

OPERATOR'S MANUAL

TAD734GE

(EMS 2)

Foreword

Volvo Penta industrial engines are relied upon throughout the world, in both mobile and stationary applications, under some of the most rigorous conditions imaginable. This is not by chance.

After more than 100 years of producing engines the name Volvo Penta has come to symbolize reliability, technical ingenuity, first-class performance and longevity. We believe that these characteristics are also ultimately your requirements and expectations for new Volvo Penta industrial engines.

To make certain that your expectations are matched, we ask that you read carefully through the instruction book before starting the engine.

Sincerely

AB VOLVO PENTA



Engine data

Engine designation Product number

Serial number

Clutch, type/nr.

Nearest Volvo Penta service location

Name Telephone

Address

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Safety information

Read this chapter very carefully. It has to do with your safety. It describes how safety information is presented in the instruction book and on the product. It also gives you an overview of the basic safety precautions for maintaining the engine.

Check that you have received the correct operator's manual before you read on. If not, please contact your Volvo Penta dealer.



Incorrect operation can lead to personal injury and damage to products or property. Therefore read through the instruction book very carefully before you start the engine or do any maintenance or servicework. If there is still something which is unclear or you are unsure of, please contact your Volvo Penta dealer for assistance.

 This symbol is used in the instruction book and on the product, to call your attention to the fact that this is safety information. Always read such information very carefully.

Safety texts in the instruction book have the following order of priority:

 **WARNING!** Warns for the risk of personal injury, major damage to product or property, or serious malfunctions if the instruction is ignored.

 **IMPORTANT!** Is used to call attention to things which could cause damage or malfunctions to product or property.

NOTE! Used to draw your attention to important information that will facilitate the work or operation in progress.

 This symbol is used on our products in some cases and refers to important information in the instruction book. Make sure that warning and information symbols on the engine are clearly visible and legible. Replace symbols which have been damaged or painted over.

Safety precautions for operation and maintenance

Daily Checks

Make a habit of always checking the engine compartment before running (**before the engine is started**) and after running (**when the engine has been stopped**). This helps you to quickly discover whether any leakage of fuel, coolant, oil or any other abnormal event has happened, or is about to happen.

Fuel Filling

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

Never over-fill the tank. Close the tank cap securely.

Only use the fuel recommended in the instruction book. The wrong grade of fuel can cause malfunctions or stop the engine. In a diesel engine, it can also cause the injection pump to bind and the engine to over-rev, entailing a strong risk of personal injury and machinery damage.

Carbon Monoxide Poisoning

Only start the engine in a well-ventilated area. When running in a confined space, exhaust fumes and crankcase gases must be led away.

Operation

The engine must not be operated in environments which contain explosive media since none of the electrical and mechanical components are spark proof.

Approaching a running engine is a safety risk. Hair, fingers, loose clothes, or dropped tools can catch on rotating components and cause severe injury.

When engines are supplied without touch guards, all rotating components and hot surfaces must be protected after installation in their application, if necessary for personal safety.

Ignition Lock

If the instrument panel does not have a key switch, the engine compartment must be lockable, to prevent unauthorized persons from starting the engine. Alternatively, a lockable main switch can be used.

Maintenance and Service

Proficiency

The instruction book contains directions on how to carry out the most common service and maintenance tasks safely and correctly. Read them carefully before starting work.

Literature for more major tasks is available from your Volvo Penta dealer.

Never do a job if you are not entirely sure about how to do it. Please contact your Volvo Penta dealer and ask for assistance instead.

Stop the Engine

Stop the engine before opening or removing the engine hatch/hood. Maintenance and service should be done with the engine stopped, unless otherwise specified.

Prevent the engine from being started by pulling out the starter key and cutting the current with the main switch. Lock them in the off position. Fix a notice by the operator's station to say that work is in progress.

Working with, or approaching a running engine is a safety risk. Hair, fingers, loose clothes, or dropped tools can catch on rotating components and cause severe injury. Volvo Penta recommends that all service work which requires the engine to be running should be done by an authorized Volvo Penta workshop.

Safety precautions for operation and maintenance (contd.)

Removing the Engine

When removing the engine the lifting rings mounted on the engine should be used. Always check that the lifting devices are in good condition and that they have the correct capacity for the lift (engine weight together with auxiliaries, if fitted). The engine should be raised with an adjustable lifting boom for safe handling. All chains or cables should be parallel to each other and should be as square as possible to the top of the engine. Note that auxiliary equipment installed on the engine may change its center of gravity. Special lifting devices may then be needed to obtain a correct balance for safe handling. Never carry out work on an engine that is **only** suspended in a hoist.

Before Starting

Re-install all guards which have been removed during service work, before re-starting the engine. Make sure that there are no tools or other objects left behind on the engine.

Never start a turbocharged engine without the air filter in place. The rotating compressor turbine in the turbocharger can cause severe injury. There is also a risk that foreign bodies could be sucked in and cause machinery damage.

Fire and Explosion

Fuel and Lubricating Oil

All fuel, most lubricants and many chemicals are flammable. Always read and follow the directions on the packages.

Work on the fuel system must be done with the engine cold. Fuel leakages and spills on hot surfaces or electrical components can cause fires.

Store oil and fuel-soaked rags and other flammable material in such a way that there is no danger of them causing fire. In certain circumstances oil-soaked rags can spontaneously ignite.

Never smoke when filling fuel, lubricating oil or when in the vicinity of fueling stations or the engine bay.

Non-original Spare Parts

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

The use of non-original spare parts can cause an explosion or fire.

Batteries

Batteries contain and give off oxyhydrogen, especially when charged. This gas is very flammable and highly explosive.

Smoking, naked flames or sparks must never occur in the vicinity of batteries or the battery compartment.

Incorrect connection of a battery cable or start cable can cause a spark which can in turn be sufficient to cause the battery to explode.

Start Spray

Never use start spray or similar preparations as a start aid on engines with air pre-heating (glow plugs/starting heater). They may cause an explosion in the inlet manifold. Danger of personal injury.

Hot Surfaces and Fluids

A hot engine always presents the risk of burns. Be on your guard against hot surfaces: the exhaust manifold, turbocharger, oil pan, charge air pipe, starting heater, hot coolant and hot lubricating oil in pipes, hoses etc.

Chemicals

Most chemicals, such as glycol, rust preventer, conservation oils, degreasers etc. are hazardous. Always read and follow the directions on the packages.

Certain chemicals such as preservative oils are flammable and also dangerous when inhaled. Ensure good ventilation and use a protective mask when spraying. Always read and follow the directions on the packages.

Keep chemicals and other hazardous materials out of the reach of children. Hand in surplus or used chemicals to a recycling station for disposal.

Lubrication System

Hot oil can cause burns. Avoid skin contact with hot oil. Make sure that the oil system is de-pressurized before starting work. Never start or run the engine with the oil filler cap removed, because of the risk of oil ejection.

Cooling System

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

Nevertheless, if the filler cap, coolant hose etc., has to be opened or removed when the engine is hot, undo the filler cap slowly and carefully, to release the pressure before removing the filler cap completely and starting work. Note that the coolant can still be hot and cause burns.

Fuel System

Always protect your hands when searching for leaks. Fluids which leak under pressure can force their way into body tissue and cause severe injury. There is a risk of blood poisoning (septicemia).

Always cover the alternator if it is located beneath the fuel filters. Fuel spillage can damage the alternator.

Electrical system

Cut the Current

Before any work is done on the electrical system, the engine must be stopped and the current cut by switching off the main switch(es). External current supply for engine heaters, battery chargers or other auxiliary equipment connected to the engine must be disconnected.

Batteries

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

If acid comes into contact with your skin, wash with soap and plenty of water. If you get battery acid in your eyes, flush at once with lots of cold water, and seek medical assistance immediately.

Arc Welding

Remove the positive and negative cables from the batteries. Then disconnect all cables connected to the alternator.

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

When welding is completed: Always connect the alternator cables **before** the battery cables are re-attached.

Introduction

This instruction book has been prepared to give you the greatest possible benefit from your Volvo Penta industrial engine. It contains the information you need to be able to operate and maintain the engine in a safe and proper manner. Read the instruction book carefully and learn how to operate the engine, controls and other equipment in a safe manner before you start the engine.

 **IMPORTANT!** This instruction book describes the engine and equipment as offered for sale by Volvo Penta. Variations in appearance and function of the controls and instruments may occur in certain variants. In these cases, refer to the operator's manual for the relevant application.

Environmental care

All of us want to live in a clean, healthy environment, where we can breathe clean air, see healthy trees, have clean water in lakes and seas, and be able to enjoy sunshine without fearing for our health. Unfortunately, this cannot be taken for granted these days; it is something all of us must work toward.

As an engine manufacturer, Volvo Penta has particular responsibility and for this reason, environmental care is an obvious foundation of our product development. Volvo Penta currently has a broad range of engines where great progress has been made in the reduction of emissions, fuel-consumption and engine noise etc.

We hope that you will take care to maintain these qualities. Always follow the directions in the instruction book regarding fuel grades, operation and maintenance, to avoid unnecessary environmental impact. Please contact your Volvo Penta dealer if you notice any changes such as increased fuel consumption or increased exhaust smoke.

Always remember to hand in hazardous waste such as drained oil, coolant, old batteries etc. for disposal at a recycling facility.

Through our common efforts, we can together make a valuable contribution to the environment.

Running in

The engine must be “run in” during its first 10 running hours, in accordance with the following:

Use the engine in normal operation. Full load should only be applied for short periods. Never run the engine at constant revolutions for prolonged periods during running in.

Higher oil consumption is normal during the first 100-200 hours of operation. For this reason, check the oil level more frequently than the normal recommendation.

When an disengageable clutch is installed, this should be checked more carefully during the first days. Adjustments may need to be done to compensate bedding-in of the friction plates.

Fuel and Oils

Only use the grades of fuels and oils recommended in the instruction book (refer to the “Maintenance” chapter under the fuel and lubrication system headings). Other grades of fuel and oils can cause malfunctions, increased fuel consumption and over time even shorten the life of the engine.

Always change the oil, oil filter and fuel filter according to the prescribed intervals.

Maintenance and Spare Parts

Volvo Penta engines are designed for maximum reliability and long life. They are built to withstand a demanding environment, but also to have the smallest possible environmental impact. Regular maintenance and the use of Volvo Penta original spare parts will ensure these qualities are retained.

Volvo Penta has a world-wide network of authorized dealers. They are Volvo Penta product specialists, and have the accessories, original spares, test equipment and special tools necessary for high quality service and repair work.

Always comply with the maintenance schedule in the instruction book, and remember to note the engine/transmission identification number when you order service and spare parts.

Certified Engines

If you own an emission certified engine, which is used in an area where exhaust emissions are regulated by law, it is important to be aware of the following:

Certification means that an engine type has been checked and approved by the relevant authority. The engine manufacturer guarantees that all engines made of the same type are equivalent to the certified engine.

This places special demands on the maintenance and service you provide your engine; accordingly:

- Maintenance and service intervals recommended by Volvo Penta must be complied with.
- Only Volvo Penta original spare parts may be used.
- Service to injection pumps, pump settings and injectors must always be done by an authorized Volvo Penta workshop.
- The engine must not be converted or modified, except with accessories and service kits which Volvo Penta has developed for the engine.

- No installation changes to the exhaust pipe and engine air inlet ducts may be made.
- Any seals on the engine may not be broken by unauthorized persons.

Otherwise the general instructions in the Operator's Manual regarding operation, maintenance and service apply.

 **IMPORTANT!** Neglected or inferior maintenance/ service or the use of non-original spare parts, will result in AB Volvo Penta no longer accepting responsibility for engine conformity with the certified model.

Damage, injury and/or costs which arise from this will not be compensated by Volvo Penta.

Warranty

Your new Volvo Penta industrial engine is covered by a limited warranty, according to the terms and conditions set out in the Warranty and Service book.

Please note that AB Volvo Penta's liability is limited to that which is stated in the Warranty and Service book. Read it carefully, as soon as possible after delivery. It contains important information about, among other things, warranty cards, service intervals and maintenance which, as the owner, is your responsibility to know, check and execute. Otherwise AB Volvo Penta may fully or partly refuse to honor its warranty undertakings.

Please contact your Volvo Penta dealer if you have not received a Warranty and Service book, or a customer copy of the warranty card.

Presentation

TAD734GE is a direct injection, straight, 6-cylinder engine.

The engine is equipped with a “common rail” fuel injection system, IEGR (Internal Exhaust Gas Recirculation), electronically-controlled fuel management (EMS 2), turbocharger, thermostatically-controlled cooling systems and electronic speed control.

Technical Description

Engine and Cylinder Block

- The cylinder block and cylinder head are manufactured of alloyed cast iron
- Seven bearing induction-hardened crankshaft
- Replaceable wet cylinder liners
- Cast aluminum pistons with oil cooling
- Three piston rings, with a “keystone” type top ring
- Induction-hardened overhead camshaft with valve lifters and push rods.
- Four valves per cylinder
- Replaceable valve seats and valve guides

Control Unit

- Microprocessor-based fuel supply control unit, EMS 2

Fuel System

- Common rail fuel injection
- Gearwheel fuel feed pump, camshaft driven
- EMS 2 (Engine Management System). See separate description.

Lubrication System

- Water oil cooler
- Crankshaft driven lubrication oil pump
- Full flow filter with bypass

Turbocharging System

- Turbo compressor

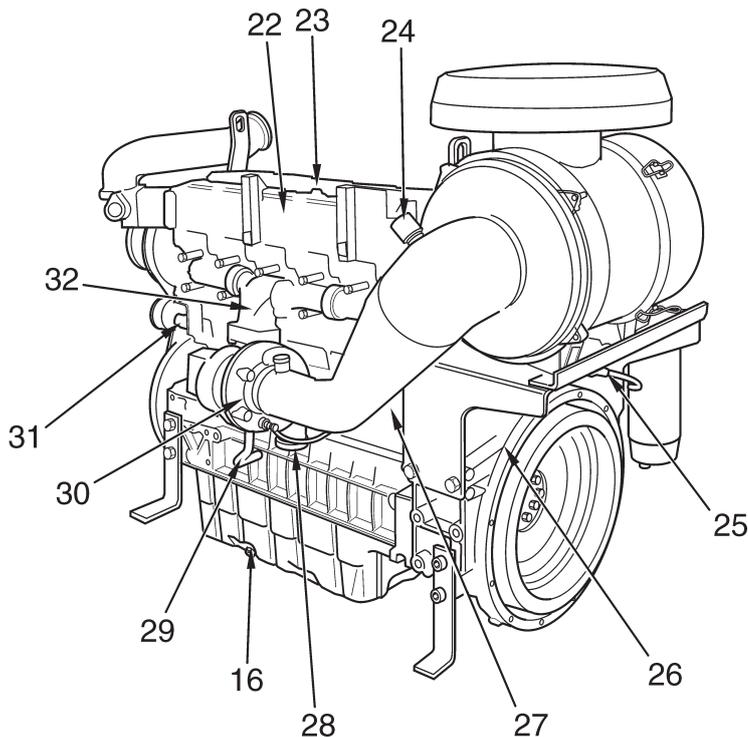
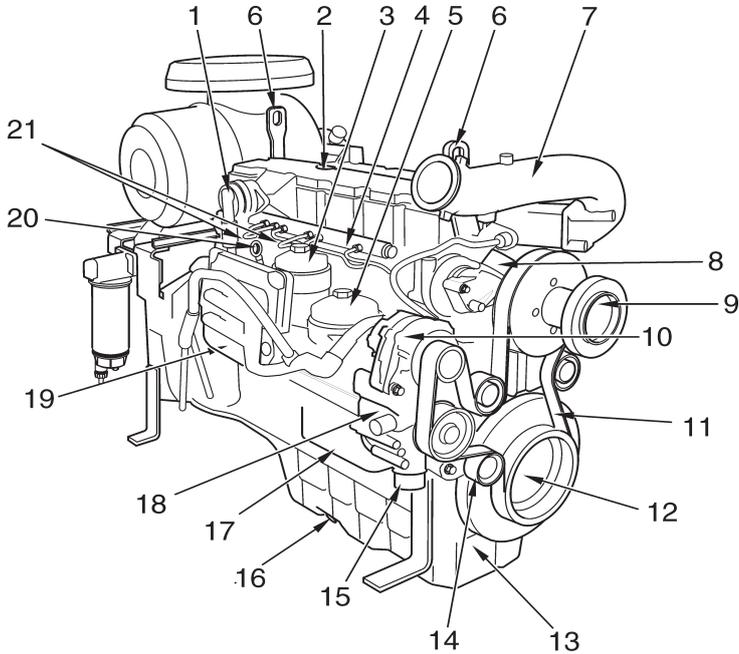
Cooling System

- Radiator with expansion tank
- Air-cooled charge air cooler

Electrical system

- 24 V

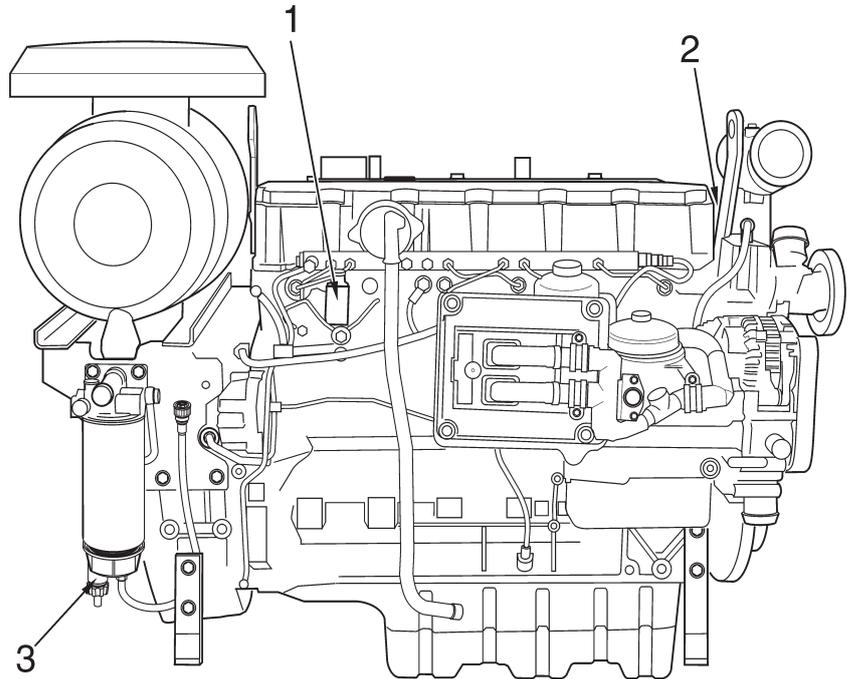
Component Locations, TAD734GE



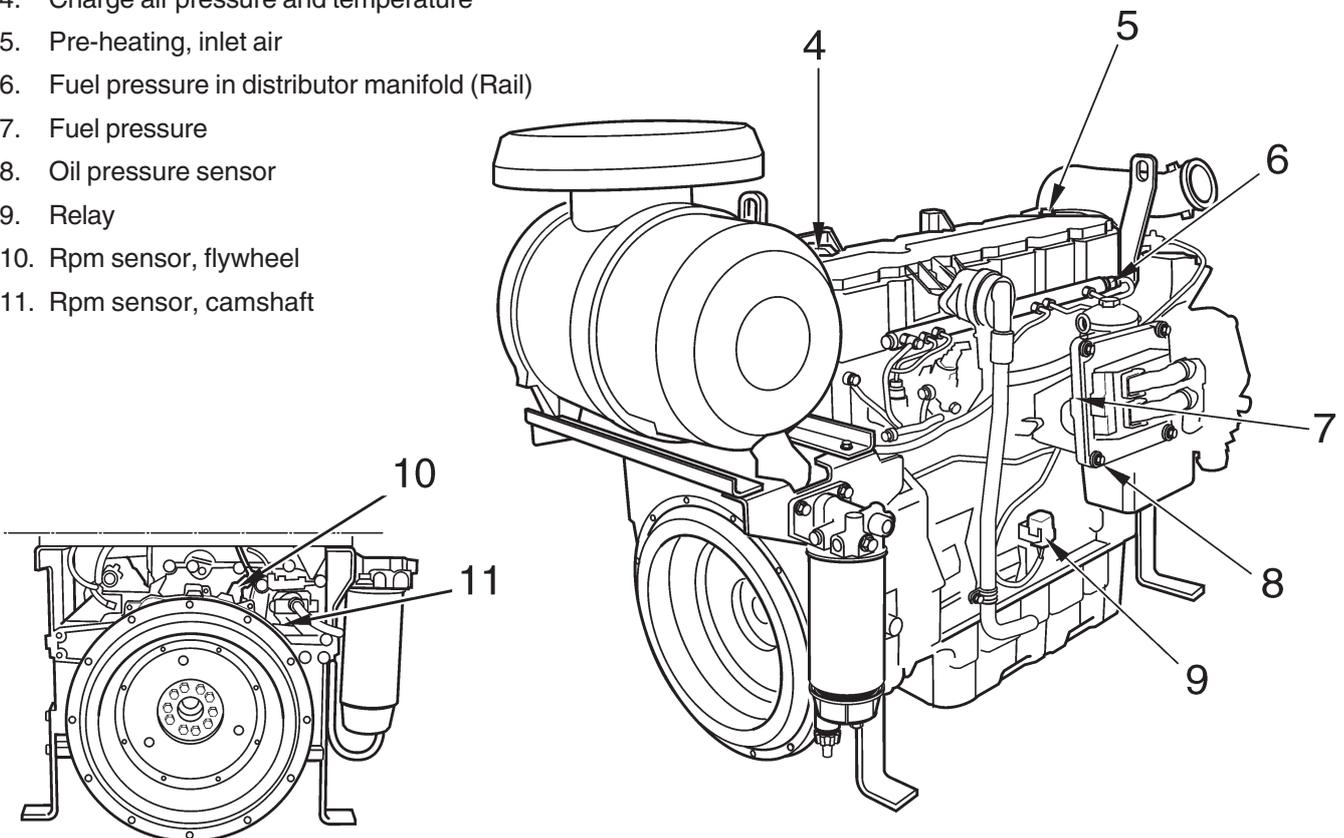
1. Crankcase ventilation, (sealed crankcase ventilation optional)
2. Oil Filler
3. Fuel filter
4. Common Rail unit, with safety valve and rail pressure sensor
5. Oil filter
6. Lifting eyes, (2 pcs)
7. Inlet, after charge-air cooler
8. Coolant outlet, from thermostat housing
9. Fan hub
10. Alternator
11. Drive belt
12. Damper and belt pulley
13. Oil pan
14. Tensioner pulley
15. Coolant inlet, to engine
16. Drain plug, oil pan
17. Oil Cooler
18. Coolant pump
19. Outlet, engine heater (option)
20. Dipstick
21. High pressure pumps
22. Air inlet pipe
23. Valve cover
24. Indicator, air filter
25. Fuel pump
26. Flywheel housing
27. Starter motor guard
28. Charge air, to cooler
29. Oil pipe, from turbo
30. Turbo
31. Relay
32. Exhaust manifold

Location of sensors

NOTE! Positions may differ, depending on the engine model.



1. Proportional solenoid valve, high pressure pump – fuel (MPROP)
2. Coolant temperature
3. Water in fuel, (mounted on fuel pre-filter).
4. Charge air pressure and temperature
5. Pre-heating, inlet air
6. Fuel pressure in distributor manifold (Rail)
7. Fuel pressure
8. Oil pressure sensor
9. Relay
10. Rpm sensor, flywheel
11. Rpm sensor, camshaft



EMS 2

EMS 2 (Engine Management System) is an electronic system with CAN communication (Controller Area Network) for diesel engine control. The system has been developed by Volvo and includes fuel control and a diagnostic function.

Summary

The system comprises, among other things, of a control unit, sensors and injectors. The sensors send input signals to the control unit, which in turn controls the injectors.

The information from the sensors give exact data about prevailing operating conditions and allows the processor in the control module to calculate correct injection amount, injection timing and check engine health.

Input signals

The control unit receives input signals about engine operating conditions from the following components:

- coolant temperature sensor
- charge air pressure and temperature sensor
- rpm sensor, camshaft
- rpm sensor, flywheel
- coolant level sensor
- oil pressure sensor
- fuel pressure sensor
- water in fuel indicator
- fuel pressure in distributor manifold

Output signals

Based on the input signals the control module controls the following components:

- unit injectors
- starter motor
- main relay
- pre-heating relay
- FCU (Fuel Control Unit)

Fuel Management

The engine fuel requirement is analyzed up to 100 times per second. The amount of fuel injected into the engine and the injection timing are fully electronically controlled, via fuel valves on the unit injectors.

This means that the engine always receives the correct amount of fuel in all operating conditions, which provides lower fuel consumption and minimal exhaust emissions etc.

Diagnostic Function

The task of the diagnostic function is to discover and localize any malfunctions in the EMS 2 system, to protect the engine and to inform about any problems that occur.

If a malfunction is detected it is denoted by warning lamps, a flashing diagnostic lamp or in text on the instrument panel, depending on the equipment used. If a flashing or text fault code is generated, use the code for guidance when trouble shooting. Fault codes can also be deciphered by Volvo's VODIA tool at authorized Volvo Penta workshops.

If there is a serious malfunction, the engine will be shut down altogether, or the control unit will reduce available power (depending on the application). Once again, a fault code will be generated for guidance in trouble shooting.

Instrument, EMS 2

NOTE! All instruments are fittings.



CIU – Control Interface Unit

The CIU is the “translator” between the EMS 2 engine control unit and the customer’s own control panel. The CIU has two serial communication links, one fast and one slow.

The fast one is a so-called CAN link. All data related to instruments, indication lamps, connectors and potentiometers is controlled by this link.

The slow link manages diagnostic information for flashing codes etc.



DU - Display Unit

The DU is an instrument panel which shows engine working values graphically on an LCD screen. It consists of a computerised unit for permanent installation in a control panel.

The DU is connected between the engine control unit and the CIU or DCU.

Monitoring

- Engine rpm, charge pressure, charge temperature, coolant temperature, oil pressure, oil temperature, fuel pressure, engine hours, battery voltage, momentary fuel consumption and average fuel consumption (trip fuel)

Diagnostics

- Shows active fault codes in text

Easy Link instrument (only in conjunction with CIU or DCU)

The following “Easy Link” instruments are available:

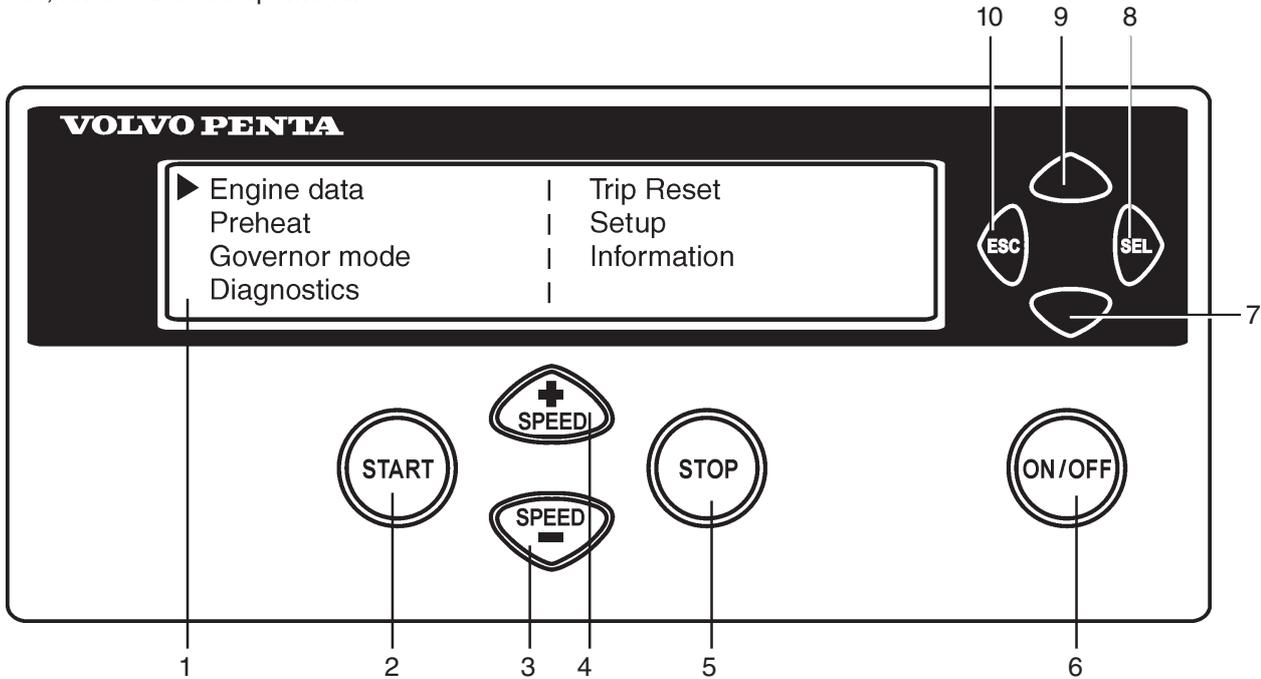
- Engine rpm/hour meter (fault codes are also displayed on the tachometer display when the diagnostic button is pressed)
- Coolant temperature
- Oil pressure
- Turbo pressure
- Battery voltage
- Alarm panel

DCU (Display Control Unit)

The DCU (Diesel Control System) control panel is available as an accessory for the EMS (Engine Management System) electronic control system. The DCU is a digital instrument panel which communicates with the engine control unit. The DCU has a number of functions such as engine control, engine monitoring, diagnostics and parameter setting.

The menus in the DCU system can be used to check, and in some cases to set, a number of different functions in the EMS system.

NOTE! The menus and illustrations shown here are from the English version. The language can be changed, however; refer to the “Setup” menu.



- 1. LED display
- 2. START. Starts the engine
- 3. SPEED -. Reduces engine rpm
- 4. SPEED +. Increases engine rpm
- 5. STOP. Stops the engine
- 6. ON/OFF. Starts and stops the system
- 7. Scrolls down in menus
- 8. SEL. Selects from menus
- 9. Scrolls up in menus
- 10. ESC. Return to previous menu selection

Start

When the DCU panel is started, the “Engine Data” menu is displayed; press “ESC” to come to the main menu.

Menus

There are several sub-menus under each main menu. There is not always space for all the menu choices on the display. To scroll through the menus, use the “7” and “9” buttons on the display. Press the “SEL” button “8” to make a selection. See illustration on the previous page.

NOTE! The “Setup” menu can be used to select the language that you want to use on the display.

▶ Engine data		Trip Reset
Preheat		Setup
Governor mode		Information
Diagnostics		

Main menu

- **Engine data**, current engine data
- **Preheat**, manual activation of preheating
OBS! Must be activated when the temperature is below 0°.
- **Governor mode**, activates droop
- **Diagnostics**, shows fault codes in text
- **Trip reset**, restores trip data
- **Setup**, parameter setting
- **Information**, shows the data for the applicable hardware, software, data set and engine identification of the engine and DCU

▶ Eng speed	rpm		Boost prs	kPa
Cool temp	C		Boost tmp	C
Oil pres	kPa		Oil temp	C
Eng hours	h		Batt Volt	V

Engine data

shows relevant engine data.

- Engine rpm, can be controlled with the “SPEED +” and “SPEED -” buttons (rpm)
- Charge pressure (kPa)
- Coolant temperature (°C)
- Charge air temperature (°C)
- Oil pressure (kPa)
- Oil temperature (value **not** shown – sender missing)
- Engine hours (h)
- Battery voltage (V)
- Fuel consumption (l/h)
- Momentary fuel consumption (trip fuel) (l)

*** Preheat ***
Press SEL to request preheat

Preheat

manual activation of preheating. When activated, the EMS system senses at start if preheating is necessary. For automatic preheating, refer to “Setup”/“Preheat on ignition” menu.

NOTE! Must be activated when the temperature is below 0°.

The preheating time is adjusted to suit the engine temperature, and can last for up to 50 seconds both before and after starting. Also refer to “Starting procedure, EMS 2”.

- Press “SEL”, the text “Preheat requested” is displayed.
- The display automatically returns to the “Engine Data” menu.

*** Governor mode ***
Droop mode

Governor mode

activates/deactivates droop. To set the droop level, refer to the “Setup”/“Governor gradient” or “Governor droop”.

- Select “Isochronous mode” or “Droop mode” with the SEL button.

*** Diagnostics 7/9 ***
20.0 h Engine oil pressure
signal failure Inactive

Diagnostics

shows the error list containing the 10 latest active and inactive faults. The fault codes are shown as text on the display.

- Scroll through the error list with the arrow keys.

*** Trip Data Reset ***
Press SEL to reset trip data

Trip reset

resets trip data e.g. fuel consumption.

- Press the SEL button to reset trip data.

Setup	
▶ Set Application :	(Versatile)
Units :	(Metric)
Language :	(English)

Setup

parameter setting in the engine's control systems. Depending on whether you select "Versatile" or "Genset" from "Set application", different menus will appear under "Customer parameter"; see below.

The parameters which can be set/selected (choice is made with the SEL button) are:

- **Set application**, setting of "Versatile" or "Genset". Depending on what is chosen here, different menus will appear under "Customer parameter",
- **Unit**, selection of units of measurement (metric or US units)
- **Language**, selection of the language shown in the display. You can choose between English, French, German and Spanish.
- **Stop energized to**, setting of external stop input. Activated by "Stop" or "Run".
"Stop": The stop input must be connected to voltage to stop the engine.
"Run": The stop input must be connected to voltage to run the engine.
- **Customer parameter**, alarm threshold limits. Refer to "Customer parameter/Versatile" and "Customer parameter/Genset".
- **Throttle input setting**, setting rpm control and voltage limits. See "Throttle input setting".
- **Display setting**, display settings. See "Display setting".

Setup (Versatile)	
▶ Idle engine speed :	rpm
Preheat on ignition :	
Governor gradient :	Nm/rpm

Customer parameter/Versatile

- **Idle engine speed** – setting idle rpm
- **Preheat on ignition** – activation of automatic pre-heat. The engine control system senses if pre-heating is needed and activates it directly when switched on.
- **Governor gradient (Nm/rpm)** – setting the droop level, when this has been activated. Refer to "Governor droop" in the main menu for activation.
- **Oil temp warning limit (°C)** – setting oil temperature alarm limit.
- **Coolant temp warning limit (°C)** – setting coolant temperature alarm limit.

Setup (Genset)

▶ Primary engine speed :
 Preheat on ignition :
 Governor droop :

Customer parameter/Genset

- **Primary engine speed** – selection of engine rpm, 1500 or 1800 rpm.
- **Preheat on ignition** – activation of automatic pre-heat. The engine control system senses if pre-heating is needed and activates it directly when switched on.
- **Governor droop (%)** – setting the droop level, when this has been activated. Refer to “Governor droop” in the main menu for activation.
- **Overspeed limit (%)** – setting the speed for the excess rpm alarm, % of set engine rpm.
- **Overspeed shutdown** – activates engine stop at excess rpm alarm. Refer to “Overspeed limit” to activate the alarm limit for the excess rpm alarm.
- **Oil temp warning limit (°C)** – setting oil temperature alarm limit (TAD734: sender not fitted).
- **Coolant temp limit (°C)** – setting coolant temperature alarm limit.

Setup(Throttle)

Setup throttle mode : *** OFF ***

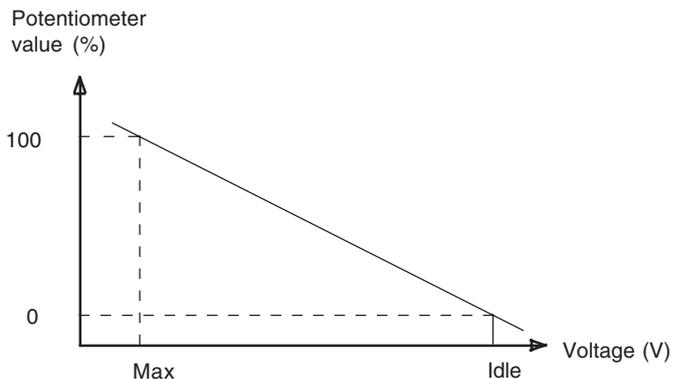
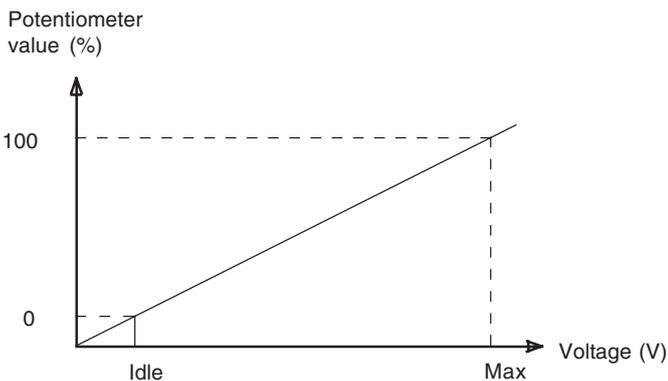
Throttle input setting

rpm control setting (throttle operation).

Setup(Throttle)

▶ Set throttle mode :
 Set idle voltage :
 Set mx voltage :

- **Set throttle mode** –
 “OFF” – rpm is controlled via the DCU panel.
 “ext throttle input” – rpm is regulated by potentiometer (gaspedal).
 “ext voltage input” – rpm is regulated by an external control unit.
- **Set idle voltage (V)** – setting voltage level at idle.
- **Set max voltage (V)** – setting voltage level at maximum rpm.



Setup (Display)		
▶ Set contrast	:	60%
Set backlighttime	:	5 sec
Set backlight brightness	:	10

Display setting

settings for the display. Adjustment is made with the “7” and “9” buttons; see DCU panel illustration.

- **Set contrast (%)** – contrast setting.
- **Set backlight time (sec)** – sets the time (in seconds) for the display backlight; the backlight switches off when the panel is not in use.
- **Set backlight brightness** – sets backlight brightness.

*** Information ***		
▶ Engine hardware Id	:	
Engine software Id	:	
Engine Dataset1 Id	:	

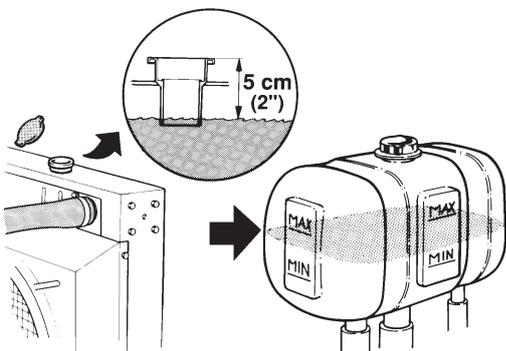
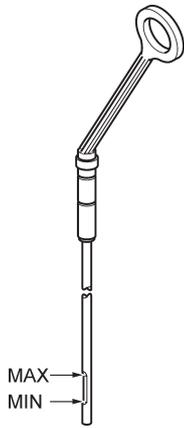
Information

displays engine and DCU data.

- **Engine hardware Id** – engine control unit article number
- **Engine software Id** – engine control unit software article number
- **Engine dataset1 Id** – article number, engine dataset 1.
- **Engine dataset2 Id** – article number, engine dataset 2.
- **Vehicle Id** – chassis number
- **DCU hardware Id** – DCU article number.
- **DCU software Id** – DCU software article number.
- **DCU dataset1 Id** – article number, DCU dataset 1.
- **DCU dataset2 Id** – article number, DCU dataset 2.

Starting the engine

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



Before Starting

- Check that the oil level is between the MAX and MIN marks. Refer to the “Maintenance, lubrication system” chapter.
- Open the fuel cocks.

- Check that there is no evidence of oil, fuel or coolant leaks present.
- Check the air filter pressure-drop indicator. Refer to the “Maintenance, Engine, General” chapter:

- Check the coolant level and that the radiator is not blocked externally. Refer to the “Maintenance, cooling system” chapter:

⚠ WARNING! Do not open the expansion tank cap when the engine is hot. Steam or hot fluid could spray out.

- Turn the main current on.

⚠ IMPORTANT! Never break the circuit with the main switch(es) when the engine is running. This can damage the alternator.

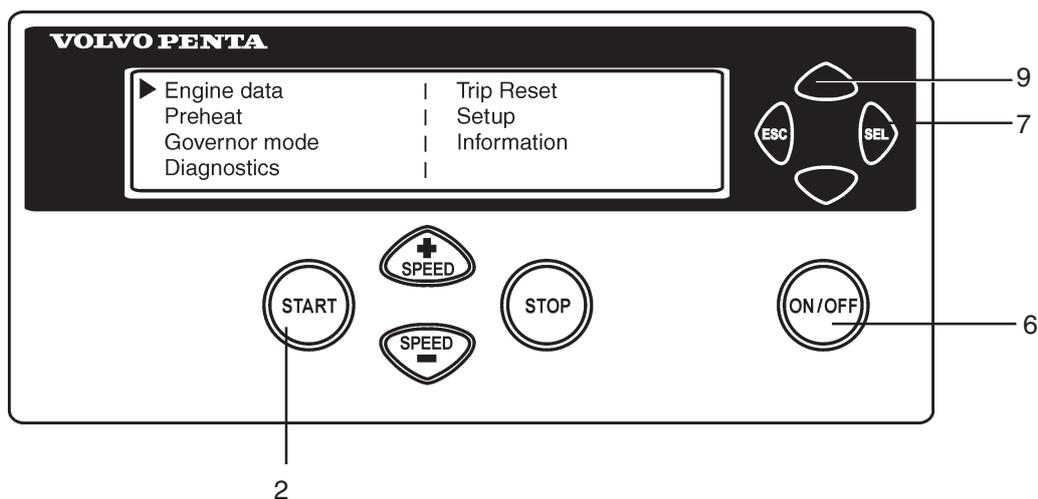
- Move the engine speed control to idle, and open the disengageable clutch/gearbox if installed.

Start routine (DCU)

The preheating time is adjusted to suit the engine temperature, and can continue for up to 50 seconds both before and after starting.

The starter motor connection time is maximized to 30 seconds. After that, the starter motor circuit is cut for 80 seconds to protect the starter motor against overheating.

NOTE! Preheat must be activated when the temperature is below 0°.



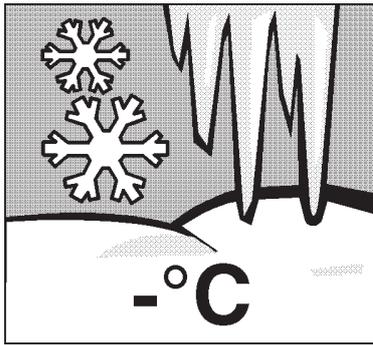
With preheating

1. Press the "ON/OFF" button (6).
2. Press the "SEL" button (7) to come to the main menu.
3. Navigate to **Preheat** with button (9). Press the "SEL" button (7)
4. In the preheat menu, press the "SEL" button (7) again to select pre-heating; the text "Preheat active please wait" is shown in the display.
5. Wait until the text disappears and then press the "START" button (2).

Without preheating

1. Press the "ON/OFF" button (6).
2. Press the "START" button (2).

Warm through the engine at idle (1500/1800 rpm).



Starting in extreme cold

To facilitate – and in some cases enable – engine starting, certain preparations must be made:

Use a winter grade fuel (of a well-known make) which is approved for the prevailing temperature. This reduces the risk of wax deposits in the fuel system. At extremely low temperatures, the use of a fuel heater is recommended.

For fully acceptable lubrication, a synthetic engine oil of recommended viscosity for the prevailing temperature should be used. Refer to the “Maintenance, lubrication system” chapter. Synthetic lubricants withstand wider temperature ranges than mineral-based lubricants.

Preheat the coolant with a separately installed electric engine heater. In extreme cases, a diesel-burning engine heater may be needed. Ask your Volvo Penta dealer for advice.

⚠ IMPORTANT! Make sure that the cooling system is filled with a glycol mixture. Refer to the “Maintenance, cooling system” chapter.

The batteries must be in good condition. Cold weather reduces battery capacity. Increased battery capacity may be necessary.



Never use start spray

⚠ WARNING! Never use start spray or similar products as a starting aid. They may cause an explosion in the inlet manifold. Injury may also result.

Starting with auxiliary batteries

⚠ WARNING! Batteries (especially auxiliary batteries) contain oxyhydrogen which is highly explosive in contact with air. A spark, which can be formed if the auxiliary batteries are wrongly connected, is enough to make a battery explode and cause damage.

1. Check that the auxiliary batteries are connected (series or parallel) so that the rated voltage corresponds to the engine system voltage.
2. First connect the red (+) jumper cable to the auxiliary battery, then to the discharged battery. Then connect the black (-) jumper cable to the auxiliary battery and finally to a place **a short distance from the discharged batteries** e.g. the main switch negative cable or the negative cable's start motor connector.
3. Start the engine.

⚠ WARNING! Do not disturb the connections during the start attempt (risk of arcing), and do not stand leaning over any of the batteries.

4. Disconnect the jumper cables in reverse order.

⚠ WARNING! The permanent standard battery cables must absolutely not be disconnected.

Operation

Correct operating technique is very important for both fuel economy and engine life. Always let the engine warm up to normal operating temperature before full power is demanded. Avoid sudden throttle openings and operation at high engine rpm.

Check instruments

Check all instruments immediately after starting, and then regularly during operation.

⚠ IMPORTANT! On engines in continuous operation, the lubricating oil level must be checked, at least every **24 hours**. Refer to the “Maintenance, lubrication system” chapter.

Fault indication

If the EMS 2 system receives abnormal signals from the engine, the control unit generates fault codes and signals alarms by means of lamps and audible warnings. This is done by means of CAN signals to the instrument.

More information about fault codes and trouble shooting is found in the “Diagnostic function” chapter.

Operation at low load

Avoid long-term operation at idle or at low load, since this can lead to increased oil consumption and eventually to oil leakage from the exhaust manifold, since at low turbo pressures oil will seep past the turbo-charger seals and carry over with the charge air into the inlet manifold.

As a consequence of this carbon builds up on valves and piston crowns, and in exhaust ports and the exhaust turbine.

At low loads the combustion temperature becomes so low that complete combustion cannot be guaranteed, with the consequent possibilities of fuel-dilution of the lubricating oil, and over time, leakage from the exhaust manifold.

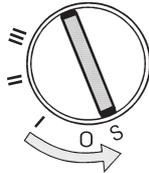
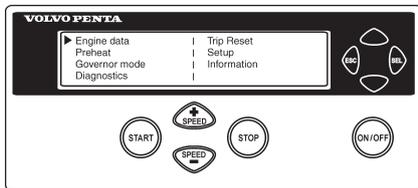
If the following points are carried out as a complement to normal maintenance, there will be no risk of malfunctions caused by operation at low load:

- Reduce operation at low load to a minimum. If the engine is regularly test run without load once a week, the duration should be limited to 5 minutes.
- Run the engine at full load for about 4 hours once a year. Carbon deposits in the engine and exhaust system are thus given the opportunity of being burned up.

Engine shutdown

During longer shutdown periods, the engine must be run and warmed through at least once every 2 weeks. This prevents corrosion in the engine. If the engine is expected to remain unused for two months or more, preservation must be carried out: See the chapter “Shutdown”.

⚠ IMPORTANT! If there is a risk of frost, the coolant in the cooling system must have sufficient frost protection. Refer to the “Maintenance, cooling system” chapter. A poorly charged battery can freeze and burst.



Before stopping

Let the engine run for a few minutes without load before stopping. In this manner temperatures are evened out and hotspots are avoided while at the same time the turbocharger cools a little. This will contribute to long service life without malfunctions.

Stop

- Disengage the clutch (if possible).
- Press the “STOP” button/turn the key to “S”.

After stopping

- Check the engine and engine compartment for signs of leakages.
- Turn off the main switches during longer stoppages.
- Carry out service in accordance with the maintenance schedule.

Auxiliary Stop

The auxiliary stop (AUX STOP) is located on the left side of the engine, to the right of the control unit.

NOTE! The auxiliary stop may **under no circumstances**, be used as the “normal” stop.

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

Maintenance schedule

General

For maximum reliability and service life to be achieved, it is important that the engine receives regular maintenance. By following maintenance recommendations, engine quality is kept high and unnecessary environmental impact avoided.

MAINTENANCE SCHEDULE

 **WARNING!** Before starting maintenance work, read the “Maintenance” chapter carefully. It contains instructions on how to carry out the work safely and correctly.

 **IMPORTANT!** When both running hours and calendar periods are specified, carry out the maintenance item at whichever time is reached first. Maintenance items marked must be carried out by an authorized Volvo Penta workshop.

Daily, before first start

- Engine oil, level check ¹⁾ page. 31
- Coolant, level check page 35
- Radiator, external check and cleaning page 36
- Leakage check, engine not shown

¹⁾ In continuous operation, checks should be made every 8 hours.

After the first 150 running hours

- Engine oil and oil filter, change ¹⁾²⁾ page 32

¹⁾ Oil change intervals vary depending on oil grade and sulfur content of the fuel. Refer to “Lubrication system”.

²⁾ The oil filter must be replaced at every oil change.

Every 50 running hours

- Battery, check electrolyte level page 42

Every 6 months

- Coolant filter, change ¹⁾ not shown

¹⁾ However, the filter need not be changed when coolant is changed

Every 125-500 running hours or at least every 12 months

- Engine oil and oil filter, change ¹⁾²⁾ page 32

¹⁾ Oil change intervals vary, depending on oil grade and sulfur content of the fuel. Refer to “Lubrication system”.

²⁾ The oil filter must be replaced at every oil change.

Every 500 running hours

- Fuel tank (sludge trap), drain Not shown
- Drive belts, inspection/adjustment page 29

Every 1000 running hours

- Charge air pipe, leakage check. page 28
- Fuel filters, replacing page 40

Every 2000 hours or every 12 months

- Valve clearance, inspection/adjustment not shown
- Inspection, air compressor, change. not shown
- Air filter, cleaning¹⁾ not shown

¹⁾ When operating in extremely dirty conditions, cleaning must take place often.

Every 2400 running hours

- Turbocharger, check not shown
- Engine with equipment, general check not shown

Every 3000 running hours

- Injector, check not shown

Every 5000 running hours or at least every 24 months

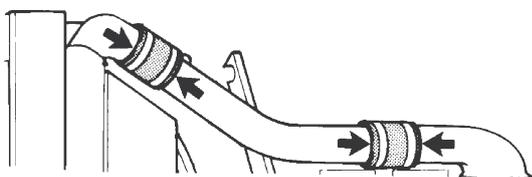
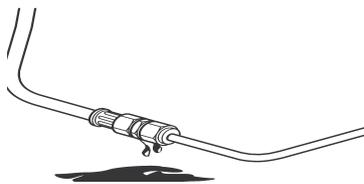
- Coolant, changing pages 35-36

Maintenance

This chapter describes how the prescribed maintenance items must be carried out. Read the instructions carefully before starting work. The times when maintenance items are to be carried out are set out in the previous chapter: Maintenance schedule.

- ⚠ WARNING!** Read through the safety precautions for maintenance and service in the “Safety information” chapter before starting work.
- ⚠ WARNING!** Maintenance and service should be performed with the engine stopped unless otherwise specified. Immobilize the engine by removing the ignition key and turning of the power supply at the main switch. Approaching or working on a running engine is a safety risk. Watch out for rotating components and hot surfaces.

Engine, general



General inspection

Make it a habit to inspect the engine and engine compartment visually **before engine start** and **after operations when the engine is stopped**. This will help you to discover quickly if anything abnormal has happened, or is about to happen.

Look especially carefully for oil, fuel and coolant leakages, loose bolts, worn or poorly tensioned drive belts, loose connections, damaged hoses and electrical cables. This inspection only takes a few minutes and can prevent serious malfunctions and expensive repairs.

- ⚠ WARNING!** Deposits of fuel, oils and grease on the engine or in the engine compartment are a fire hazard and must be removed as soon as they are discovered.
- ⚠ IMPORTANT!** If you discover a leakage of oil, fuel or coolant, investigate the cause and fix the fault before you start the engine.
- ⚠ IMPORTANT!** Pay attention to the following when washing with a power washer: Never aim the water jet at radiators, charge air cooler, seals, rubber hoses or electrical components.

Charge air pipe, leakage check

Inspect the condition of the charge air pipes, hose unions and the condition of the clamps with regard to cracks and other damage. Change as necessary.

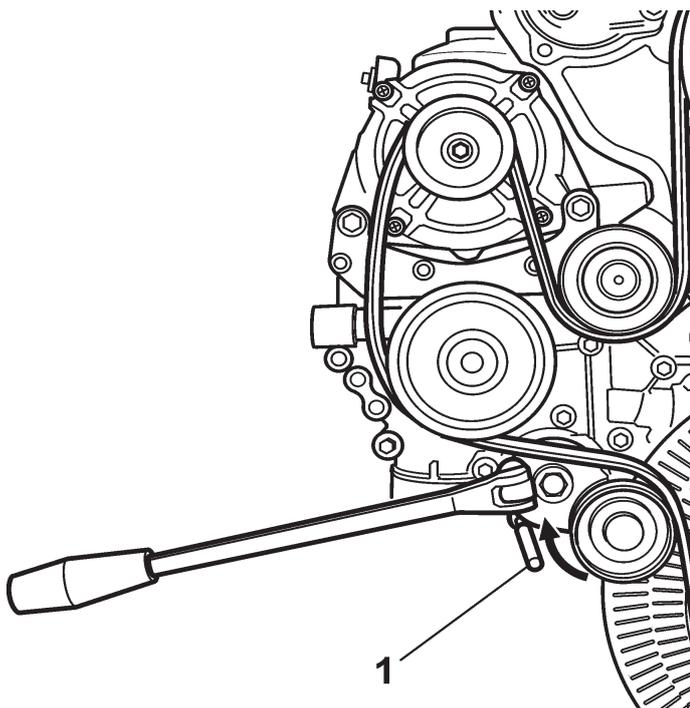
Drive belt, inspection/changing

Inspection should be done after running, when the belts are hot.

It should be possible to press the alternator belts and drive belts down about 3-4 mm between the pulleys.

The alternator belts and drive belts have automatic belt tensioners and do not need to be adjusted. Check the condition of the belts. Change as necessary; refer to "Alternator belt, change" and "Drive belt, change".

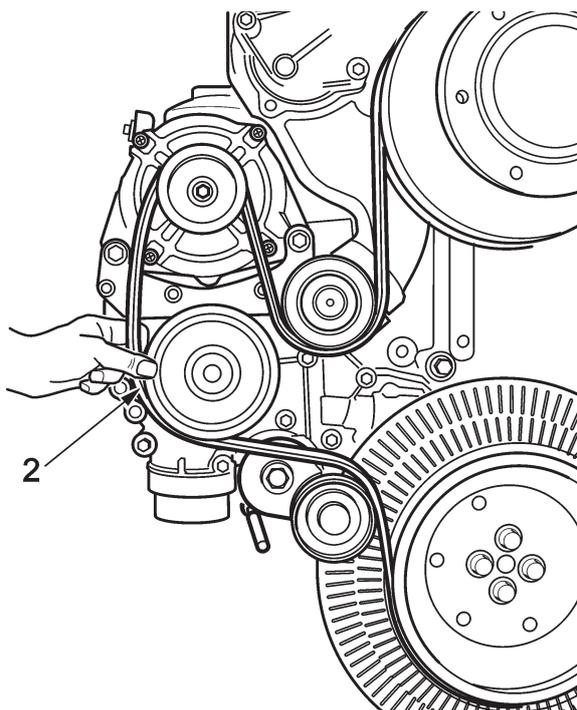
1. Release the belt tensioner and lock it in place with a mandrel (1).



2. First remove the belts (2), from the coolant pump.

3. Install the new belt.

Release the belt tensioner. Check that the belts are correctly aligned in their grooves and are correctly tensioned.



Lubrication System

Oil change intervals vary from **125 to 500 hours** depending on oil grade and sulfur content of the fuel. **Note that oil change intervals must never exceed a period of 12 months.**

If you want longer oil change intervals than given in the table below, the condition of the oil must be checked by the oil manufacturers through regular oil testing.

NOTE! The oil filters must be changed during each oil change.



	Oil grade	Sulfur percentage in fuel by weight		
		< 0,5 %	0,5-1,0 %	> 1,0 % ¹⁾
		Oil change interval: reached first in operation		
open crankcase ventilation	VDS-3 VDS-2 ACEA: E7, E5, E3 API: CI-4, CH-4, CG-4	500 hrs/12 mos.	250 hrs/12 mos.	125 hrs/12 mos.
closed crankcase ventilation	ACEA:E6, E4 API: CI-4, CH-4 NOTE! Fully synthetic oil must be used	500 hrs/12 mos.	250 hrs/12 mos.	125 hrs/12 mos.

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

¹⁾ If sulfur content is >1,0 % by weight, use oil with TBN >15.

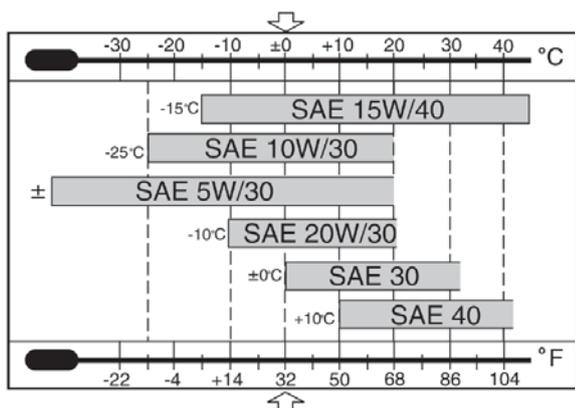
²⁾ Lubrication oil must comply with both requirements. Note API: CG-4 or CH-4 can be approved in markets outside Europe (instead of ACEA E3).

VDS = Volvo Drain Specification

ACEA = Association des Constructeurs Européenne d'Automobiles

API = American Petroleum Institute

TBN = Total Base Number



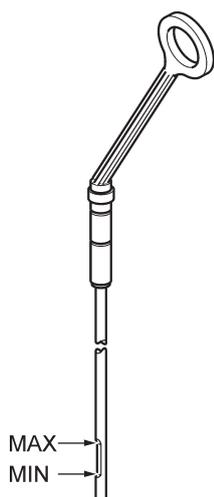
Viscosity

Select the viscosity from the adjacent table, for the appropriate continuous ambient air temperature.

*Denotes synthetic or semi-synthetic oils

Oil change volume

Refer to the "Technical Data" chapter

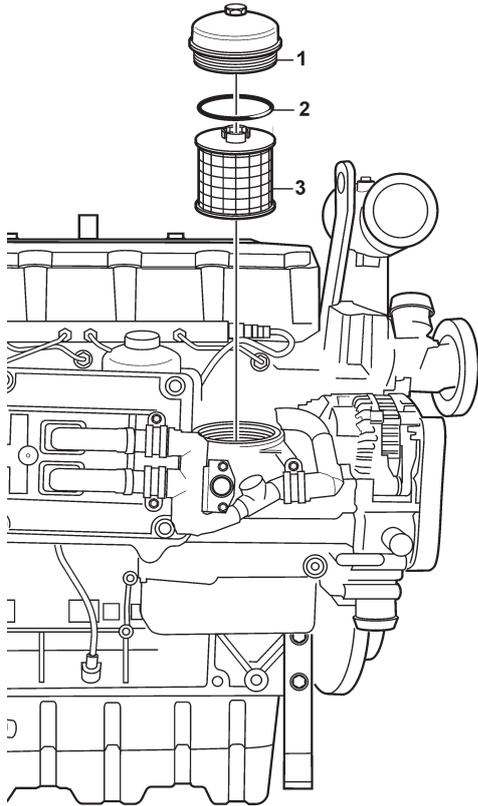


Oil level. Inspection

Make sure that the oil level is between the MIN and MAX marks.

IMPORTANT! In continuous operation, the oil level should be checked every 24 hours.

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



Oil filter. Change

Change the oil filters during each oil change.

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

1. Drain the oil according to the instructions in “Engine oil Replacement”.

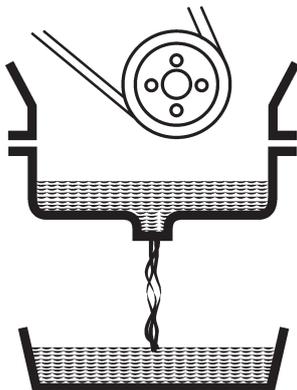
NOTE! Position a suitable vessel underneath the filter to avoid oil spillage.

2. Clean around the oil filter.
3. **Carefully** remove the filter cover, **(1)** with filter.
4. Remove the O-ring **(2)** and filter **(3)**.
5. Let the oil drip off, into a collection vessel.
6. Install a new filter **(3)** and a new O-ring **(2)**.
7. Install the filter cover with filter **(1)**.
(Tighten to 25 Nm.)
8. Top up with oil according to the instruction in “Engine oil. Change”.

Engine oil. Change

Always follow the recommended oil change interval and always change the oil filter during oil changes. On static engines the drain plug must **not** be removed. Use an oil change pump to remove the oil.

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



1. Run engine until warm.
2. Remove the drain plug. Drain the oil.

NOTE! Collect the old oil and old filters and hand them to a re-cycling station for disposal

3. Install the drain plug with a new gasket
4. Change the oil filter according to the “Oil filter, changing” instruction.

6. Fill oil to the correct level.

NOTE! Do not fill over the MAX level.

7. Start the engine and let it idle. Check that the oil pressure is normal.
8. Stop the engine. Check that no oil leakage occurs around the filters. Top up with oil as necessary.

Cooling System

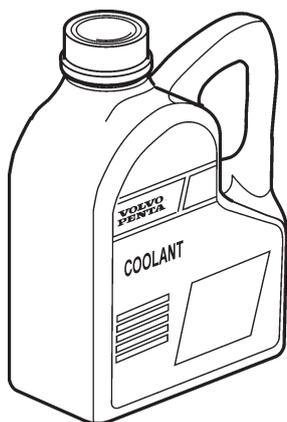
The cooling system ensures that the engine works at the right temperature. It is a closed system and must therefore always be filled with a mixture of at least 40 % concentrated coolant and 60 % water, to protect against interior corrosion, cavitation and frost bursting.

We recommend that you use “**Volvo Penta Coolant, Ready Mixed**”, alternatively “**Volvo Penta Coolant**” (concentrated) mixed with **pure** water according to spec, see “Coolant. Mixing”. This grade of coolant is the only one suitable for, and approved by, Volvo Penta.

For complete engine protection the coolant should contain good quality ethylene glycol of a suitable chemical composition. Using an anti-corrosion mixture exclusively is not permitted in Volvo Penta engines. Never use water alone as the coolant.

⚠ IMPORTANT! Coolant of a suitable chemical composition must be used all year round. This applies even if there is no risk for frost damage, so that the engine has complete corrosion protection. Future warranty claims on the engine and ancillaries may be rejected if an unsuitable coolant has been used or if the instructions concerning coolant mixing have not been adhered to.

NOTE! Corrosion protection additives become less effective after a time, which means that the coolant must be replaced; see “Maintenance schedule”. The cooling system should be flushed when the coolant is changed; refer to “Cooling system. Cleaning”.



“**Volvo Penta Coolant**” is a concentrated coolant which must be mixed with water. It has been prepared to work best with Volvo Penta engines and offers excellent protection against frost and cavitation damage, plus frost bursting.

“**Volvo Penta Coolant, Ready Mixed**” is a ready-mixed coolant, 40 % “Volvo Penta Coolant” and 60 % water. This mixture protects the engine from corrosion damage, cavitation damage and frost bursting down to -28 °C.



Coolant. Mixing

⚠ WARNING! All glycol is dangerous to human health and ecologically damaging. Must not be ingested! Glycol is flammable.

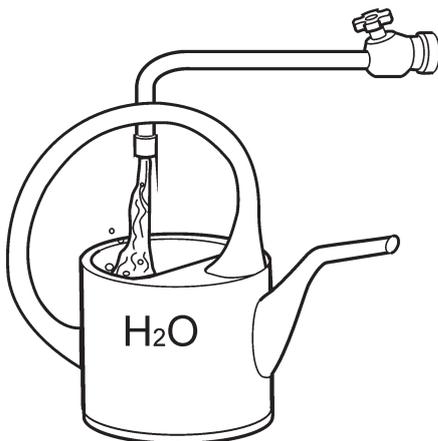
⚠ IMPORTANT! Ethylene glycol should not be mixed with other types of glycol.

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

This mixture protects against internal corrosion, cavitation and frost damage down to -28 °C. (Using 60 % glycol lowers the freezing point to -54 °C.) Never mix more than 60 % concentrate (Volvo Penta Coolant) in the cooling liquid, since this would give reduced cooling effect and increase the risk of overheating and frost damage.

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

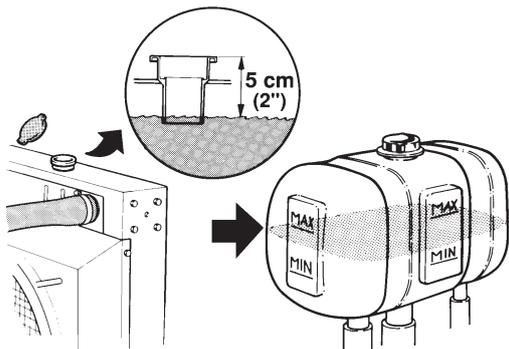
⚠ IMPORTANT! It is extremely important that the correct concentration of coolant is added to the system. Mix in a separate clean vessel before filling the cooling system. Make sure that the liquids mix.



Water quality

ASTM D4985:

Total solid particles	< 340 ppm
Total hardness	< 9.5° dH
Chloride	< 40 ppm
Sulfate	< 100 ppm
pH value.....	5.5-9
Silica (acc. to ASTM D859)	< 20 mg SiO ₂ /l
Iron (acc. to ASTM D1068)	< 0.10 ppm
Manganese (acc. to ASTM D858)	< 0.05 ppm
Conductivity (acc. to ASTM D1125)	< 500 µS/cm
Organic content, COD _{Mn} (acc. ISO8467)	< 15 mg KMnO ₄ /l



Coolant. Checking and filling

⚠ WARNING! Do not open the filler cap when the engine is hot, except in emergencies. Steam or hot fluid could spray out.

Check the coolant level daily before starting. Top the coolant up as necessary.

The level should be about 50 mm below the sealing plane of the filler cap, or between the MIN and MAX markings, if a separate expansion tank is installed.

⚠ IMPORTANT! Topping up should be done with the same type of mixture as is already in the cooling system; refer to “Coolant, mixing”.

Filling a completely empty system

Filling should be done with the engine stopped. Fill up slowly, to allow the air to flow out. The system is vented automatically.

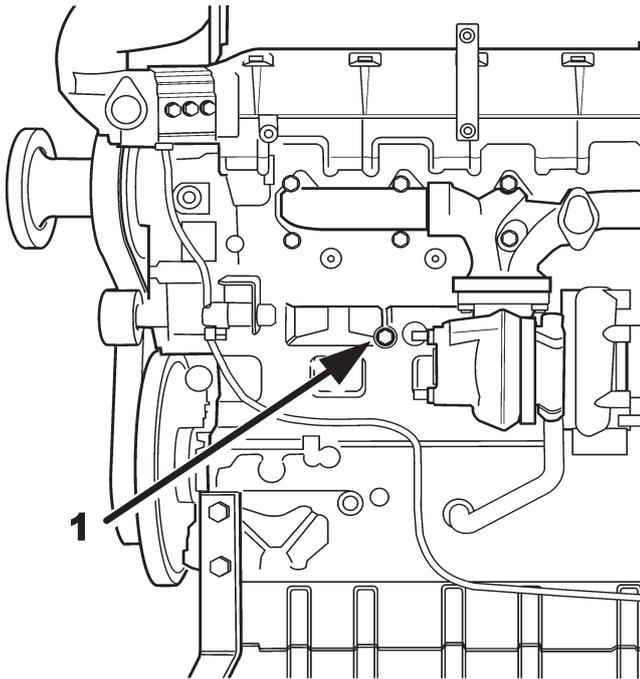
Fill up with coolant to the correct level. **Do not start the engine until the system is vented and completely filled.**

Start the engine and warm it up until the thermostats are open, about 20 minutes. Open any venting taps some while after starting, to allow trapped air to escape. Check the coolant level and top up as necessary.

NOTE! If a heating unit is connected to the engine cooling system, the heat control valve should be opened and the installation vented during filling.

Coolant. Draining

Before draining, stop the engine and unscrew the filler cap.



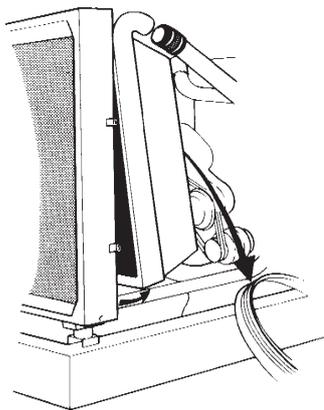
⚠ WARNING! Do not open the filler cap when the engine is hot, except in emergencies. Steam or hot fluid could spray out.

⚠ WARNING! Glycol is poisonous (dangerous to ingest). Collect the old coolant and hand it to a re-cycling station for disposal.

1. Position a suitable vessel underneath the drain plug (1) and undo the plug.
2. Let the coolant run out.

⚠ IMPORTANT! Deposits, which must be cleared away, may be found inside the drain plugs/taps. Check that all coolant really does drain out.

3. Screw the drain plug back (1).



Charge air cooler. External cleaning

Remove guards as necessary, to access the radiator. Clean with water and a mild detergent. Use a soft brush. Be careful not to damage the radiator matrix. Re-install the components

⚠ IMPORTANT! Do not use a high-pressure power washer.

Cooling system, cleaning

Cooling performance is reduced by deposits in the radiator and cooling galleries. The cooling system should therefore be cleaned when coolant is changed.

 **IMPORTANT!** Cleaning must not be done if there is any risk of the cooling system freezing, since the cleaning solution does not have any frost protection properties.

1. Empty the cooling system. Refer to “Cooling system, draining”.
2. Put a hose into the expansion tank filling hole and flush with **clean** water, according to Volvo Penta specifications – refer to section “Water quality” – until the water draining out is completely clear.
3. Should contamination still remain after a long period of flushing, cleaning using coolant may be carried out. Otherwise, continue according to item 8 below.
4. Fill the cooling system with 15-20 % mixture of concentrated coolant. Use only Volvo Penta recommended concentrated coolant mixed with **clean** water.
5. Drain the coolant after 1-2 days of operation.

NOTE! To prevent suspended material from settling back in the system, emptying should be done rapidly, within 10 minutes, without the engine standing still for a long time. Remove the filler cap and if necessary the lower radiator hose to increase emptying speed.

6. Flush the system immediately and thoroughly with **clean** hot water to prevent dirt from resettling on the inner surfaces. Flush until the water that runs out is completely clean. Make sure that any heater controls are set to full heating during emptying.
7. If contamination should still be left after a long period of flushing, cleaning may be carried out using Volvo Penta radiator cleaner, followed up with Volvo Penta neutralizer. Follow the instructions on the package carefully. Otherwise, continue according to item 8 below.
8. When the cooling system is completely free from contamination, close the drain taps and plugs.
9. Fill up with Volvo Penta recommended coolant, according to the instructions in the sections “Coolant, mixing” and “Coolant, filling”.

 **IMPORTANT!** It is extremely important that the correct concentration and volume of coolant is added to the system. Mix in a separate clean vessel before filling the cooling system. Make sure that the liquids mix.

Fuel System

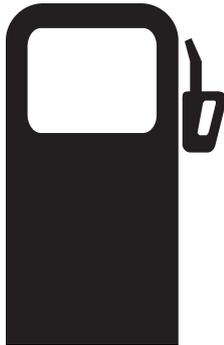
Use only recommended grades of fuel in accordance with the fuel specification below. Always observe the greatest cleanliness during re-fueling and work on the fuel system. Should dirt get into the system, it may cause injector failure.

All work on the injection system of the engine must be done by an authorized workshop.



WARNING! Fire hazard. Work on the fuel system must be done with the engine cold. Fuel spills on hot surfaces or electrical components can cause fires. Store fuel-soaked rags in such a way that they cannot cause a fire.

Fuel specification



At a minimum fuel must comply with national and international standards regarding marketable fuels.

NOTE! Bio-diesel according to EN 14214, kerosene and light fuel oil may not be used.

The following fuel standards are approved:

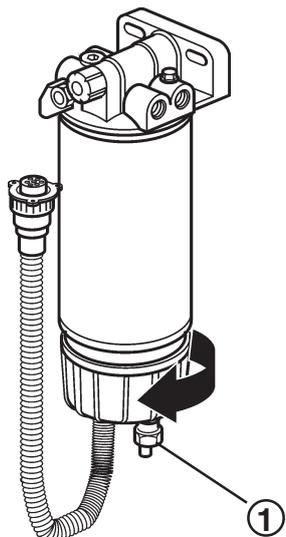
EN590 (with nationally adapted environmental and coldstandards)

ASTM-D975-No 1-D, 2-D

JIS KK 2204 (may only be used if lubricity corresponds to EN 590)

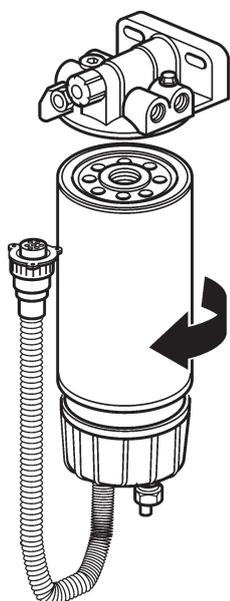
Sulfur content: Conform to relevant national legislation. If sulfurcontent exceeds 0.5 percent by weight **oil changeintervals** must be ammended; see heading "Lubrication system".

Extremely low sulfur content fuel (urban diesel in Sweden and city diesel in Finland) can cause a loss of up to 5 % of power and an increase in fuel consumption of about 2-3 %.



Fuel pre-filter, draining water

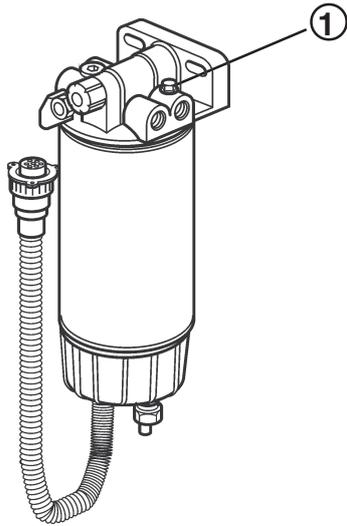
1. Stop the engine and open the fuel tap.
2. Position a suitable vessel underneath the filter.
3. Open the drain valve (1) and drain off fuel/water.
4. Unscrew the water reservoir from the filter cartridge by turning it clockwise.
5. Clean the reservoir and screw it back onto the filter cartridge.
6. Close the drain valve and open the fuel tap.
7. Vent the system. Test run the engine and check that no leakage occurs.



Fuel pre-filter, change

Filter inserts must be changed in accordance with the maintenance schedule recommendations.

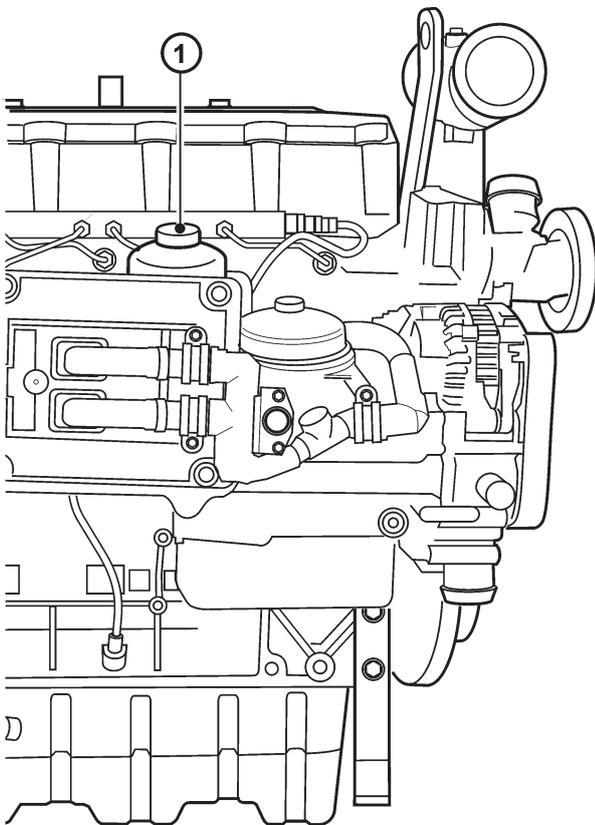
1. Stop the engine and open the fuel tap.
2. Unscrew the water reservoir and empty any water.
3. Unscrew the filter cartridge.
4. Check that the filter cartridge is absolutely clean and that the seal is undamaged. Apply a film of oil on the gasket.
5. Screw the filter cartridge and the water reservoir together and install them on the filter bracket.
6. Open the fuel tap and vent the system.
7. Start the engine and check that no leakage occurs.



Purging the fuel system

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

1. Position a suitable vessel underneath the fuel filter.
2. Open the vent screw (1).
3. Turn the hand pump anti-clockwise to open the pump.
4. Pump until the fuel is completely free from air bubbles.
4. Tighten the venting screw (1) and close the hand fuel pump.
5. Start the engine and check that no leakage occurs.



Fuel filter, replace

NOTE! Do not fill the new fuel filter with fuel before assembly; there is a risk that contamination could get into the system and cause malfunctions or damage.

⚠ WARNING! The fuel filter must be changed when the engine is cold, to avoid the risk of fire due to spilled fuel on hot surfaces.

1. Clean round the fuel filter.
2. Remove the filter (1), with a suitable filter remover. Collect any spilled fuel in a collection vessel.
3. Clean the filter mating surface on the filter bracket.
4. Lubricate the seal with diesel fuel and install the new fuel filter. Tighten the fuel filter in accordance with the instructions on the fuel filter.
5. If necessary, vent the fuel system; see "Fuel System, Venting".

Electrical system

 **WARNING!** Before any work is done on the electrical system, the engine must be stopped and the current cut by the main switch. Battery chargers or other auxiliary equipment installed on the engine must be disconnected.

Fuses

Two fuses are delivered with the engine wire harness. One 10 A to the EMS unit and one 150 A to the pre-heat element. No other fuses are delivered with the engine.

Fuses cut the current if the electrical system is overloaded.

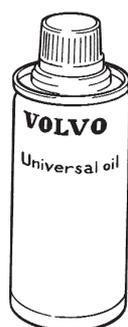
If the engine cannot be started or if the instrument panel stops working during operation, the fuse may have blown. Check and replace fuses or re-set circuit breakers.

 **IMPORTANT!** Always investigate the reason for the overload!

Main switch

The main switch must never be switched off before the engine has been stopped. If the circuit between the alternator and the battery is broken when the engine is running, the alternator can be damaged.

 **IMPORTANT!** Never disconnect the current with the main switch when the engine is running.



Electrical connections

Check that electrical connections are dry, free from oxide and that they are securely tightened. Spray these connections as necessary with water-repellent spray (Volvo Penta universal oil).

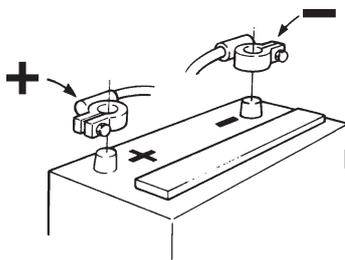


Battery. Maintenance

WARNING! Fire and explosion hazard. Batteries must never be exposed to naked flames or sparks.

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

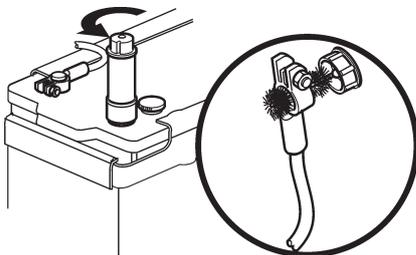
WARNING! Battery electrolyte is highly corrosive. Always protect your eyes, skin and clothes when handling batteries. Always use protective goggles and gloves. If acid comes into contact with your skin, wash with soap and plenty of water. If you get battery acid in your eyes, flush at once with lots of water, and seek medical assistance immediately.



Connection and disconnection

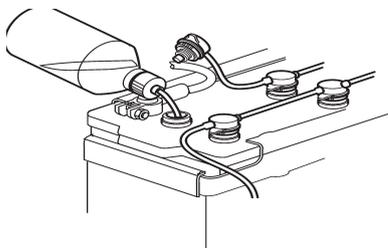
When you connect batteries, first connect the + cable (red) to the + pole on the battery. Then connect the - cable (black) to the - pole on the battery.

When you disconnect batteries, connect the - cable (black) first, then the + cable (red).



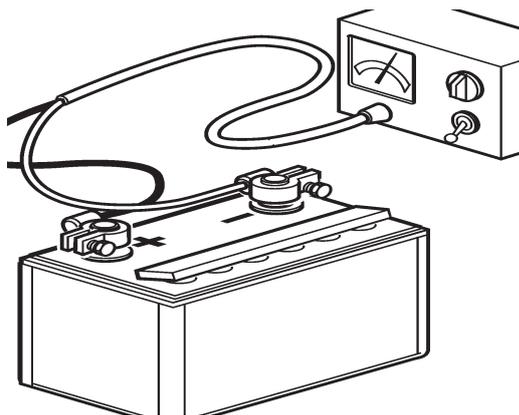
Cleaning

Keep the batteries dry and clean. Contamination and oxide on the batteries and battery posts can cause stray currents, voltage drop and discharge, especially in wet weather. Clean oxidation from the battery posts and cable clamps with a brass brush. Tighten the cable clamps securely and grease them with terminal grease or petroleum jelly.



Filling

The electrolyte level should be 5-10mm above the cell plates in the battery. Add **distilled water** as needed. After filling, the battery should be charged for at least 30 minutes by running the engine at fast idle. **NOTE!** Some maintenance-free batteries have special instructions, which must be followed.



Batteries, charging

⚠ WARNING! Explosion risk! Hydrogen is given off when batteries are charged. This forms an explosive mixture with air. A short circuit, open flame or spark could cause a violent explosion. Ventilate well.

⚠ WARNING! Battery electrolyte is highly corrosive. Protect your eyes, skin and clothes. Always use protective goggles and gloves. If acid comes into contact with your skin, wash with soap and plenty of water. If you get battery acid in your eyes, flush at once with lots of cold water, and seek medical assistance immediately.

Charge batteries if they have become discharged. If the engine is not used for a longer period of time, the batteries should be fully charged, then trickle charged if necessary (refer to the battery manufacturer's recommendations). Batteries are damaged by being left discharged, and can also freeze and burst more easily in cold weather.

⚠ IMPORTANT! Follow the battery charger instruction manual carefully. To avoid the risk of electrochemical corrosion when an external charger is connected, the battery cables should be removed from the batteries before the charger is connected.

During charging, unscrew the cell plugs but leave them in the plug holes. Ventilate well, especially if the batteries are charged in an enclosed space.

⚠ WARNING! Always switch off the charging current **before** the charging clips are removed. Never confuse the positive (+) and negative (-) poles on the batteries. This can bring about serious arcing and can cause an explosion.

For so-called **quick charging** special instructions apply. Quick charging can shorten battery life, and should therefore be avoided.

Shutdown

Preservative measures must be taken to ensure the engine and its associated equipment is not damaged during shutdowns of two months or more. It is important that this is done in the correct manner, and that nothing is forgotten. For this reason, we have compiled a check list covering the most important points.

Before shutting down for long periods, an authorized Volvo Penta workshop carry out an inspection. Have any faults and defects remedied, so that the equipment is in working order the next time it is started.

-  **WARNING!** Before starting maintenance work, read the “Maintenance” chapter carefully. It contains instructions on how to carry out the work safely and correctly.
-  **WARNING!** Some preservative oils are flammable. Some are also dangerous to inhale. Ensure good ventilation. Use a mask when spraying.
-  **IMPORTANT!** Pay attention to the following when washing with a power washer: Never aim the water jet at seals, rubber hoses or electrical components.



Preservation

- **For shutdowns of up to 8 months:**
change the oil and engine oil filters and afterwards run the engine until warm.

For shutdowns longer than 8 months:

Treat the lubrication and fuel systems with preservative oil. **Refer to the instruction on the next page.**

- Check that the coolant offers sufficient frost protection. Top up as necessary. Alternatively, drain the coolant (also drain the coolant filter).
- Drain water and contamination from the fuel filters and fuel tank. Fill the fuel tank completely, to avoid condensation.
- Disconnect the battery cables, clean and charge the batteries. Trickle charge the batteries during the shutdown period. **A poorly charged battery can freeze and burst.**
- Clean the outside of the engine. Do not use a high pressure washer for engine cleaning. Touch up paint damage with Volvo Penta original paint.
- Spray the components of the electrical system with water-repellent spray.
- Check and rust-proof any control cables.
- Put a note on the engine with the date, type of preservation and the preservative oil used.
- Cover the engine air inlet, exhaust opening and engine if necessary.

Returning to service

- Remove any covers from the engine, air filter and exhaust pipe.
- Top the engine up with the correct grade of oil, if necessary. Install a new oil filter if the filter was not changed during conservation.
- Install new fuel filters and vent the fuel system.
- Check the drive belt(s).
- Check the condition of all rubber hoses, and re-tighten the hose clamps.
- Close drain taps and fit drain plugs if necessary.
- Check coolant level. Top up as necessary.
- Connect the fully charged batteries.
- Start the engine and warm it through at fast idle with no load.
- Check that no oil, fuel or coolant leaks are present.

Preservation of the lubrication and fuel systems for more than 8 months' shutdown:

- Drain the engine oil and fill with **preservative oil*** to just above the MIN-mark on the dipstick.
- Connect the fuel supply and return lines to a canister filled with 1/3 **preservative oil*** and 2/3 dieselfuel.
- Purge the fuel system.
- Start the engine and run at a fast idle until about 2 liters of the fluid in the cannister have been used. Stop the engine and connect the permanent fuel pipes.
- Drain the preservative oil from the engine.
- To continue, follow the instructions on the previous page.

* Preservative oils are sold by oil companies.

Touble Shooting

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

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

Symptoms and possible causes

☼ The diagnosis button lamp flashes	Refer to the “Diagnostic information” chapter
Engine cannot be stopped	2, 4
Starter motor does not rotate	1, 2, 3, 4, 5, 6, 7, 24
Starter motor rotates slowly	1, 2
Starter motor rotates normally but engine does not start	8, 9, 10, 11
Engine starts but stops again	8, 9, 10, 11, 13
Engine does not reach correct operating rpm at full throttle	9, 10, 11, 12, 13, 21, 25, 26
Engine runs roughly	10, 11, 27
High fuel consumption	12, 13, 15, 25
Black exhaust smoke	12, 13
Blue or white exhaust smoke	14, 15, 22
Lubrication oil pressure too low	16
Coolant temperature too high	17, 18, 19, 20
Coolant temperature too low	20
No, or poor charge	2, 23

- | | | |
|--|--|--|
| 1. Discharged batteries | 10. Air in the fuel system | 18. Air in the coolant system |
| 2. Poor contact/open circuit in electrical cable | 11. Water/contamination in fuel | 19. Faulty circulating pump |
| 3. Main switch turned off | 12. Faulty injection pumps | 20. Defective thermostat |
| 4. Faulty ignition lock | 13. Insufficient air supply to the engine: | 21. Blocked charge air cooler |
| 5. Faulty main relay | – clogged air filter | 22. Oil level too high |
| 6. Faulty starter motor relay | – air leakage between the turbo and the engine’s intake pipe | 23. Alternator drive belt slips |
| 7. Faulty starter motor/solenoid | – dirty compressor part in the turbocharger | 24. Water entry into engine |
| 8. No fuel: | – faulty turbocharger | 25. High back pressure in exhaust system |
| – fuel cocks closed | – poor engine room ventilation | 26. Break in “Pot+” cable to pedal |
| – fuel tank empty/wrong tank connected | 14. Coolant temperature too high | 27. Faulty adjustment, engine speed regulator/actuator |
| 9. Blocked fuel filter/pre-filter (because of contamination, or paraffin fraction separation in fuel at low temperature) | 15. Coolant temperature too low | |
| | 16. Oil level too low | |
| | 17. Coolant level too low | |

Diagnostic Function

The diagnostic function monitors and checks that the EMS 2 system is functioning normally.

The diagnostic function has the following tasks:

- Detecting and locating malfunctions
- Reporting detection of malfunctions
- Providing guidance when troubleshooting

Fault messages

If the diagnosis function detect a disturbance in the system, this is reported using fault codes/fault messages via the instruments.

Both active (unactioned) and passive (actioned) faults are stored in the control unit.

Refer to the “Operation” heading for deciphering fault codes/fault messages.

All fault codes and fault messages are found in the fault code list, with information about the reason, reaction and measures to be taken; refer to the “Fault codes” chapter

NOTE! All instruments are accessories

Active faults

DCU (Display Control Unit)

- The text “!! ENGINE WARNING !!” is shown on the display.

NOTE! You can choose the language that the information is presented in.

CIU (Control Interface Unit)

- the diagnostic lamp starts to flash.
- “Easy Link” instrument (only with CIU)
 - the relevant lamp on the alarm panel lights up
 - after the diagnostic button has been pressed, the fault code is shown as text on the tachometer display.

DU (Display Unit)

- Either “WARNING!” or “ALARM STOP” (a buzzer sounds) will be shown on the display, depending on the severity of the fault.

NOTE! You can choose the language that the information is presented in.

- Fault codes can also be deciphered by means of the **VODIA** tool. Refer to the “VODIA User’s Guide” for advice on use.

The fault is simultaneously stored in the control unit memory. When the fault has been attended to and the ignition is switched off and on again, the fault disappears as active.

Inactive faults

- DCU – the fault is indicated as passive
- CIU – the diagnostic lamp goes out
- DU – the fault message disappears (inactive faults cannot be deciphered)
- “Easy Link” – the lamp on the alarm panel goes out

Effect on engine

Engines are affected differently, depending on the severity of the fault discovered by the diagnostic function.

A fault message in the form of a fault code is always generated when a malfunction is discovered by the diagnostic function.

Engines are affected differently, depending on the severity of the fault.

- The engine is not affected
- Engine drops to idle rpm
- Engine torque is restricted to a certain amount
- Engine is stopped

Operation

When a malfunction has occurred and the diagnostic system has generated one or more fault codes, these are deciphered differently depending on the equipment used; refer to "Fault code messages".

If the system indicates that a fault code has been set:

1. Reduce engine speed to idling. Do not switch of the engine. (If the engine is switched of fault codes may disappear.)
2. **For DCU/DU**
Read the fault code from the display; refer to "Reading fault codes via the DCU" or "Deciphering fault codes via the DU".

For CIU

press the diagnostic button and read the fault code, by observing the flashing of the diagnostic lamp; refer to "Deciphering fault codes via the diagnostic lamp, CIU"

3. Look up the fault code in the list in the "Fault Code" chapter and take the recommended measures.

Reading fault causes via the DCU (Display Control Unit)

When a fault code is set, the following text is shown on the display:

"!! ENGINE WARNING !!"

alternated with

"Press SEL for information".

NOTE! You can choose the language that the information is presented in.

Read the fault code as follows:

1. Press the SEL button to come to the fault list.
The fault list shows:
 - Running hours
 - Fault message
 - Active/inactive
2. Look up the fault code in the list in the "Fault Code" chapter and take the recommended measures.
3. Press the ESC button to leave the fault list.

NOTE! To access the fault list when no fault code has been set, press the SEL button and select "Diagnostics" from the menu.

Reading fault codes via the DU (Display Unit)

Depending on the severity of the fault the text, either "WARNING!" or "ALARM STOP" (a buzzer sounds).

1. Press any button to get to the fault list.

The fault list shows:

- Running hours
- Fault message

2. Look up the fault code in the list in the "Fault Code" chapter and take the recommended measures.
3. Press **ACK** to acknowledge the fault code. The display background will change color (the buzzer stops sounding).
4. Press **EXIT** to leave the fault list.

Reading fault codes via the diagnostic lamp on the instrument panel, CIU

When the system has discovered a malfunction, the diagnostic lamp starts to flash. If the diagnostic button is depressed and then released, a fault code is flashed.

The fault code consists of two groups of flashes, separated by a pause of two seconds. A fault code is obtained by counting the number of flashes in each group.

Example: ✨ ✨ pause ✨ ✨ ✨ ✨ = Fault code 2.4

The fault code is stored and can be deciphered as long as the malfunction remains. You can find information about cause, action and measures in the fault code list in the "Fault Code" chapter.

Read the fault code as follows:

1. Press the diagnostic button.
2. Release the diagnostic button and make a note of the fault that is flashed out.
3. Repeat items 1-2. A new fault code is flashed out if more are stored. Repeat until the first fault code is repeated.

NOTE! When the first fault code recurs all the fault codes have been read.

If the diagnostics button is depressed after the fault has been corrected and the fault code deleted, the code 1.1, "No fault" will be shown.

Reading the fault codes via an "Easy link" instrument (only with a CIU)

When the system has discovered a malfunction, it is reported by the diagnostic lamp which starts to flash.

1. Press the diagnostic button: the fault code is shown as text on the tachometer display.
2. Look up the fault code in the list in the "Fault Code" chapter and take the recommended measures.
3. When the fault has been rectified, the fault code disappears from the display and the diagnostic lamp goes out.

Erasing fault codes

Fault codes must be erased by means of the VODIA tool.

Fault codes

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

NOTE! Reading the fault codes below, such as **Code 2.1, PID/SPN 97**, where **2.1** is a flash code indicated by a flashing diagnostic lamp. **PID/SPN 97** is deciphered with the VODIA diagnostic tool. When using DCU or DU, the fault code is displayed as plain text.

For a further explanation, see “Reading fault codes”.

NOTE! Refer to “Wiring schedule CIU and DCU” for references to the sockets in the electrical connectors on the engine control unit.

Code 1.1 No faults

There are no active faults.

Code 2.1, PID/SPN 97. Water in fuel

Reason:

- Water in fuel.

Reaction:

- None.

Action:

- Drain the fuel pre-filter.

Code 2.2, PID/SPN 111. Coolant level

Reason:

- Low coolant level.

Reaction:

- Engine control unit reduces engine power (unless the protection has been shut off with the VODIA diagnostic tool).
- Engine stopped

Action:

- Check the coolant level.
- Check coolant level monitor function.

Code 2.3, PID/SPN 111. Coolant level sensor

Reason:

- Short circuit to positive (+).
- Fault in sensor.

Reaction:

- None.

Action:

- Check that the coolant level sensor cable is not damaged.
- Check coolant level sensor function.

Code 2.4, SID 22/SPN 637 Engine rpm sensor, flywheel

Reason:

- No signal.
- Abnormal frequency.
- Intermittent signal from the sensor.
- Fault in sensor.

Reaction:

- Engine is very difficult to start and runs roughly when it starts.

Action:

- Check that the sensor connector is correctly installed.
- Check that the engine rpm sensor cable is not damaged.
- Check that the engine rpm sensor is correctly installed in the flywheel casing.
- Check engine rpm sensor function.

**Code 2.5, SID 21/SPN 636
Engine rpm sensor, cam disc**
Reason:

- No signal.
- Abnormal frequency.
- Fault in sensor.

Reaction:

- Engine takes longer to start than normal. Engine runs normally when running.

Action:

- Check that the engine speed sensor connector is correctly installed.
- Check that the engine rpm sensor cable is not damaged.
- Check that the engine rpm sensor is correctly installed in the upper timing gear cover.
- Check engine rpm sensor function.

Code 2.6, PID/SPN 190. Engine speed
Reason:

- Engine rpm too high.

Reaction:

- None.

Action:

- After the engine has stopped, trace the reason for the high rpm.

**Code 2.8, PPID 132/SPN 608
Engine rpm potentiometer connected to CIU**
Reason:

- Short circuit to positive (+) or negative (-).
- Fault in sensor.

Reaction:

- Engine drops to idle rpm.
- Rpm is "frozen".

Action:

- Check that the potentiometer is correctly connected.
- Check that the potentiometer cable is not damaged.
- Check potentiometer function.

**Code 2.9, PID/SPN 97
Indicator for water in fuel**
Reason:

- Short circuit.
- Open circuit.
- Fault in indicator.

Reaction:

- None.

Action:

- Check the indicator cables for breaks and short circuits.
- Check indicator function. Change indicator as necessary.

Code 3.1, PID/SPN 100. Oil pressure sensor
Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the oil pressure sensor cable is not damaged.
- Check that the oil pressure sensor is correctly connected.

**Code 3.2, PID/SPN 105
Charge air temperature sensor**
Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the charge air temperature sensor connector is correctly installed.
- Check that the charge air temperature sensor cable is not damaged.
- Check that the charge air temperature sensor is correctly installed.
- Check charge air temperature sensor function.

**Code 3.3, PID/SPN 110
Coolant temperature sensor**

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- Preheating is also activated when the engine is hot.

Action:

- Check that the coolant temperature sensor connector is correctly installed.
- Check that the coolant temperature sensor cable is not damaged.
- Check that the coolant temperature sensor is correctly installed.
- Check coolant temperature sensor function.

**Code 3.4, PID/SPN 106/102
Charge pressure sensor**

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- Engine smokes more than normally during acceleration/load increase.

Action:

- Check that the charge air pressure sensor connector is correctly installed.
- Check that the charge air pressure sensor cable is not damaged.
- Check that the charge air pressure sensor is correctly installed.
- Check charge air temperature sensor function.

Code 3.5, PID/SPN 106/102. Charge pressure

Reason:

- Charge pressure too high.

Reaction:

- Engine control unit reduces engine power (unless the protection has been shut off with the VODIA diagnostic tool).

Action:

- Check turbocharger compressor function.
- Check charge air temperature sensor function.
- Check fuel volume/injector.

Code 3.6, PID/SPN 94. Fuel pressure sensor

Reason:

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- None.

Action:

- Check that the fuel pressure sensor connector is correctly installed.
- Check that the fuel pressure sensor cable is not damaged.
- Check that the fuel pressure sensor cable is correctly installed.
- Check fuel pressure sensor function.

Code 3.8, PID/SPN 94. Fuel pressure

Reason:

- Low supply pressure.

Reaction:

- None.

Action:

- Check if it is possible to build up pressure with the hand pump.
- Check the fuel filter.
- Check the fuel pre-filter.

Code 3.9, PID/SPN 158. Battery voltage, EMS

Reason:

- Faulty battery cables, battery.
- Faulty alternator.

Reaction:

- None.

Action:

- Check the supply voltage to the control unit.

**Code 4.6, PPID 3/SID 39/SPN 677
Start output/Starter motor relay****Reason:**

- Short circuit to positive (+) or negative (-).
- Activated for too long.

Reaction:

- Engine cannot be started.
- The engine starts as soon as the ignition is switched on.

Action:

- Check that the starter switch connections are not damaged.
- Check that the wiring to the starter key is not damaged.

**Code 4.8, PPID 6/SPN 970
Stop input EMS****Reason:**

- Short circuit to negative (-).
- Open circuit.

Reaction:

- Engine can only be stopped by the auxiliary stop. (Or via the CAN-link.)

Action:

- Check that the connections and harness are not damaged.

**Code 5.2, PPID 4/SPN 520194
Start input CIU****Reason:**

- Short circuit to negative (-).
- Activated for too long.

Reaction:

- Engine cannot be started.
- The engine starts as soon as the ignition is switched on.

Action:

- Check that the starter switch connections are not damaged.
- Check that the wiring to the starter key is not damaged.

Code 5.3, PPID 6/SPN 520195. Stopp input, CIU**Reason:**

- Short circuit to negative (-).
- Open circuit.
- Activated for too long.

Reaction:

- Engine can only be stopped with the auxiliary stop (AUX STOP) on engine.
- Engine stops. A fault code is displayed for 40 seconds and the engine cannot be started during this time. When a fault code is active, the engine can be started but not stopped.

Action:

- Check that the starter switch connections are not damaged.
- Check that the wiring to the starter key is not damaged.

Code 5.4, PID 45/SPN 626. Preheater relay**Reason:**

- Short circuit to positive (+) or negative (-).
- Open circuit.

Reaction:

- Preheating can not be activated.
- Preheating is constantly connected.

Action:

- Check that the relay input cable is not damaged.
- Check relay function.

Code 6.1, PID/SPN 110. Coolant temperature

Reason:

- Coolant temperature is too high.

Reaction:

- Engine control unit reduces engine power (unless the protection has been shut off with the VODIA diagnostic tool).

Action:

- Check the coolant level.
- Check the charge air cooler (cleanliness).
- Check if there is air in the cooling system.
- Check the pressure cap on the expansion tank.
- Check coolant temperature sensor function.
- Check thermostat function.

Code 6.2, PID/SPN 105. Charge air temperature

Cause:

- The charge air temperature is too high.

Reaction:

- Engine control module reduces engine power (unless the protection has been shut off with the VODIA diagnostic tool).

Remedy:

- Check coolant level.
- Check the charge air cooler (cleanliness).
- Check charge air temperature sensor function.
- Check thermostat function.

Code 6.4, SID 231/SPN 639. Data link (CAN), CIU

Reason:

- Faulty data link (CAN), CIU.

Reaction:

- Instruments and warning lamps stop working.

Action:

- Check that the 8-pin connector is not damaged.
- Check that the cables between the CIU and the engine control unit are not damaged.

Code 6.5, SID 231/SPN 639/2017/PSID 201 Data link (CAN), EMS 2

Reason:

- Internal fault in control unit.

Reaction:

- Engine not operating: engine cannot be started. Engine running: engine idles and can only be stopped with the auxiliary stop (AUX-stop).

Action:

- Check that the 8-pin connector is not damaged.
- Check that the cables between the CIU and the engine control unit are not damaged.
- Check that sockets 11 and 12 in the connector on the CIU are not damaged.

Code 6.6, PID/SPN 100. Oil pressure

Reason:

- Oil pressure is too low.

Reaction:

- Engine control unit reduces engine power (unless the protection has been shut off with the VODIA diagnostic tool).

Action:

- Check oil level.
- Check that the oil filters are not blocked.
- Check system pressure valves and safety valves in the oil system.
- Check oil pressure sensor function.

Code 6.9, PID/SPN 158 Battery voltage, CIU

Reason:

- Short circuit to negative (-).
- Faulty alternator.
- Faulty battery, battery cables.

Reaction:

- Engine start problems.

Action:

- Check the supply voltage from the control unit.
- Check the battery.
- Check the alternator.
- Check the 8-pin connector.

**Code 7.1, SID 1/SPN 651
Injector, cylinder #1**
Reason:

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Action:

- Check that the unit injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Perform a compression test and check cylinder #1.

**Code 7.2, SID 2/SPN 652
Injector, cylinder #2**
Reason:

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Action:

- Check that the unit injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Perform a compression test and check cylinder #2.

**Code 7.3, SID 3/SPN 653
Injector, cylinder #3**
Reason:

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Action:

- Check that the unit injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Perform a compression test and check cylinder #3.

**Code 7.4, SID 4/SPN 654
Injector, cylinder #4**
Reason:

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Action:

- Check that the unit injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Perform a compression test and check cylinder #4.

**Code 7.5, SID 5/SPN 655
Injector, cylinder #5**

Reason:

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Action:

- Check that the unit injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Perform a compression test and check cylinder #5.

**Code 7.6, SID 6/SPN 656
Injector, cylinder #6**

Reason:

- Electrical fault.
- Faulty compression or injector.

Reaction:

- Engine runs on 5 cylinders.
- Abnormal sound.
- Reduced performance.

Action:

- Check that the unit injector cables are not damaged.
- Check that the injector connections are not damaged.
- Check fuel supply pressure.
- Check the valve clearance.
- Perform a compression test and check cylinder #6.

**Code 8.3, SID 42/SPN 679.
Injection pressure, regulator**

Reason:

- Faulty cables.
- Faulty actuator.
- Fault in MPROP.

Reaction:

- Engine control unit limits engine power.

Action:

- Contact an authorized Volvo Penta workshop.

**Code 8.3, PSID 96/SPN 1239
Pressure in distribution manifold**

Reason:

- Leakage in the high pressure fuel system.
- Leakage in the high pressure supply pipe to the injector.

Reaction:

- Engine control unit limits engine power.

Action:

- Contact an authorized Volvo Penta workshop.

Code 8.3, PSID 97/SPN 679. Pressure valve

Reason:

- Leakage in the PRV (Pressure Release Valve).
- The PRV stuck closed.
- The PRV stuck open.

Reaction:

- Engine control unit limits engine power.

Action:

- Contact an authorized Volvo Penta workshop.

Code 8.3, PID/SPN 164. Injection pressure**Reason:**

- Faulty fuel supply.
- Faulty fuel pump.
- Faulty cables.
- Faulty sensor.

Reaction:

- Warning lamp lights up.
- Engine control unit limits engine power.

Action:

- Check the cables.
- Check sensor.
- Check the filter.
- Check the fuel pumps.

Code 8.4 PPID 55/SPN 1136 EMS temperature**Reason:**

- Electrical fault, damaged sensor.
- Control unit incorrect assembly, too hot.

Reaction:

- None

Action:

- Check the control unit installation. Recommended ambient temperature is 50 °C.

Code 8.6, SID 70/SPN 729. Preheating sensor**Reason:**

- Faulty cables.
- Faulty preheating relay.

Reaction:

- Not possible to activate preheating.

Action:

- Check cables.
- Check the preheating relay.

**Code 9.3, SID 232/221/SPN 620/1079/1080
Voltage supply to sensor****Reason:**

- Short circuit.
- Fault in one of sensors.

Reaction:

- Faulty values in oil pressure and charge air pressure sensors.
- Fault code for oil pressure and charge air pressure sensors.
- Low power.
- Oil pressure and oil temperature instruments show 0.

Action:

- Check that the oil pressure and charge air pressure sensors are not damaged.
- Check the oil pressure sensor and charge air pressure sensor.

**Code 9.8, SID 254/SPN 629.
Fault in control unit, CIU****Reason:**

- Faulty EEPROM, CIU.
- Faulty flash memory, CIU.
- Fault in control module, CIU.

Reaction:

- CIU returns to factory setting.
- Engine drops to idle rpm.
- Engine cannot be started.

Action:

- Re-program the unit.

Code 9.9, SID 240/SPN 639, Memory fault in EMS

Reason:

- Memory fault in engine control unit (EMS).

Reaction:

- Engine might not start.

Action:

- Re-program the unit.

Code 9.9, SID 254/SPN 629. Control unit EMS

Reason:

- Internal fault in control unit.

Reaction:

- Engine misfires.
- Engine does not start.

Action:

- Change engine control unit.

Technical data

General

Type designation	TAD734GE
Power	Refer to the sales literature
Torque	Refer to the sales literature
No. of cylinders	6
Bore	108
Stroke, mm	130
Cylinder volume, dm ³	7.15
Weight*, app., kg	764
Weight, app., kg	954
Weight*, wet, kg	788
Weight, wet (GenPac), kg	1021
Firing order	1-5-3-6-2-4
Compressionratio	17:1
Low idle, rpm	900
High idle, rpm	1500/1800

* only engine, excluding cooling system

Lubrication System

Oil grade Refer to the “Maintenance, lubrication system” chapter

Oil change volume, including change of filters:

oil pan, standard 29 liter (7.7 US gallon)

Oil pressure with engine oil at operating temperature (min 120 °C)

At rated engine rpm 420-450 kPa (61-65 psi)

Automatic stop at pressure less than 100 kPa (15 psi)

Oil grade Refer to the specification under “Maintenance”.

Viscosity Refer to the specification under “Maintenance”.

Oil filters, full flow filter:

Number 1

(tighten 1/2-3/4 turn after it just touches)

Lubrication oil pump

Type Gearwheel oil pump

Fuel System

Feed pump

Supply pressure, at 1200 rpm: 0.2 MPa (29 psi)

Fuel specification Refer to the “Maintenance; fuel system” chapter

Cooling System

Type	Pressurized, sealed
Pressure valve, max. opening pressure:	120 kPa (17.4 psi)
Volume (engine)	
TAD734GE:	8 liter (2.11 US gal)
Thermostat	
Quantity and type	1 pc piston thermostat
Opening temperature	83 °C (181 °F)
Fully open at	103 °C (217 °F)

Electrical system

System voltage	24V
Alternator:	
voltage/max. current density	28V/80A

Notes

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ENG

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

Publication number: 7747302

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Please note that this offer is valid for 12 months from the date of delivery of the engine, after this it is subject to availability.

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Publikationsnummer: 7747303

Name

Anschrift

Land

Bitte beachten Sie, dass das Angebot für die Dauer von 12 Monaten ab dem Lieferdatum des Motors gilt, danach nur noch bis zum Aufbrauchen des Lagerbestandes.

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Numéro de publication: 7747304

Nom

Adresse

Pays

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SPA

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Número de publicación: 7747305

Nombre

Dirección

País

Observe que la oferta es válida durante 12 meses a partir de la fecha de entrega del motor. A partir de la fecha de finalización de la oferta, la misma es válida siempre que haya existencias.

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Public. No.: 7747306

Nome e Cognome

Indirizzo

Paese

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Ja tack,

jag vill kostnadsfritt ha en instruktionsbok på svenska.

Publikationsnummer: 7747301

Namn

Adress

Land

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

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Ik wil kosteloos een instructieboek in het Nederlands ontvangen.

Publicatienummer: 7747308

Naam

Adres

Land

Denk eraan dat de aanbieding geldt tot 12 maanden na levering van de motor, daarna nog slechts indien beschikbaar.

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Kyllä kiitos,

haluan suomenkielisen ohjekirjan veloituksetta.

Julkaisunumero: 7747307

Nimi

Osoite

Maa

Ota huomioon, että tarjous on voimassa 1 vuoden ajan moottorin luovutuspäivämäärästä, sen jälkeen vain tuotteen saatavuuden perusteella.

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Número de publicação: 7747309

Nome

Endereço

País

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GRE

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Αριθμός έκδοσης: 7747310

Όνομα

Διεύθυνση

Χώρα

Παρακαλούμε σημειώστε ότι αυτή η προσφορά ισχύει για 12 μήνες από την ημερομηνία παράδοσης της μηχανής. Μετά θα είναι θέμα διαθεσιμότητας.

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