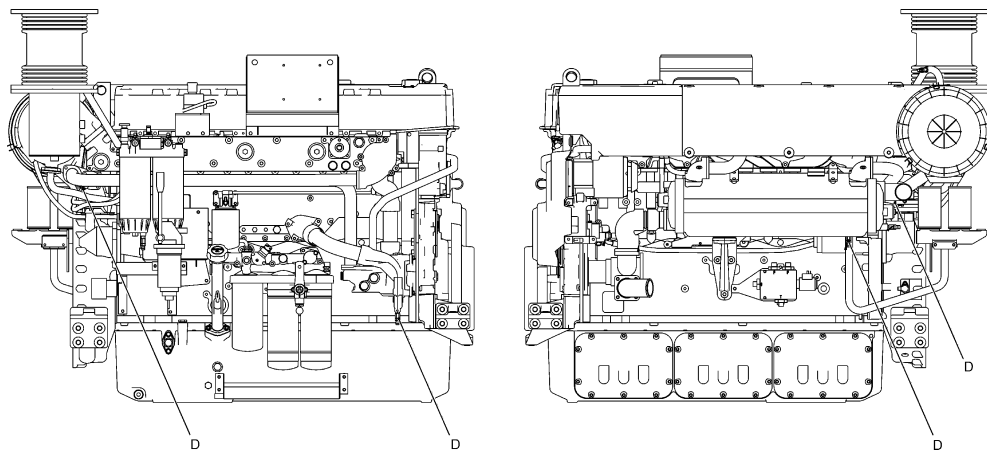
Engine mounted heat exchanger

The system includes two circuits. The freshwater system is cooling the charge air, the cylinder liners and the cylinder heads. An engine driven cooling water pump circulate the coolant through the heat exchanger and through the engine. The raw water system is cooling the coolant in the heat exchanger. The raw water system is connected to a seawater inlet or a central cooling system.

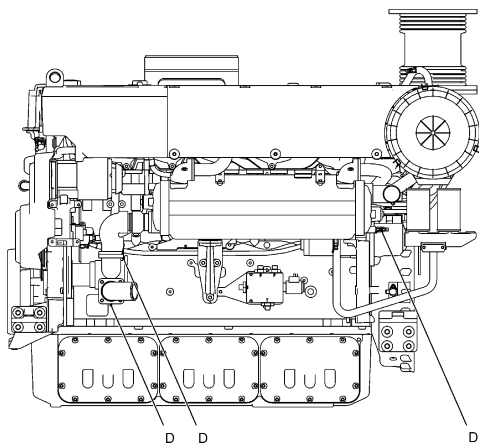


1. Engine
2. Freshwater pump
3. Lubrication oil cooler
4. Thermostat valve
5. Expansion tank
6. Charge air cooler
7. Heat exchanger
8. Raw water pump
9. Freshwater circuit
10. Raw water circuit

Drain points fresh water system

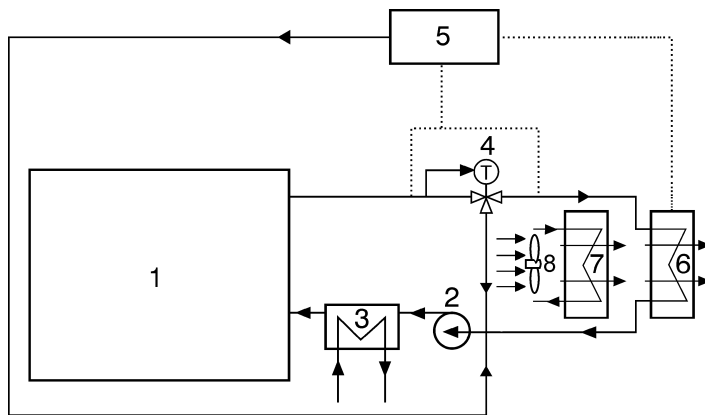


Drain points raw water system



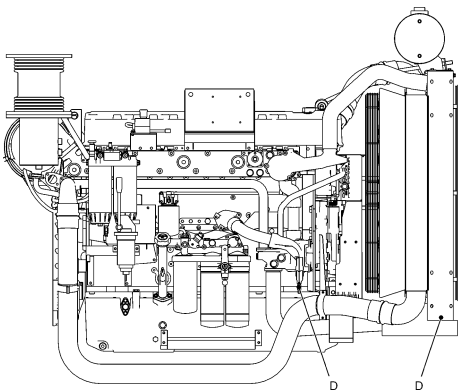
Radiator cooling

The engine cooling water is cooled by a radiator in a one-circuit cooling system. Air is forced through the radiator by an engine driven cooling air fan. The charge air is cooled in an air-to-air charge air cooler mounted in front of the radiator and it make use of the air flow from the engines cooling fan before it enters the radiator.



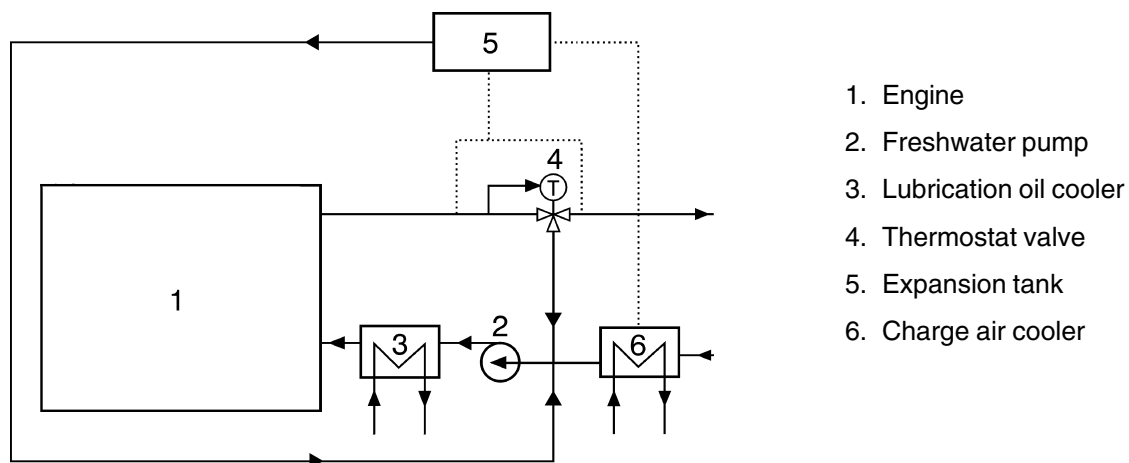
1. Engine
2. Freshwater pump
3. Lubrication oil cooler
4. Thermostat valve
5. Expansion tank
6. Radiator
7. Charge air cooler
8. Radiator fan

Drain points fresh water system

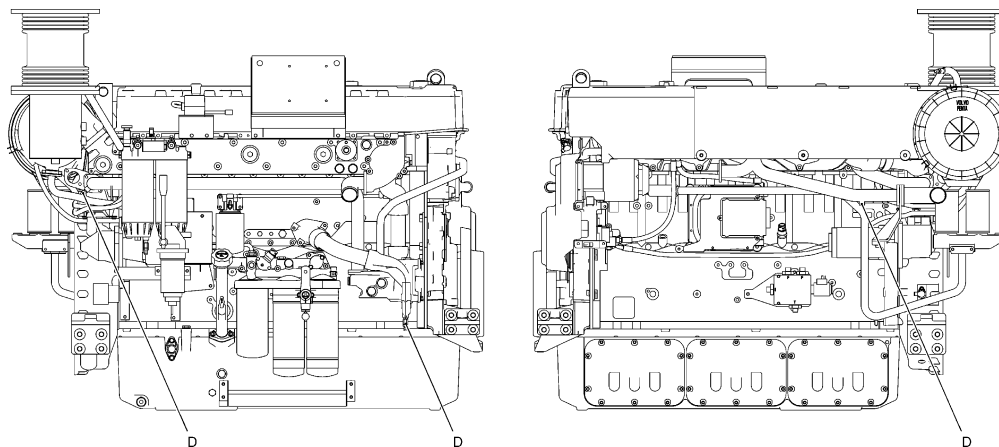


Without engine mounted heat exchanger (Keel cooled)

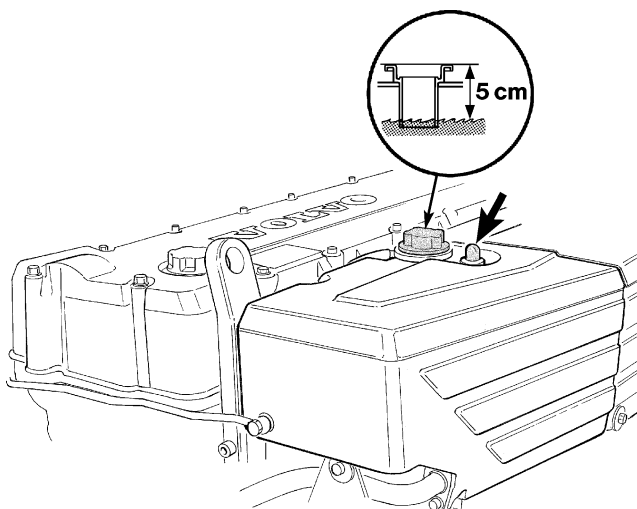
The engine cooling water is cooled by, e.g. a box cooler, a grid cooler, or any other external heat exchanger. The same coolant (fresh water) is cooling the complete engine (charge air, cylinders, etc.).



Drain points fresh water system



Freshwater system



Coolant level check

Coolant level can be checked through a level glass on top of the expansion tank. The green float must be visible in the level glass.

The coolant level should be about five centimetres (2") below the pressure cap sealing plane in the expansion tank.

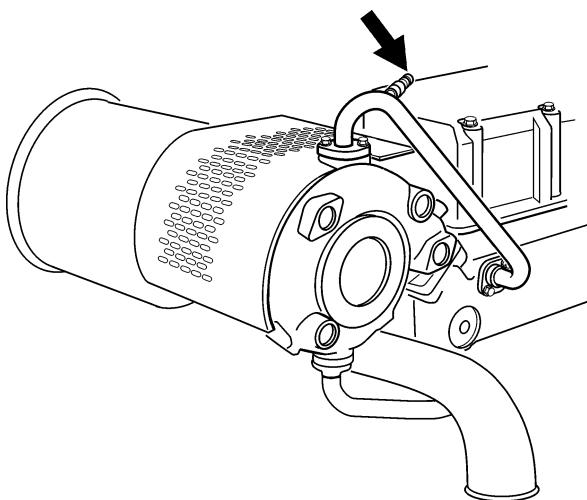
⚠ IMPORTANT! When topping up, use the same coolant mixture as is already in the cooling system.

Coolant filling

Topping up

Fill the freshwater system with coolant to the correct level through the filler opening in the expansion tank, for correct level, refer to section "coolant level check". Fill slowly so that evacuated air is able to pass the filler opening.

NOTE! For coolant specification refer to section "technical data coolant".



Filling when the system is empty

1. Open the air ventilation cock that is placed by the turbo charger
2. Make sure that systems connected to the cooling system also are ventilated, e.g. heater, water heater.
3. Fill the freshwater system with coolant through the filler opening in the expansion tank. Fill slowly letting air bleed from the ventilation cock and the filler opening. When air-free coolant flows out, close the ventilation cock and continue to fill to the correct level, for correct level, refer to section "coolant level check".
4. Start the engine and run it under no load until the thermostat valve opening temperature is reached.

⚠ IMPORTANT! The engine must not be operated under full load before the system has been bled and topped up.

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

Coolant drain

1. Remove the filler cap from the expansion tank and open the vent tap by the turbocharger.
2. Connect a suitable hose to each drain point, refer to section "Drain points". Open the drains and allow the coolant to drain off into a suitable vessel.

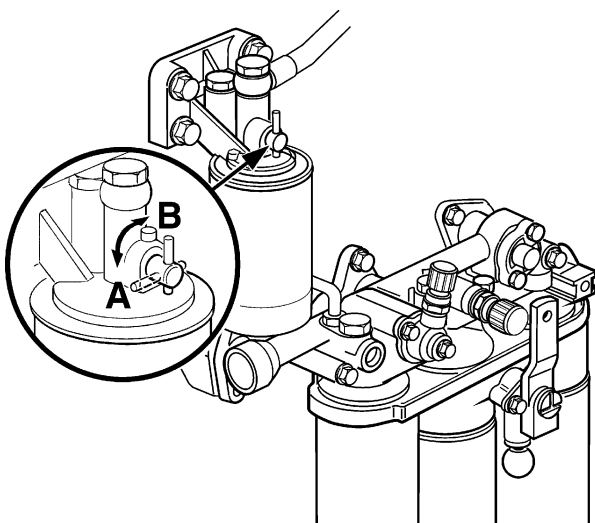
⚠ IMPORTANT! Check that all coolant really does drain out. Deposits may need to be cleared away, inside the drain plug(s)/tap(s).

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 system should be flushed before changing coolant to avoid inferior cooling performance due to deposits in the cooling system.

1. Drain the coolant as described earlier.
2. Insert a hose into the filler opening on the expansion tank and flush with fresh water.
3. Flush until the water running out of the drainage points is clean.
4. Close all drain points when the flushing water has run out.
5. Fill with coolant. See section coolant filling when empty.



Coolant filter. Change

⚠ IMPORTANT! Do **not** change the filter when the coolant is changed. The concentration of rust-preventer in the coolant can become too high, which would cause foaming and impaired cooling.

1. Clean the filter bracket.
2. Close the filter tap (1), (position A).
3. Unscrew the filter with a suitable wrench.
4. Clean the filter mating surface on the filter bracket.
5. Moisten the seals on the new filter with engine oil and screw the filter on by hand until the rubber seal just touches the mating surface on the filter bracket. Then tighten a further 1/2 turn.
6. Open the filter tap (1), (position B).
7. Start the engine and check carefully that no leakage occurs.

Raw water 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! The raw water system must be closed and drained before commencing work on the system. This due to the risk of sea water or water from the central cooling system entering the vessel.

Draining the raw water system

1. Close the raw water in- and outlet cocks.
2. Connect a suitable hose to each drain point, refer to section "Drain points". Open the drains and allow the raw water to drain off into a suitable vessel.

⚠ IMPORTANT! Check that the raw water really drains. Deposits may need to be removed from inside the drain plugs/taps.

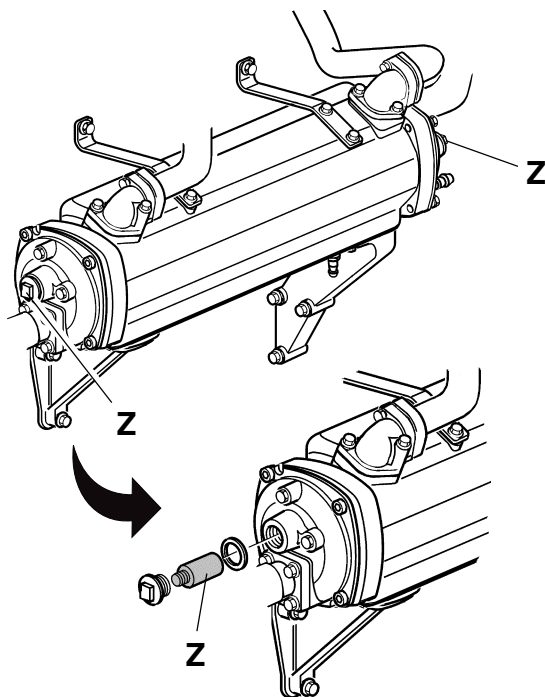
Check and Change the zinc anodes

NOTE! Valid only for engines with engine mounted heat exchanger.

1. Drain the external cooling water as described in the section draining the raw water system.
2. Unscrew the zinc (Z) anodes from the heat exchanger (2 pcs.).
3. Replace the anode if less than 50% remains. If not, clean the anode with emery cloth to remove the layer of oxide.

⚠ IMPORTANT! Do not use a wire brush or other metal tool for cleaning as this may decrease the galvanic protection.

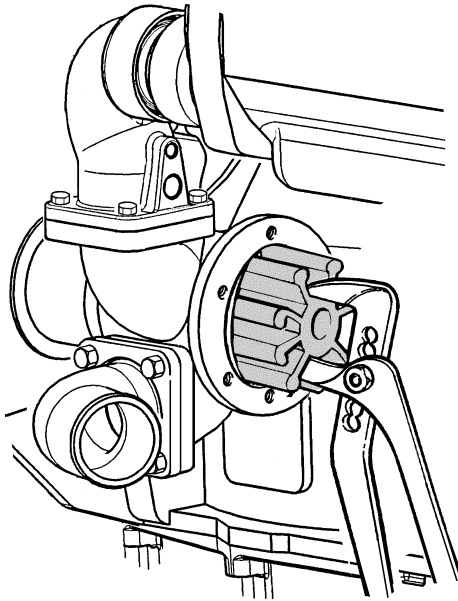
4. Fit the zinc anodes. Make sure there is good contact between the anode and the metal goods.
5. Close drains and open the raw water cocks before starting the engine
6. Check the installation and make sure there are no leaks.



Seawater filter check/clean

If the vessel is equipped with a seawater filter refer to the maintenance description delivered by the supplier of the filter.

NOTE! If the water wherein the vessel operates is severely polluted, contains large amounts of seaweed, etc., the filter must be checked more often than is specified. The filter can otherwise become clogged and the engine overheated.



Raw water pump impeller check/change

⚠ IMPORTANT! Always keep a spare impeller and gasket in store aboard the ship.


1. Drain the external cooling water as described in the chapter draining the seawater system.
2. Remove the pump end cover and the impeller.
3. Inspect the impeller. Change the impeller if there are any visible cracks or other defects.
4. Clean the inside of the housing. Lubricate the pump housing and the inside of the cover with water-resistant grease (non-aggressive on rubber).
5. Push the impeller into position while rotating it in the normal operating direction.
6. Fit the cover with a new sealing ring.
7. Open the seawater cocks.


Electrical system

General

The engines have a comprehensive electrical engine management system. This automatic system monitors engine speed as well as the electrical and fuel systems and the engine cooling and lubrication functions. The system consists of a number of switches and sensors which activate an alarm or shut down if a fault is detected in the engine.

Supply voltage is 24V.

 **WARNING!** Before starting work on the electrical system, the engine must be stopped and the power turned off with the main switches. Shore power to the engine heater, battery charger or other extra equipment fitted on the engine must be disconnected.


 **WARNING!** If maintenance has to be carried out on a powered up system, set control system to LOCAL MODE to prevent remote start.

Check the electrical wiring

Make sure electrical connections are tightened, dry and free from oxide. If necessary, spray these connections with water-repellant (Volvo Penta all-round oil).

Main switches


The main switches must never be turned off until the engine has been stopped. Breaking the circuit between the generator and the batteries while the engine is running can damage the generator. For the same reason, the charge circuits must never be switched while the engine is running.

 **IMPORTANT!** Never turn the power off using the main switches while the engine is running.

Electric welding

Disconnect the positive and negative battery cables. Then disconnect all the leads to the generator.

Always connect the weld clamp to the component being welded and as close to the welding point as possible. Never connect the clamp to the engine or generator in such a way that current can pass across a bearing.

 **IMPORTANT!** When welding has ceased, connect the leads to the generator **before** reconnecting the battery cables.



Battery maintenance

⚠ WARNING! Risk for fire and explosion. Never expose the battery to naked flames or sparks.

⚠ WARNING! Never reverse the polarity of the battery. Risk of sparks and explosion.

⚠ WARNING! Battery electrolyte is extremely corrosive. Protect eyes, skin and clothes when handling batteries. Always use protective goggles and gloves. In case of splashes on the skin, wash with soap and plenty of water. In case of splashes in the eyes, rinse immediately with plenty of water and call a doctor.

Connecting and disconnecting

Connect the (+) cable (red) to the (+) terminal of the battery first. Then connect the (–) cable (black) to the (–) pole of the battery.

Disconnect the (–) cable (black) first and then the (+) cable (red).

Cleaning

Keep batteries dry and clean. Contaminants and oxide on batteries and battery terminals can cause short-circuits, voltage drops and discharging, especially in damp weather. Clean oxide from battery terminals and cable shoes with a brass brush. Tighten cable shoes well and grease them with terminal grease or petroleum jelly.

Electrolyte level

The electrolyte should be 5–10 mm (0.2–0.4") above the cell plates in the battery. If necessary, top up with distilled **water**. The battery should be charged for at least 30 minutes after filling by running the engine at no load.

NOTE! Special instructions must be followed for certain maintenance-free batteries.



Battery charging

⚠ WARNING! Risk for explosion. Charging generates hydrogen gas (oxyhydrogen gas). A short circuit, naked flame or spark can cause a powerful explosion. Ventilate well.

⚠ WARNING! Battery electrolyte is extremely corrosive. Protect eyes, skin and clothes. Always use protective goggles and gloves. In case of splashes on the skin, wash with soap and plenty of water. In case of splashes in the eyes, rinse immediately with plenty of water and call a doctor.

Charge the batteries if they have been discharged. The batteries will be harmed if left discharged and can also freeze and crack in cold weather.

⚠ IMPORTANT! Follow the battery charger user instructions carefully. Disconnect the battery cables before connecting the battery charger to avoid electrochemical corrosion when using an external battery charger.

The battery plugs must be unscrewed but left in the holes while charging is in progress. Ventilate well, especially if batteries are being charged in confined spaces.


⚠ WARNING! Always cut the charging current **before** disconnecting the charger cables. Never reverse the polarity of the battery. Risk of sparks and explosion.


Special directions apply for rapid charging. Rapid charging can impair the service life of the batteries and should be avoided.

Inhibiting

General

To prevent the engine and other equipment from being harmed during long (2 months or more) periods out of service, it must be conserved. It is of utmost importance that the conservation is performed correctly. Therefore we have compiled a checklist of the most important points. Before taking the engine out of service for long periods, it should be checked by a Volvo Penta dealer for possible need of overhaul or repair.

 **WARNING!** Read the chapter "Maintenance" thoroughly before starting any maintenance work. It contains directions for performing maintenance in a safe and correct manner. Certain preservatives are flammable. Some are also dangerous to inhale. Provide good ventilation. Use a protective mask.

 **IMPORTANT!** The following must be considered when cleaning with a high-pressure water jet: Never point high-pressure water jets directly at seals, rubber hoses or electrical components. Never use the high-pressure function when washing the engine.

Preparation

1. Stop up to eight months: Change oil and oil filter on the engine and then run it warm

Stop over eight months: Treat the lubricating and fuel systems with conservation oil. See directions on next page.


2. Make sure there is enough anti-freeze in the coolant. Add more if necessary. An alternative is to drain the coolant.
3. Drain the rawwater system.
4. Remove the impeller from the rawwater pump. Keep the impeller in a cool place in a closed plastic bag.
5. Drain off any water and contaminant from the fuel tank. Fill the tank with fuel to avoid condensation.
6. Disconnect the battery cables and clean and charge the batteries. Trickle charge during the storage period. A poorly charged battery can freeze and break.


7. Clean the engine externally. Touch up any paint damage with Volvo Penta original paint.


8. Spray electric system components with water repellent.

9. Inspect all control cables and apply anti-corrosion agent.

10. Cover the air intake to the engine, the exhaust aperture and the engine.


 **IMPORTANT!** Never use vinyl sheets for covering. This can result in condensation and harm the installation.

 **IMPORTANT!** Store the engine in a well-ventilated room.

 **IMPORTANT!** Affix a label on the engine giving the date, type of conservation and the preservative that was used.

Care during Storage

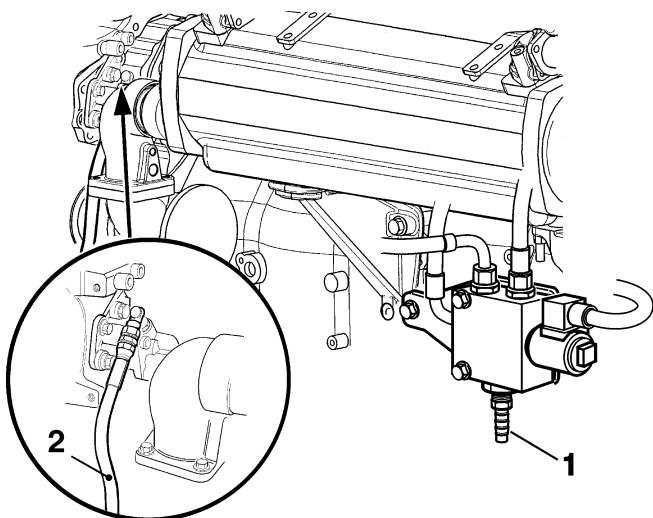
Recharge the battery at least once a month.

 **IMPORTANT!** During longer periods out of operation, the preparations must be repeated every 12 months.

Return the Engine to Service

1. Remove any protective covers on the engine, air intake and exhaust pipe.
2. Top up with lubricant of the correct grade in the engine if necessary.
3. Fit new fuel filters and bleed the fuel system.
4. Check drive belts.
5. Check the condition of rubber hoses and check the tightness of all hose clips.
6. Close the drain cocks and fit the drain plugs of the rawwater system. Fit the impeller in the rawwater pump. Fill and bleed the rawwater system.
7. Check the coolant level and anti-freeze. Top up if necessary.
8. Check under and around the engine for such items as loose or missing bolts, oil, fuel or coolant leaks and repair if needed.
9. Connect fully charged batteries.
10. Start the engine and run it at no load until it reaches operating temperature before loading it.
11. Check for oil, fuel or coolant leaks.
12. When the engine has run long enough to warm up apply the load.

Conserving the lubricating and fuel systems for stops longer than eight months:



1. Drain the oil from the engine and fill with **conservation oil*** to just over the MIN mark on the dipstick.
2. Connect supply (1) and return (2) fuel lines to a fuel can filled with 1/3 **conservation oil*** and 2/3 diesel fuel.
3. Bleed the fuel system.
4. Start the engine and run it at no load until approximately two liters of the fuel/conservation oil mixture have been consumed. Stop the engine and connect the ordinary fuel lines.
5. Drain the conservation oil from the engine.
6. Follow the directions on the previous page in other respects.

* Conservation oils are available from oil companies.

In case of emergency



Start with auxiliary batteries

⚠ WARNING! Ventilate well. Battery gas is explosive.

⚠ WARNING! Never confuse positive and negative poles on the batteries.

1. Connect red jumper cable to positive pole (+) of the flat battery, then to the positive pole of the help start battery.
2. Connect black jumper cable to negative pole (–) of the help start battery, and then to a place some distance from the flat batteries, such as the negative connection on the starter motor.

⚠ WARNING! Black jumper cable (–) must not touch positive connection on the starter motor.

⚠ WARNING! Do not touch poles during start attempt, risk of arcing. Do not bend over the batteries.

3. Start engine and run at fast idle for ten minutes to charge the batteries.
4. Stop the engine. Remove the jumper cables in the reverse order from installation.

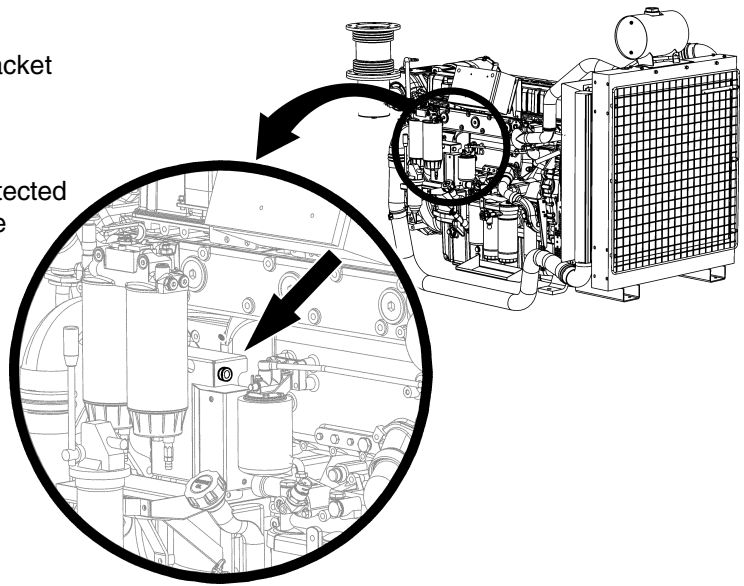
Auxiliary START

In case of control system(MCU) failure it is possible to by-pass the control system and start the engine “manually”.

In case of battery power loss, refer to section “Start with auxiliary battery”.

1. Locate AUXILIARY START button on the bracket above the starter.
2. Push the button until the engine starts.

NOTE! The engine will still be monitored and protected by the EMS and the Power Module as well as the Shutdown Unit.



Troubleshooting

A number of symptoms and possible causes for engine disturbances are described in the table below. If faults or hitches arise that you cannot solve alone, you must always get in touch with your Volvo Penta dealer.

⚠ WARNING! Read the safety directions for maintenance and service in the chapter “Safety information” before starting any work.

⚠ IMPORTANT! Handle parts carefully. Only use original Volvo Penta spare parts.

NOTE! Dust and foreign particles are the most common cause of excessive wear of parts. When disassembling a component, take measures to prevent dust and foreign particles from entering it.

NOTE! If the engine won't start, make sure the emergency stop button is reset

Symptoms and possible causes	
Starter motor does not rotate when cranking	1,2,3,4,6,7,49
Starter motor rotates slowly when cranking	1,2,15,42
Engine does not start	5,13,14,16,17,19
Engine starts but stops again	5,13,14,16,17,19,44,45
Engine does not reach correct operating speed	5,11,12,13,14,15,16,17,18,19,20,24,27,29,43
Engine runs unevenly	5,9,10,16,17,19,20,44
Engine knocks	14,20,45
Engine vibrates	10,16,24,25,30
Engine can not be stopped	1,2,3,4,46
High fuel consumption	8,10,12,13,14,19,21,24
Black or Dark gray exhaust smoke	8,10,11,12,13,14,19,21
Blue or white exhaust smoke	10,12,13,14,15,21,24,37,38,44
High lubrication oil consumption	15,23,24,25,38
Lubrication oil pressure too low	15,22,26,39,40
Coolant temperature too high	27,28,31,32,33,34,35,36,37,47
Coolant temperature too low	36
No charge or poor charge	1,2,41

- | | | |
|---|---|---|
| 1. Flat batteries | 22. Too low lubrication oil level | 43. High back pressure in exhaust system |
| 2. Poor contact/broken cables | 23. Lubrication oil leakage | 44. Very cold engine and lubrication oil |
| 3. Main switch turned off | 24. Worn cylinder liners and/or piston rings | 45. Abnormal load |
| 4. A fuse/circuit breaker has blown/tripped | 25. Worn valve stem seals | 46. Engine consume lubrication oil or combustible gas |
| 5. Lack of fuel | 26. Blocked lubrication oil filter | 47. Cylinder liner have scalings or such that reduce cooling effect |
| 6. Defective Power Module | 27. Radiator blocked | 48. Alternator/Rectifier broken |
| 7. Faulty starter motor/solenoid | 28. Blocked heat exchanger insert | 49. Water entry into engine |
| 8. Defective fuel supply pump | 29. Blocked aircooler | |
| 9. Blocked fuel injectors | 30. Faulty engine mounting | |
| 10. Defective fuel injectors | 31. Too low coolant level | |
| 11. Incorrect valve clearance | 32. Air in fresh water system | |
| 12. Incorrect fuel injection timing | 33. Blocked sea water inlet/pipe/filter | |
| 13. Low compression pressure | 34. Defective impeller in seawater pump | |
| 14. Improper fuel oil | 35. Circulation pump drive belt slips | |
| 15. Improper lubrication oil | 36. Defective fresh water pump | |
| 16. Air in fuel system | 37. Defective/wrong thermostat | |
| 17. Water/contamination in fuel | 38. Too high lubrication oil level | |
| 18. Engine speed control wrongly adjusted | 39. Defective lubrication oil pump | |
| 19. Insufficient air supply | 40. Defective relief valve | |
| 20. Too high coolant temperature | 41. Alternator drive belt slips | |
| 21. Too low coolant temperature | 42. Defective bearings/abnormal cylinder friction | |

Technical Data

D12 MG HE Marine genset

General

Number of cylinders	6
Displacement	12,1 liters (740 in ³)
Valve clearance (cold engine):	
inlet	0,2 mm (0,008")
exhaust	0,5 mm (0,020")
Compression pressure	
at starter motor speed (120 rpm)	not available
Dry Weight*, engine with heat exchanger, without generator and frame, approx.	1400 kg (3087 lbs)
*excl. engine oil & coolant	

Exhaust temperatures: 310 kW @ 1500 rpm

at 25% of ISO Standard Power	227°C/(441°F)
at 50% of ISO Standard Power	301°C/(574°F)
at 75% of ISO Standard Power	333°C/(631°F)
at 100% of ISO Standard Power	352°C/(666°F)
at 110% of ISO Standard Power	362°C/(684°F)

Exhaust temperatures: 370 kW @ 1800 rpm

at 25% of ISO Standard Power	202°C/(396°F)
at 50% of ISO Standard Power	245°C/(473°F)
at 75% of ISO Standard Power	284°C/(543°F)
at 100% of ISO Standard Power	335°C/(635°F)
at 110% of ISO Standard Power	350°C/(662°F)

Lubricating system

Oil capacity, approx.	Including oil filters
No engine inclination	56 liters (14,8 US gals)
volume difference min. –max.	10 liters (2,6 US gals)
Oil pressure at operating speed	400-550 kPa

Cooling system

Freshwater system capacity including heat exchanger, approx.	60 liters (15,9 US gals)
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Electrical system

System voltage	24V
AC alternator voltage/max. amperage	28V/60A
AC alternator output, approx.	1700W
Battery electrolyte density at +25°C (77°F):	
fully charged battery	1,28 g/cm ³ = 0,0462 lb/in ³
battery recharged at	1,13 g/cm ³ = 0,0408 lb/in ³

D12 MG RC Marine genset

General

Number of cylinders	6
Displacement	12,1 liters (740 in ³)
Valve clearance (cold engine):	
inlet	0,2 mm (0,008")
exhaust	0,5 mm (0,020")
Compression pressure	
at starter motor speed (120 rpm)	not available
Dry Weight*, engine, without generator and frame, approx.	not available
*excl. engine oil & coolant	

Exhaust temperatures: **292 kW @ 1500 rpm**

at 25% of ISO Standard Power	242°C/(468°F)
at 50% of ISO Standard Power	295°C/(563°F)
at 75% of ISO Standard Power	321°C/(610°F)
at 100% of ISO Standard Power	340°C/(644°F)
at 110% of ISO Standard Power	350°C/(662°F)

Exhaust temperatures: **339 kW @ 1800 rpm**

at 25% of ISO Standard Power	216°C/(421°F)
at 50% of ISO Standard Power	240°C/(464°F)
at 75% of ISO Standard Power	268°C/(514°F)
at 100% of ISO Standard Power	317°C/(603°F)
at 110% of ISO Standard Power	347°C/(657°F)

Lubricating system

Oil capacity, approx.	Including oil filters
No engine inclination	56 liters (14,8 US gals)
volume difference min. –max.	10 liters (2,6 US gals)
Oil pressure at operating speed	400-550 kPa

Cooling system

Freshwater system capacity including heat exchanger, approx.	60 liters (15,85 US gals)
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Electrical system

System voltage	24V
AC alternator voltage/max. amperage	28V/60A
AC alternator output, approx.	1700W
Battery electrolyte density at +25°C (77°F):	
fully charged battery	1,28 g/cm ³ = 0,0462 lb/in ³
battery recharged at	1,13 g/cm ³ = 0,0408 lb/in ³

D12 MG KC Marine genset

General

Number of cylinders	6
Displacement	12,1 liters (740 in ³)
Valve clearance (cold engine):	
inlet	0,2 mm (0,008")
exhaust	0,5 mm (0,020")
Compression pressure	
at starter motor speed (120 rpm)	not available
Dry Weight*, engine with heat exchanger, without generator and frame, approx.	1330 kg(2933 lbs)
*excl. engine oil & coolant	

Exhaust temperatures:

310 kW @ 1500 rpm

at 25% of ISO Standard Power	227°C/(441°F)
at 50% of ISO Standard Power	301°C/(574°F)
at 75% of ISO Standard Power	333°C/(631°F)
at 100% of ISO Standard Power	352°C/(666°F)
at 110% of ISO Standard Power	362°C/(684°F)

Exhaust temperatures:

370 kW @ 1800 rpm

at 25% of ISO Standard Power	202°C/(396°F)
at 50% of ISO Standard Power	245°C/(473°F)
at 75% of ISO Standard Power	284°C/(543°F)
at 100% of ISO Standard Power	335°C/(635°F)
at 110% of ISO Standard Power	350°C/(662°F)

Lubricating system

Oil capacity, approx.

Including oil filters

No engine inclination	56 liters (14,8 US gals)
volume difference min. –max.	10 liters (2,6 US gals)
Oil pressure at operating speed	400-550 kPa

Cooling system

Freshwater system capacity

engine only, approx.	50 liters (13 US gals)
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Electrical system

System voltage	24V
AC alternator voltage/max. amperage	28V/60A
AC alternator output, approx.	1700W

Battery electrolyte density at +25°C (77°F):

fully charged battery	1,28 g/cm ³ = 0,0462 lb/in ³
battery recharged at	1,13 g/cm ³ = 0,0408 lb/in ³

Fuel specification

Fuel must comply with national and international standards for commercially supplied fuels, e.g.:

JIS KK 2204. Type1, Type2, Type3
ASTM, D975 No.1-D, No.2-D
EN590 with national environment
and cold requirements

Sulfur content

Complying with legal requirements in each country. If the sulfur content exceeds 0.5 wt%, service intervals must be changed, (refer to chapter Maintenance lubrication system).

Fuels with low density (urban diesel in Sweden and city diesel in Finland) can result in a loss of power by approx. 5% and an increase in fuel consumption of approx. 2–3 %.

Lubrication oil specification

Recommended types of engine oil

⚠ Important! Use of improper or inferior oil can cause excessive wear of bearings and moving parts, thus shortening the engine life. It can also result in sticking of piston rings and seizing of pistons in the cylinders, thus causing major damage.

Oil grade	Sulphur content in fuel, by weight		
	up to 0.5%	0.5–1.0%	more than 1.0% ¹⁾
	Oil change interval: Reached first in operation:		
VDS-3	600 hr. or 12 months.	200 hr. or 12 months.	100 hr. or 12 months.
VDS-2 and ACEA E5 VDS-2 and Global DHD-1	400 hr. or 12 months.	200 hr. or 12 months.	100 hr. or 12 months.
VDS and ACEA E3 ²⁾	300 hr. or 12 months.	150 hr. or 12 months.	75 hr. or 12 months.
ACEA: E4, E3, E2 API: CF, CF-4, CG-4	200 hr. or 12 months.	100 hr. or 12 months.	50 hr. or 12 months.

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

¹⁾ If sulphur content is > 1.0% by weight, use oil with TBN > 15.

²⁾ Lubrication oil must comply with **both** requirements.

Note. API: CG4 or CH4 can be approved in markets outside Europe.

VDS = Volvo Drain Specification

ACEA = Association des Constructeurs Européenne d'Automobiles

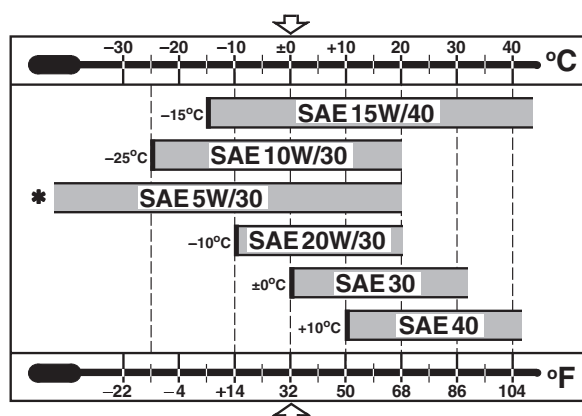
API = American Petroleum Institute

TBN = Total Base Number

Selection of oil viscosity

Use the following chart to select appropriate oil viscosity according to the ambient temperature.

⚠ Important! Excessively high oil viscosity causes power loss and higher oil temperature, while excessively low oil viscosity results in inadequate lubrication and leakage of combustion gas with increased wear and reduced output as a result.



* Refers to synthetic or semi-synthetic oils.

Coolant specification

Always use Volvo Penta Coolant in the freshwater cooling circuit. Volvo Penta Coolant acts both as anti-freeze agent and provides corrosion protection for the metal parts of the cooling system. It also lubricates the coolant pump seals and reduce the risk of cavitation. Future claims might be rejected should Coolant 90 not have been used.

⚠ IMPORTANT! Mixing other types of concentrated coolant with Volvo Penta Coolant, may decrease corrosion protection and may damage the engine or block the cooling system.

Water quality

Always use clean water that complies with the requirements in ASTM D4985. If these requirements are not complied with, corrosion may occur, which would result in impaired cooling performance.

Total solid content	< 340 ppm
Total hardness	< 9,5 °dH
Chloride	< 40 ppm
Sulphate	< 100 ppm
pH value	< 5,5 – 9
Silica	< 20 mg SiO ₂ /l
Iron	< 0.10 ppm
Manganese	< 0.05 ppm
Conductivity	< 500 µS/cm
Organic content, COD _{Mn}	<15 mg KMnO ₄ /L

Volvo Penta Coolant

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

Volvo Penta Coolant, Ready Mixed

A ready-mixed coolant, 40% "Volvo Penta Coolant" and 60% water. This concentration protects the engine against corrosion, cavitation damage and freezing conditions down to -28 °C (18°F).

Mixing ratio

Mix 40% Volvo Penta Coolant and 60% water. This mixture protects the engine against internal corrosion, cavitation and frost damage down to -28 °C (18°F). (Using 60 % glycol lowers the freezing point to -54 °C (65°F)).

If the coolant contains less than 40% Volvo Penta Coolant, the cooling galleries in the engine or radiator may be blocked by contamination. If the coolant contains more than 60% Volvo Penta Coolant the cooling ability of the coolant mixture is impaired, this may cause the engine to overheat. Too high concentration of Volvo Penta Coolant also impairs the frost protection.

⚠ IMPORTANT! Coolant must be mixed with clean water, use **distilled - de-ionized water**. The water must comply with the requirements in ASTM D4985, refer to "Water quality".

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

Identification numbers D12 MG Genset engine

Type plates with identification numbers and labels with information on certificates and classification, can be found on the engine. This information must always be used as a reference when ordering service and spare parts.

IMO decal (1)

Warranty decal (1)

Product designation
Serial and basic engine number
Product number

Engine plate (3)

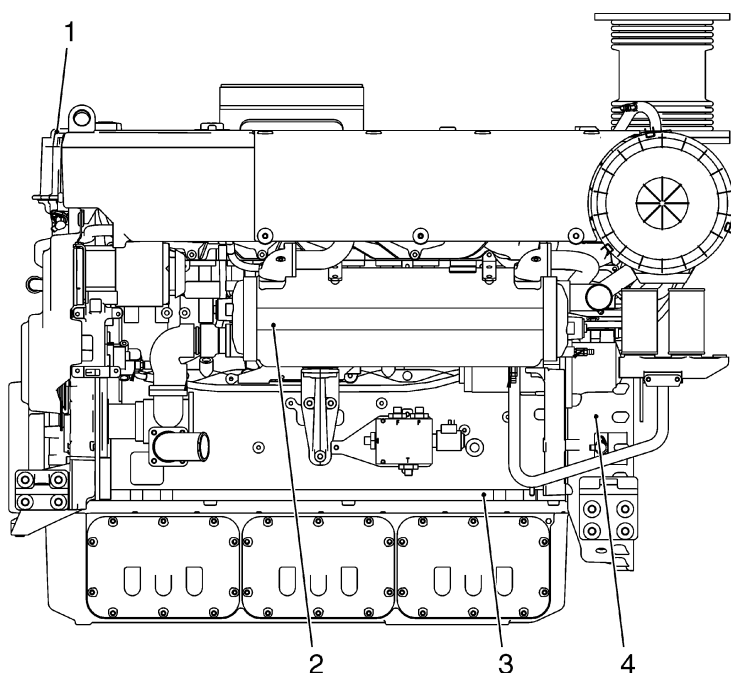
Product designation
Product number
Serial number

Control unit decal (behind heat exchanger) (2)

Dataset
Spec Number
ECU batch

Certification plate (with classified engine) (4)

Product designation
Serial number
Product number



- 1.
- 1.
- 2.
- 3.
- 4.

