# OPERATOR'S MANUAL

## Generating set and industrial engines

### 4-7 liter (EDC 4)

VOLVO PENTA

# 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 90 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**



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**Engine data**

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

Serial number .....

Clutch, type/nr. .....

**Nearest Volvo Penta service location**

Name ..... Telephone.....

Address.....

# Table of contents

# Safety information

Read this chapter very carefully. It has to do with your safety. This describes how safety information is presented in the instruction book and on the product. It also gives you an introduction to the basic safety rules for using and looking after the engine.

**Check that you heave received the correct instruction book 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. So read the instruction book through very carefully before you start the engine or do any maintenance or service work. If there is still something which is unclear or if you feel unsure about it, 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!** Is used to call attention to important information, to facilitate work processes or operation.

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 rules for operation and maintenance

## ⚠ Daily checks

Make it a habit to give the engine and engine bay a visual check before operating (**before starting the engine**) and after operation (**when you have stopped the engine**). 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 during fuel filling. Smoking is not permissible, and the engine should be stopped.

Never over-fill the tank. Shut 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 will 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 operated in a confined space, exhaust fumes and crankcase gases must be ventilated.

## ⚠ Operation

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

Going close to 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 room must be lockable, to prevent unauthorized persons from starting the engine. Alternatively, a lockable main switch can be used.

## ⚠ Care and maintenance

**Knowledge**

The instruction book contains instructions for doing the most common service and maintenance tasks in a safe and correct manner. 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. Care and maintenance work should be done with the engine stopped unless otherwise specified.

Prevent the engine from being started by cutting the current with the battery isolator, or remove the cable from the battery positive pole before you start service work. Fix a notice by the operator's seat to say that work is in progress.

Working with, or going close to 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 a Volvo Penta authorized workshop.

# Safety rules for operation and maintenance (contd.)

### Lifting the engine

The existing lugs on the engine should be used for lifting. 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 lifted 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. Please note that auxiliary equipment installed on the engine could change its centre of gravity. Special lifting devices may then be needed to obtain the correct balance and safe handling. Never do any work on an engine which **just** hangs from a lifting devise.

### 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 lubrication oil

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

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

Store oil and fuel soaked rags and other flammable material in a fire-proof manner. Oil soaked rags can self-ignite in certain circumstances.

Never smoke when filling fuel, lubrication oil or close to fuel filling 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 an explosive gas, especially when charged. This gas is very flammable and highly explosive.

Smoking, open flames or sparks must never occur in or near to batteries or the battery locker.

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

### Start spray

Never use start spray or similar preparations to help in starting an engine with air pre-heating (glow plugs / starting heater). Explosions could occur in the inlet manifold. Danger of personal injury.

## ⚠ Hot surfaces and fluids

A hot engine always offers 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 observe the advice on the packages.

Some chemicals, such as conservation oils, are flammable and also hazardous to breathe. Ensure good ventilation and use a protective mask for spraying. Always read and observe the advice on the packages.

Store chemicals and other hazardous material out of the reach of children. Hand in surplus or used chemicals to a recycling station for destruction.

## ⚠ 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 spillage.

## ⚠ Cooling system

Avoid opening the coolant filling cap when the engine is hot. Steam or hot coolant can spray out at the same time as the pressure built up is lost.

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

## ⚠ 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 during charging and other handling of batteries. Always use protective goggles and gloves.

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

## ⚠ Electric 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 put back.

# 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 safely and correctly. Please read the instruction book carefully and learn to handle the engine, controls and other equipment in a safe manner before you start the engine.

⚠ **IMPORTANT!** This instruction book describes the engine and equipment sold by Volvo Penta. Variations in appearance and function of the controls and instruments may occur in certain variants. In these cases, please refer to the instruction book for the relevant application.

## Environmental responsibility

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 the sunlight without fearing for our health. Unfortunately, this is not self-evident these days, it is something all of us must work for.

As an engine manufacturer, Volvo Penta has particular responsibility and for this reason, environmental care is a self-evident foundation of our product development. Volvo Penta has a wide engine program these days, where considerable progress has been made in reducing exhaust fumes, fuel consumption, engine noise etc.

We hope that you will be want to preserve these values. Always observe the advice in the instruction book about 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.

Please remember to always hand in hazardous waste such as drained oil, coolant, old batteries etc. for destruction at an approved recycling facility.

If we all pull together, we can make a valuable contribution to the environment together.

## Running in

**The engine must be "run in" during its first 10 hours, as follows:**

Use the engine in normal operation. Full load should only be applied for short periods. Never run the engine for a long period of time at constant speed during this period.

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

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

## Fuel and oils

Only use the fuels and oils recommended in the instruction book (please 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 eventually even shorten the life of the engine.

Always change the oil, oil filter and fuel filter at the specified 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. Through regular service and use of Volvo Penta original spare parts, 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 needed for high quality service and repair work.

**Always observe the maintenance intervals 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 makes special demands on the care and maintenance you give your engine, as follows:**

- Maintenance and service intervals recommended by Volvo Penta must be complied with.
- Only Volvo Penta original spares 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 for the 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 done.
- No seals may be broken by unauthorized personnel.

The general advice in the instruction book about operation, care and maintenance applies.

⚠ **IMPORTANT!** Delayed or inferior care/maintenance, and the use of non-original spares, mean that AB Volvo Penta can no longer be responsible for guaranteeing that the engine complies with the certified version.

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, under the conditions and instructions compiled in the Warranty and Service book.

Please note that AB Volvo Penta's liability is limited to the specification in the Warranty and Service book. Read it carefully, as soon as possible after delivery. It includes important information about warranty cards, service intervals, maintenance, which it is the responsibility of the owner to know, check and carry out. If this is not done, 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

TD420VE, TAD420VE, TD520GE, TAD520GE and TAD520VE are in-line, direct injected, 4-cylinder industrial diesel engines.

TAD620VE, TD720GE, TAD720GE, TAD720VE, TAD721VE and TAD722VE are in-line, direct injected, 6-cylinder industrial diesel engines.

All engines are equipped with electronically controlled fuel management (EDC4), turbocharger, thermostatically controlled cooling systems and electronic speed control. All TAD engines are also equipped with an intercooler.

## Technical description

**Engine and engine block**

– The engine block and cylinder head are manufactured of alloyed cast iron

– Five bearing, induction hardened crankshaft (TD420VE, TAD420VE, TD520GE, TAD520GE, TAD520VE)

  Seven bearing, induction hardened crankshaft (TAD620VE, TD720GE, TAD720GE, TAD720VE, TAD721VE, TAD722VE)

– Replaceable wet cylinder liners (TD520GE, TAD520GE, TAD520VE, TD720GE, TAD720GE, TAD720VE, TAD721VE, TAD722VE)

Replaceable dry cylinder liners (TAD620VE)

Liner-less (TD420VE, TAD420VE)

– 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.

– Two valves per cylinder

– Replaceable valve seats and valve guides (does not apply to TD420VE, TAD420VE, TAD620VE)

**Control unit**

– Microprocessor based fuel supply control unit (EDC 4)

– Maximum ambient temperature 80° C

– Automatic sensing of 24 V or 12 V.

– Atmospheric pressure sensor for high altitude applications (option)

**Fuel system**

– Belt driven feed pump - BOSCH injection pump, one for each cylinder

– HEINZMANN actuator

– EDC 4 (Electronic Diesel Control). Please refer to a separate description.

**Lubrication system**

– Water cooled oil cooler.

– Crankshaft driven lube oil pump

– Full flow filter with bypass

**Turbocharging system**

– Turbocharger

**Cooling system**

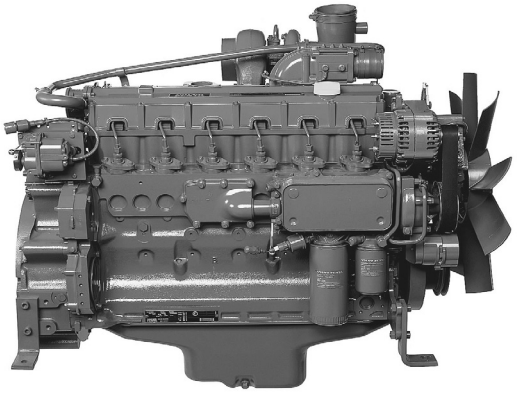
– Radiator with expansion tank

– Air cooled intercooler (TAD)

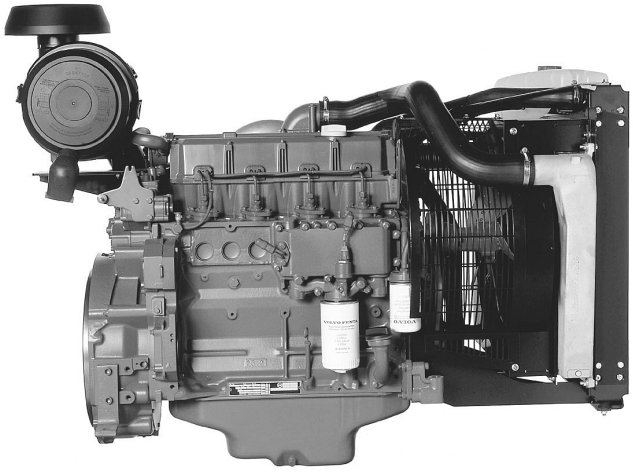
**Electrical system**

– 24 V (standard), 12 V (option)

**TD420VE, TAD420VE, TAD620VE**

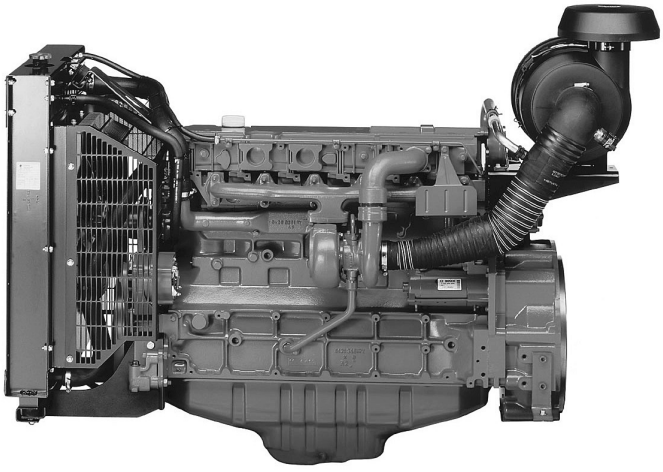


**TD520GE, TAD520GE, TAD520VE**



**TD720GE, TAD720GE**

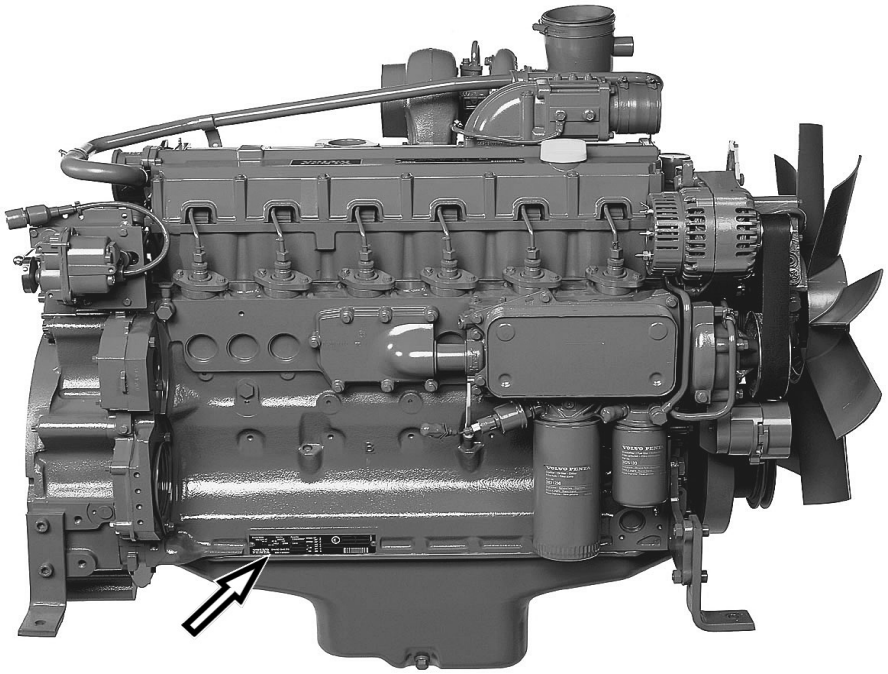
**TAD720VE, TAD721VE, TAD722VE**

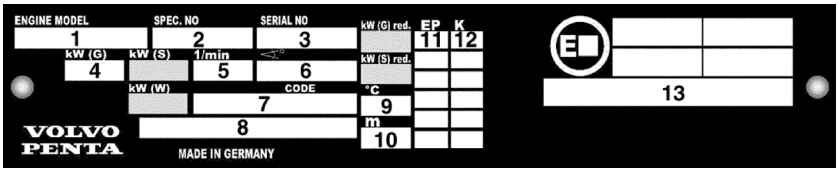


# Identification numbers

### Location of engine signs

The engines are supplied with two engine signs, of which one is installed on the right side of the engine block.






### Engine plate

1. Engine model
2. Engine specification number
3. Engine series number (10 digits)
4. Engine power, peak, without fan
5. Engine speed
6. Injection advance and type of camshaft
7. Manufacturer's identification code
8. Indication of standard and/or specification
9. Air temperature in °C (°F), in accordance with ISO 3046
10. Altitude above mean sea level, in accordance with ISO 3046
11. EP code for injection pump (cylinder 1 on top)
12. Piston class
13. Extra information

# EDC 4

EDC 4 (Electronic Diesel Control) and is an electronic system with CAN (Controller Area Network) or potentiometer communication for diesel engine control. The system includes fuel management and diagnostic functions.



### Summary

The system includes sensors, control unit and an engine speed regulator. The sensors send input signals to the control unit, which controls the control rod for the injection pumps in its turn, by means of an actuator in the engine speed regulator.

### Input signals

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

– speed sensor, camshaft
– coolant temperature sensor
– charge pressure sensor
– oil pressure sensor
– fuel temperature sensor
– coolant level sensor (the function is implemented in the control unit as standard, but no sensor is supplied with the engine as a standard feature)

### Output signals

The control unit controls the following components on the basis of the input signals received:

– engine speed regulator (with position sensor for the control rod and acutator)
– electric air pre-heating (option)

Information from the sensors provides exact information about current operation conditions and allows the processor to calculate the correct fuel volume, check engine status etc.

### Diagnostic function

The task of the diagnostic function is to discover and localize any malfunctions in the EDC 4 system, to protect the engine and to ensure operation in the event of serious malfunctions.

If a malfunction is discovered, this is notified by the diagnostic function, by warning lamps or via the CAN network. By pressing the diagnostic switch, the operator will receive a fault code as a guide for any fault-tracing. Fault codes can also be output via the CAN interface or with Volvo's VODIA tool (including the Penta EDC4 software) at an authorized Volvo Penta workshop.

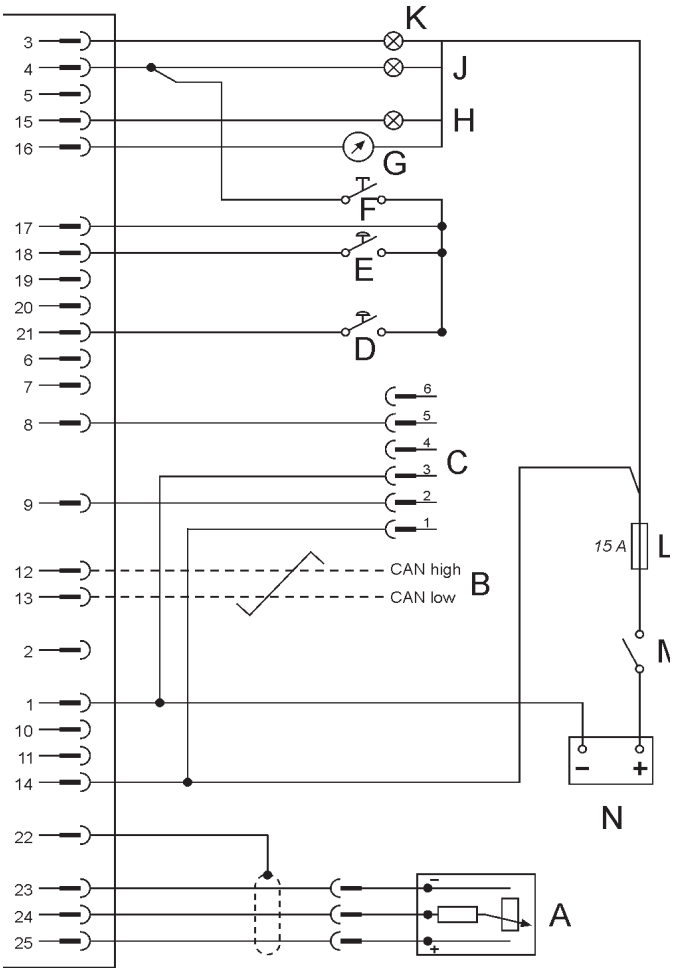
If there is a serious malfunction, the engine is shut down altogether. Yet again, fault codes can be output via diagnostic connector, the CAN interface or with Volvo's VODIA tool (including the Penta EDC4 software) at an authorized Volvo Penta workshop.

# Instruments

The engines are not supplied with instruments and controls. The choice of instrument type and controls is made by the customer.

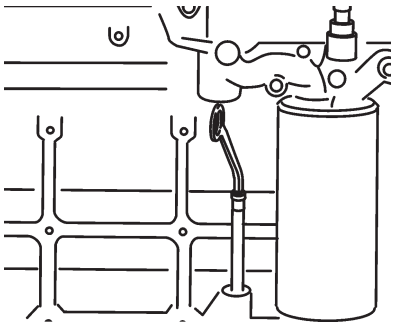
The functions available are described below.

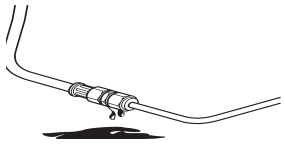
A. Engine speed potentiometer (throttle control)
B. CAN interface SAE J 1939
C. VODIA input
D. Droop contact
E. 1500 / 1800 rpm switch
F. Diagnostic button
G. Tachometer
H. Warning lamp, oil pressure
J. Diagnostic lamp
K. Warning lamp, high coolant temperature
L. Fuse 15 A
M. Main switch
N. Battery (24(12 V).

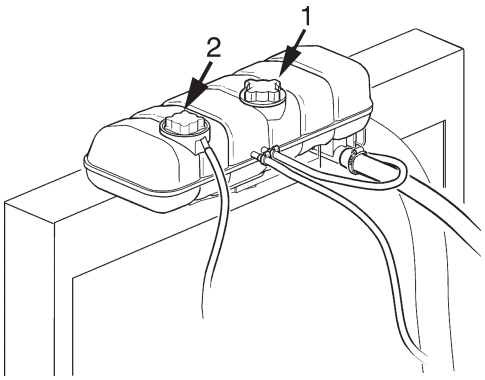


# Starting the engine

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. Please refer to the “Maintenance, lubrication system” chapter:
- Open the fuel taps.
- Check that there is no leakage of oil, fuel or coolant.
- Check the air filter pressure drop indicator. Please refer to the “Maintenance, Engine, general” chapter:
- Check the coolant level and that the radiator is not blocked externally. Please 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 disconnect the current with the main switch(es) when the engine is running. This will damage the alternator.

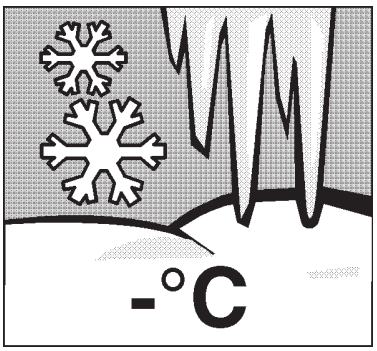
- Move the engine speed control to idle, and release the opening clutch/gearbox if installed.

## Starting method EDC 4

The engine speed lever must always be in neutral before starting. The EDC4 system ensures that the engine always receives the correct amount of fuel **- even when the engine is cold!**

Start the engine.

If the engine is equipped with a pre-heater, the pre-heating time is adjusted to suit the engine temperature.




## Starting in extreme cold

Certain preparations must be made to facilitate engine starting, and in some cases to make starting possible at all.

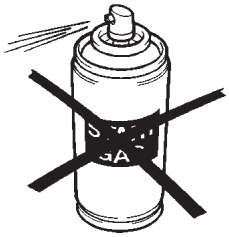
Use a winter grade fuel (of a well-known make) which has been approved for the relevant temperature. This reduces the risk of wax deposits in the fuel system. At extremely low temperatures, the use of a fuel heater is recommended.

For fully acceptable lubrication, a synthetic engine oil of recommended viscosity for the relevant temperature should be used. Please refer to the “Maintenance, lubrication system” chapter: Synthetic lubricants are able to manage a wider temperature range than mineral-based lubricants.

Pre-heat 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. Please refer to the “Maintenance, cooling system” chapter:

The batteries should be in good condition. Cold weather reduced battery capacity. Increased battery capacity may be necessary.



## Never use start spray

⚠ **WARNING!** Never use start spray or similar products as a starting aid. Explosions could occur in the inlet manifold. The consequence could be personal injury.

## Starting with auxiliary batteries

⚠ **WARNING!** Batteries (especially auxiliary batteries) contain hydrogen 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 flat battery. Then connect the black jumper cable (–) to the auxiliary battery, and lastly to a place **some distance from the flat batteries**, such as the negative cable by the main switch or the negative cable connection on the starter motor.
3. Start the engine.

⚠ **WARNING!** Do not move the connections when you attempt to start the engine (risk of arcing), and do not stand and lean over one of the batteries.

4. Remove the jumper cables in the reverse order from installation.

⚠ **WARNING!** The ordinary cables to the standard batteries must not be loosened on any condition.

# Operation

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

## Checking instruments

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

⚠ **IMPORTANT!** The lubrication oil level must be checked **every 8 hours** on engines which operate continuously. Please refer to the “Maintenance, lubrication system” chapter:

## Fault indication

If the EDC4 system receives abnormal signals from the engine, the “Diagnostic lamp” will start to flash. By pressing the “Diagnostic button”, a fault code can be received which can guide fault tracing (or a fault code can be received via the CAN network).

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

## Effect on engine

The diagnostic function affects the engine in the following ways:

1. The diagnostic function has discovered a minor malfunction which does not damage the engine.

   **Reaction:** The engine is not affected. The diagnostic lamp lights up.

2. The diagnostic function has discovered a serious malfunction which will not immediately damage the engine (e.g. high coolant temperature):

   **Reaction:** The engine goes into “limp home” mode. The diagnostic lamp lights up.

3. The diagnostic function has discovered a serious malfunction which makes it impossible to control the engine.

   **Reaction:** The diagnostic lamp starts to flash. Engine is shut off.

## Engine speed control

Avoid sudden and violent throttle opening.

## 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 oil will seep past the turbocharger seals and accompany the induction air into the inlet manifold at low turbo boost pressure.

One consequence of this is that carbon builds up on valves, piston crowns, exhaust ports and the exhaust turbine.

At low load, the combustion temperature is so low that full combustion of the fuel can not be ensured, which means that the lubrication oil can be diluted by diesel fuel, and the exhaust manifold will eventually leak oil.

**If the following points are done 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, operation duration should be limited to 5 minutes.

- Run the engine at full load for about 4 hours once a year. This gives carbon deposits in the engine and the exhaust pipe a chance to be burned away.

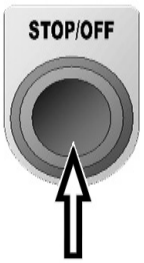
# Stopping the engine

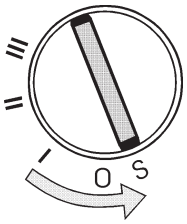
During longer breaks in operation, the engine must be warmed up at least once every fortnight. This prevents corrosion damage in the engine. If you expect the engine to be unused for two months or more, it must be laid up: Please refer to the “Laying up” chapter.

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


## Before stopping

Allow the engine to run for a few minutes without load before stopping it. This permits the temperature inside the engine to even up, “after-boiling” is avoided, at the same time as the turbocharger cools somewhat. This contributes to long service life without malfunctions.



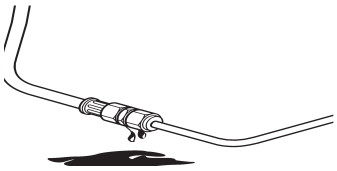




## Stop

- Disengage the clutch (if possible).
- Depending on the equipment installed; press the stop button and keep it depressed until the engine has stopped, or turn the key to the stop position. Release the key when the engine has stopped.

## After stopping

- Check the engine and engine bay for leakage.
- Turn off the main switches before any long stoppage.
- Carry out maintenance in accordance with the schedule.



⚠ **WARNING!** Working with, or going close to a running engine is a safety risk. Watch out for rotating components and hot surfaces.

# Maintenance schedule

## General

It is important that the engine receives regular care & maintenance, to achieve maximum reliability and service life. By following the service recommendations, engine performance is sustained and unnecessary environmental impact is avoided.

## MAINTENANCE SCHEDULE

⚠ **WARNING!** Before you start to do any maintenance work, read the “Maintenance” chapter carefully. This contains instructions for doing work in a safe and correct manner.

⚠ **IMPORTANT!** When both operation and calendar time are specified, do the maintenance job at the interval which is reached first. Maintenance points marked ☐ must be done by an authorized Volvo Penta workshop.

### Daily, before first start

- Engine oil, level check [1] ..... page 23
- Coolant, level check ..... page 26
- Radiator, external checking and cleaning ..... page 28
- Air filter indicator, inspection [1, 2, 3] ..... page 20
- Leakage check, engine ..... not shown

[1] In continuous operation, checks should be done every 8 hours.
[2] The air filter should be changed when the indicator remains in the red field after the engine has been stopped.
[3] When operated in extremely dirty conditions, special air filters must be used.

### After the first 100-200 hours

☐ Valve clearance, check ..... not shown
☐ Injectors, re-tighten 50Nm (36.88 lbf ft) ..... not shown

### Every 50 hours

- Battery, checking the electrolyte level ..... page 32
- Release bearing, lubrication [1] ..... not shown

[1] Applies to a disconnection clutch with more than 15-20 clutch operations per day. Otherwise, every 400 hours.

### Every 6 months

- Coolant filter, change [1] ..... not shown

[1] The filter should not be changed when the coolant is changed, however.

### Every 50-600 hours or at least every 12 months

- Engine oil and oil filter, change [1] ..... page 22-23

[1] Oil change intervals vary, depending on oil grade and sulfur content of the fuel. page 26.

### Every 500 hours

- Fuel tank (sludge trap), drain ..... not shown
- Drive belts, inspection/adjustment ..... page 21
- Coolant (corrosion protection fluid), top up [1] ..... page 24-25

[1] Top up with 0.5 liter (0.53 US qt) anti-corrosion agent if the cooling system is filled with an anti-corrosion mixture

### Every 1000 hours

- Air hoses, leakage check ..... page 20
- Fuel filter, changing ..... page 29

### Every 1500 hours

- ☐ Valve clearance, inspection/adjustment ..... not shown

### Every 2000 hours or every 12 months

- Air filter for air compressor, change ..... not shown
- Air filter, clean (TAD engines) [1] ..... not shown
- Coolant (corrosion protection fluid), change ..... page 24–25

[1] When operated in extremely dirty conditions, it must be cleaned frequently.

### Every 2400 hours

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

### Every 3000 hours

- ☐ Injectors, check ..... not shown

### Every 5000 hours or at least every 24 months

- Coolant (glycol mixture), change ..... page 24-25

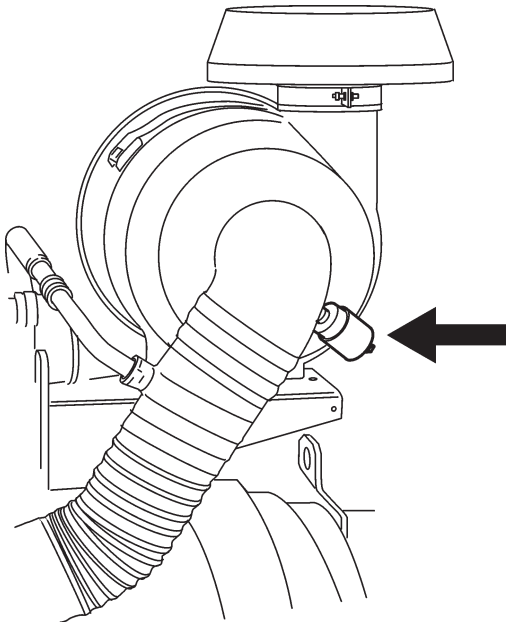
# Maintenance

This chapter describes how the specified maintenance points should be done. Read them carefully before starting work. The times when maintenance points need to be attended to are given in the previous chapter: Maintenance schedule

**WARNING!** Read through the safety advice for care and maintenance work in the “Safety information” chapter before starting work.

**WARNING!** Care and maintenance work should be done with the engine stopped unless otherwise specified. Make it impossible to start the engine by removing the ignition key and cutting the system voltage with the main switch. Working with, or going close to a running engine is a safety risk. Watch out for rotating components and hot surfaces.

## Engine, general



### Air filter Check/change.

Change the air filters when the indicator remains in the red field after the engine has been stopped. Reinstate the pressure drop indicator after changing the filter, by pressing in the button.

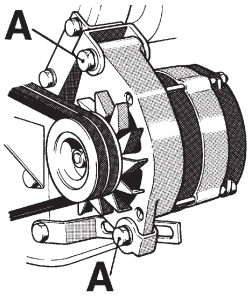
**NOTE!** The filters should not be touched until the indicator shows the red field. Scrap the old filters. No cleaning or re-use may be done.

**IMPORTANT!** In continuous operation, the filters should be checked every 8 hours.

When operated in extremely dirty conditions, such as coal mines, stone crushing mills etc., special filters are needed (not sold by Volvo Penta).

### Air hoses. Leakage check.

Inspect the condition of the hoses, for cracks and other damage. Change as necessary. Test all hose clamps for tightness.




## Drive belts. Inspection/adjustment

Inspection and any adjustment should be done after operation, when the belts are hot.

Loosen the screws (A) before tensioning the alternator belts. It should be possible to press the belts down about 10 mm (3/16 “) between the pulleys. Worn belts which operate in pairs should be changed together.

On TD420VE, TAD420VE and TAD620VE, the fan belts have an automatic belt tensioner and do not need to be adjusted.

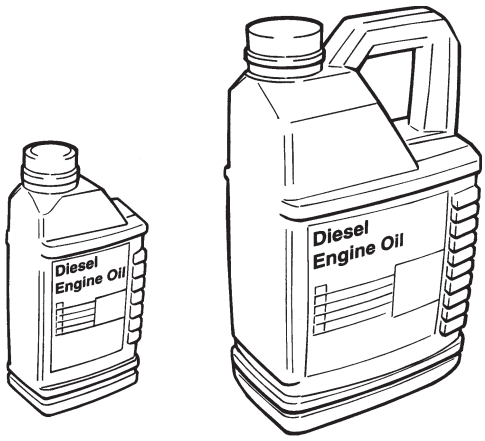
TD520GE, TAD520GE, TAD520VE, TAD620VE, TD720GE, TAD720GE, TAD720VE, TAD721VE and TAD722VE have mechanical belt tensioners.

Always check the condition of the drive belts. Change as necessary.

# Lubrication system

Oil change intervals can vary from **40 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.**

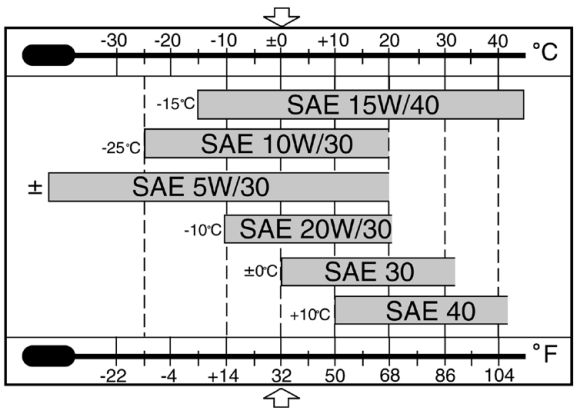
If you want longer oil change intervals than given in the table below, the condition of the oil must be checked by the oil manufacturers through regular oil testing.




| Oil grade | Sulfur content in fuel, by weight | | |
|---|---|---|---|
| | **up to 0,5 %** | **0,5 – 1,0 %** | **more than 1,0 %** |
| | **Oil change interval: Reached first in operation:** | | |
| VDS, VDS-2, VDS-3<br>ACEA E3, E2 | **500** hours or<br>12 months. | **250** hours or<br>12 months. | **125** hours or<br>12 months. |

**NOTE!** Fully synthetic oil must be used for the TAD722VE engine. Mineral based oil, either fully or semi-synthetic can be used in other engines, on condition that it complies with the quality requirements above.
If the 6 and 7 liter engines are equipped with a low-profile oil pan, the oil change intervals should be changed.

**VDS = Volvo Drain Specification**
**ACEA = Association des Constructeurs Européens d'Automobiles**



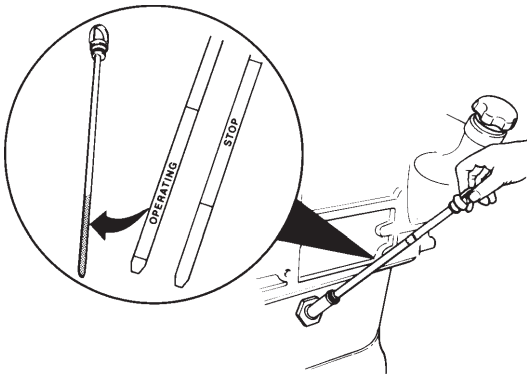

## Viscosity

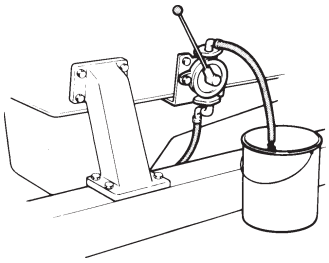
Select the viscosity from the table below, for the appropriate continuous ambient air temperature.

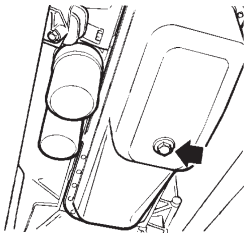
* Refers to synthetic or semi-synthetic oils.

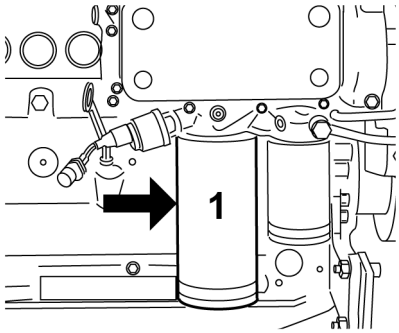
## Oil change volume

Please refer to the "Technical Data" chapter.








## Oil level. Inspection

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

⚠ **IMPORTANT!** In continuous operation, the oil level should be checked every 8 hours.

⚠ **WARNING!** Working with, or going close to a running engine is a safety risk. Watch out for rotating components and hot surfaces.

## Oil and oil filters. Change

Always follow the recommended oil change interval and always change the oil filter during oil changes. On stationary engines, the bottom plug should **not** be removed. Use an oil drain pump to suck the oil up.

1. Clean the oil filter holder thoroughly to avoid dirt entry when the new filter(s) is/are installed.
2. Warm the engine up.
   ⚠ **WARNING!** Hot oil and hot surfaces can cause burns.
3. Remove the bottom plug. Drain the oil.
4. Install the bottom plug with a new gasket.
5. Remove the filer (1). Check that the gasket has not been left behind on the engine.
5. Fill the new filters with engine oil and wipe oil on the gaskets. Screw the filters on by hand until the gaskets just touch the mating surface. Then turn the filter a further half turn. **Not more!**
6. Fill up with oil to the correct level. **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.

**Collect the old oil and old filters and hand them to a re-cycling station for destruction.**

# Cooling system

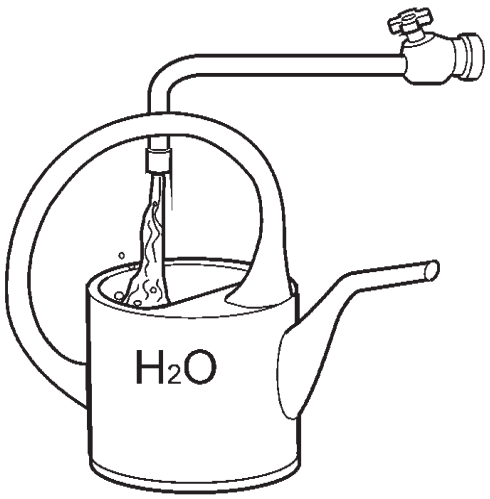
The cooling system shall always be filled with coolant which protects the engine from internal corrosion and from frost damage if the climate requires it. **Never use water by itself.**

**The corrosion protection additives become less effective as time passes, which means that the coolant must be changed. The following change intervals apply, on condition that Volvo Penta's recommendations are followed:**

| Coolant | Change interval |
|---|---|
| Volvo Penta coolant (glycol mixture) **with** coolant filter | Every 4 years or at least every 10,000 hours. |
| Volvo Penta coolant (glycol mixture) **without** coolant filter | Every 2 years or at least every 5000 hours. |
| Volvo Penta anti-corrosion agent | Every year |

⚠ **IMPORTANT!** The cooling system should be flushed when the coolant is changed. Please refer to the "Cooling system" heading. Flushing". The coolant filter (option) should not be changed at the same time as the coolant, it should be changed six months after the first coolant change and then every 6 months. Please refer to "Coolant filter". Replacement".



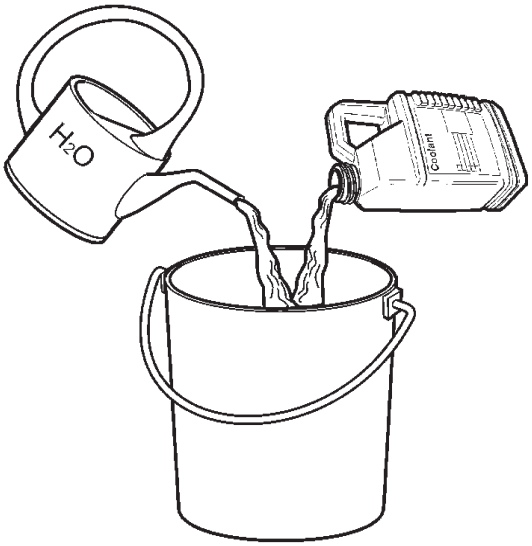



## Coolant. General

⚠ **IMPORTANT!** The following recommendations must be followed to avoid blockage and/or frost and corrosion damage in the engine and cooling system:

**Water quality**
Always use fresh water which complies with the requirements in ASTM D4985. If this requirement is not complied with, the coolant system will be obstructed, with consequent lower cooling capacity. If the water can not be purified to comply with this demand, distilled water or ready-mixed coolant **must** be used.

| | |
|---|---|
| **Total solid particles** | < 340 ppm |
| **Total hardness:** | < 9.5° dH |
| **Chloride** | < 40 ppm |
| **Sulfate** | < 100 ppm |
| **pH value** | 5.5–9 |
| **Silica** | < 20 mg $SiO_2$/l |
| **Iron** | < 0.10 ppm |
| **Manganese** | < 0.05 ppm |
| **Conductivity** | < 500 µS/cm |
| **Organic content, $COD_{Mn}$** | < 15mg $kMnO_4$/l |



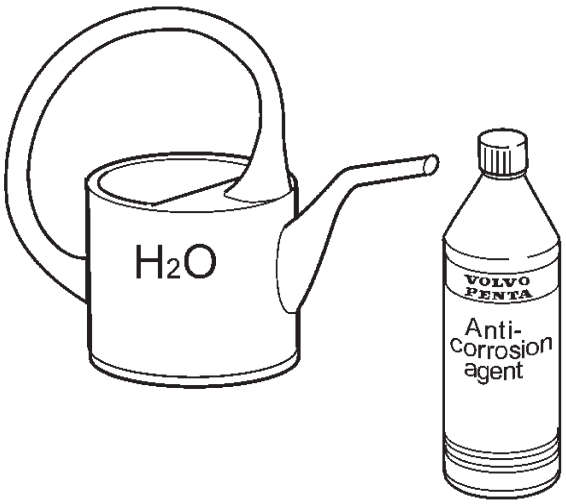

**If there is a risk of frost**
Use a mixture of 50% Volvo Penta anti-freeze (glycol) and 50% water (to ASTM D4985): This mixture prevents against frost bursting down to about –40°C (–40°F), and should be used all year round.

⚠ **IMPORTANT!** Even if the temperature never falls down as far as –40°C (–40°F), use the above-mentioned mixture ratio to give full corrosion protection.

Mix the glycol with water in a separate vessel before filling the system.

⚠ **WARNING!** Glycol is poisonous (dangerous to drink).

⚠ **IMPORTANT!** Do not use alcohol in the cooling system.




**No risk of frost**
When there never is a risk of frost, water (according to ASTM D4985) with the addition of Volvo Penta anti-corrosion agent can be used as coolant.

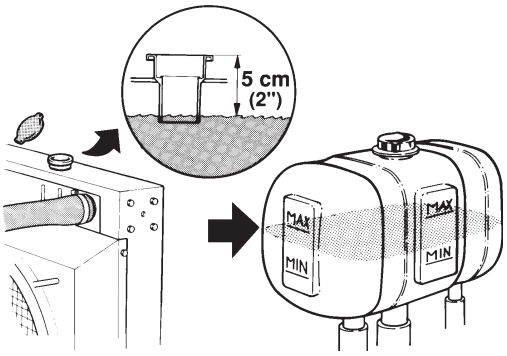
**We recommend that a mixture of Volvo Penta glycol and water should be used all year round, irrespective of the climate.**

Mixture ratio 1:30. Warm the engine up after filling, to give the additive the best effect.

If operation time exceeds 500 hours per annum, the corrosion protection of the coolant must be topped up with 1/2 liter (0.53 US qt) of anti-corrosion additive every 500 hours of operation.

⚠ **WARNING!** Anti-corrosion additive is poisonous (dangerous to drink).

⚠ **IMPORTANT!** Never mix anti-corrosion additive with anti-freeze (glycol). This can cause foaming, and severely affect cooling ability.




## Coolant. Checking and filling

⚠ **WARNING!** Do not open the filler cap when the engine is warm, 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 (2”) 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.

**Filling a completely empty system**
Check that all drain points are closed.

**The location of drain and vent taps is shown overleaf.**

Filling should be done with the engine stationary. Fill up slowly, to allow the air to flow out.

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

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 fully open (about 20 minutes). Open any venting taps some while after starting, to allow shut-in air to escape. Check the coolant level and top up as necessary.

## Coolant. Draining.

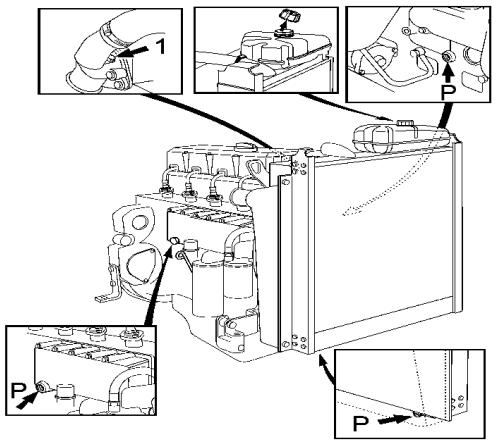
**The engine must be stopped before draining, and the filler cap unscrewed.**

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

Open the drain taps and remove the drain plugs (positions are shown below). Unscrew and empty the coolant filter if installed.

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






## Drain/vent taps. Location

**Drain plugs (P):**

- under the radiator
- beside cyl. 3 or cyl. 5 (4 or 6-cylinder engines)
- under the oil cooler

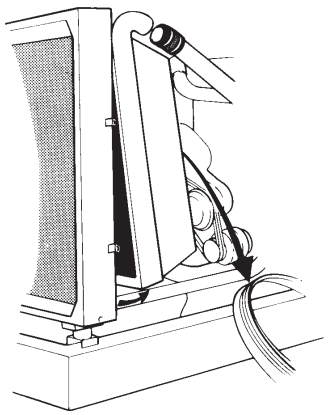
**Vent tap (1):**

- On the coolant pump

## Cooling system Flushing

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

1. Drain the coolant, as in the description on the previous paragraph.
2. Insert a hose into the filler hole in the radiator, and flush with fresh water until the water which runs out is completely clear.
3. Close the drain taps and plugs. Fill up with fresh coolant, as in the instructions in the chapter entitled “Coolant. Checking and filling”.



## Radiator (air cooled intercooler TAD). 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.

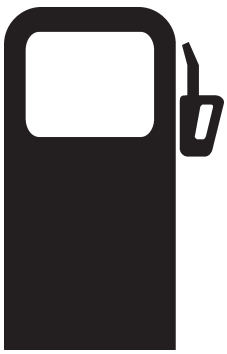
⚠ **IMPORTANT!** Do not use a high pressure power washer.

# Fuel system

Only use the grades of fuel recommended in the fuel specification below. Always observe the greatest cleanliness during re-fueling and work on the fuel system.

All work on the injection system of the engine must be done by an authorized workshop. **If the seal on the injection pump is broken by an unauthorized person, all warranties are void.**

⚠ **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 a fire-proof manner.



## Fuel specification

The fuel must comply with national and international standards for commercially supplied fuels, such as:

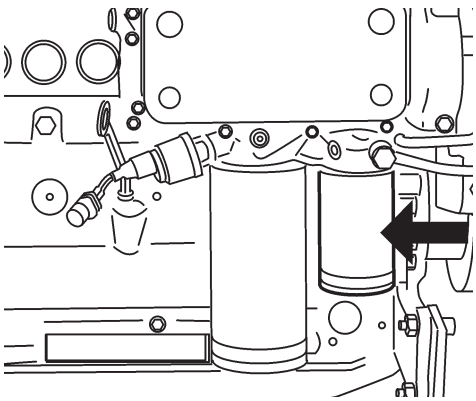
**EN590** (with nationally adapted environmental and cold requirements)

**ASTM-D 975-No 1-D and 2-D.**

**JIS KK 2204**

**Sulfur content:** Complying with legal requirements in each country. If sulfur content exceeds 0.5% by weight, the **oil change intervals** must be changed, please refer to the “Lubrication system” heading.

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 filter. Change

Cleanliness! No dirt must be allowed to get into the fuel system.

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

Remove the filters. Wipe a film of oil on the gaskets of the new filters. Screw the filters on by hand until the gaskets just touch the mating surface. Then tighten a further half turn, **no more**. Vent the fuel system. **Hand old filters in to an authorized waste processing facility for destruction.**

Start the engine and make sure that no leakage occurs.

## Fuel system. Venting

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

Use the hand pump, if fitted, to vent the fuel system. In other cases, vent the system by operating the starter motor.

# Electrical system

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

## Fuses

No fuses or circuit breakers are supplied with the engine. Customers have to install the electrical system on the side of the vehicle themselves.

Fuses cut the current if the electrical system is overloaded.

If the engine can not be started, or if the instrument stop working during operation, a fuse or circuit breaker can have tripped. Check and replace fuses or reset circuit breakers.

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

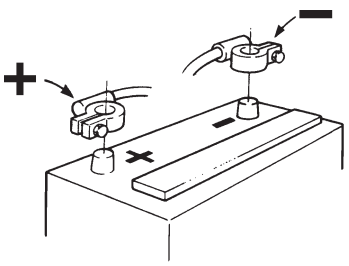
## Main switch

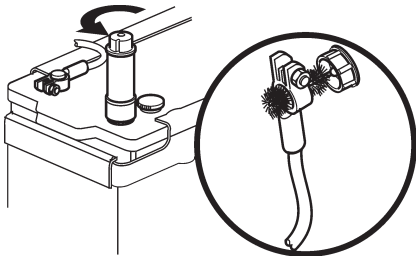
The main switch must never be disconnected before the engine has been stopped. If the circuit between the alternator and the battery is disconnected when the engine is running, the alternator can be damaged.

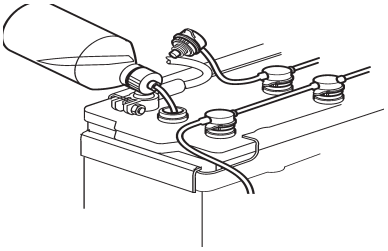
⚠ **IMPORTANT!** Never disconnect the current with the main switch when the engine is running.


## 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 open 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 at once with soap and a lot of water. If you get battery acid in your eyes, flush at once with a lot of water, and get medical assistance at once.

### 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

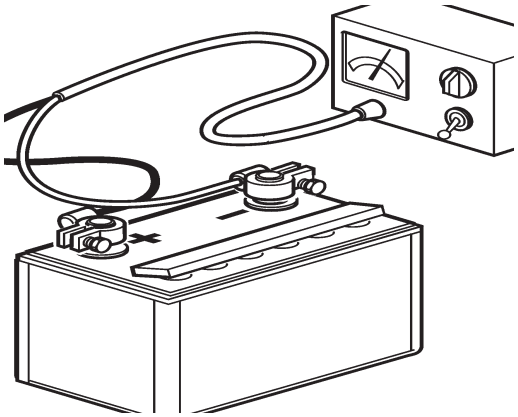
When you disconnect batteries, connect the - cable (black) first, then the + cable (red).

### Cleaning

Keep the batteries dry and clean. Contamination and oxide on the batteries and battery poles can cause stray currents, voltage drop and discharge, especially in wet weather. Clean oxidation from the battery poles and terminals, using a copper brush. Tighten the terminals securely and grease them with terminal grease or Vaseline.

### Filling

The electrolyte level should be 5-10 mm (0.2-0.4”) above the cell plates in the battery. Top up with **distilled water** as necessary. 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 observed.



## 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 at once with soap and a lot of water. If you get battery acid in your eyes, flush at once with a lot of cold water, and get medical assistance at once.

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 possibly trickle charged (please refer to the battery manufacturer's recommendations). Batteries are damaged by being left discharged, and can also freeze and burst easier in cold weather.

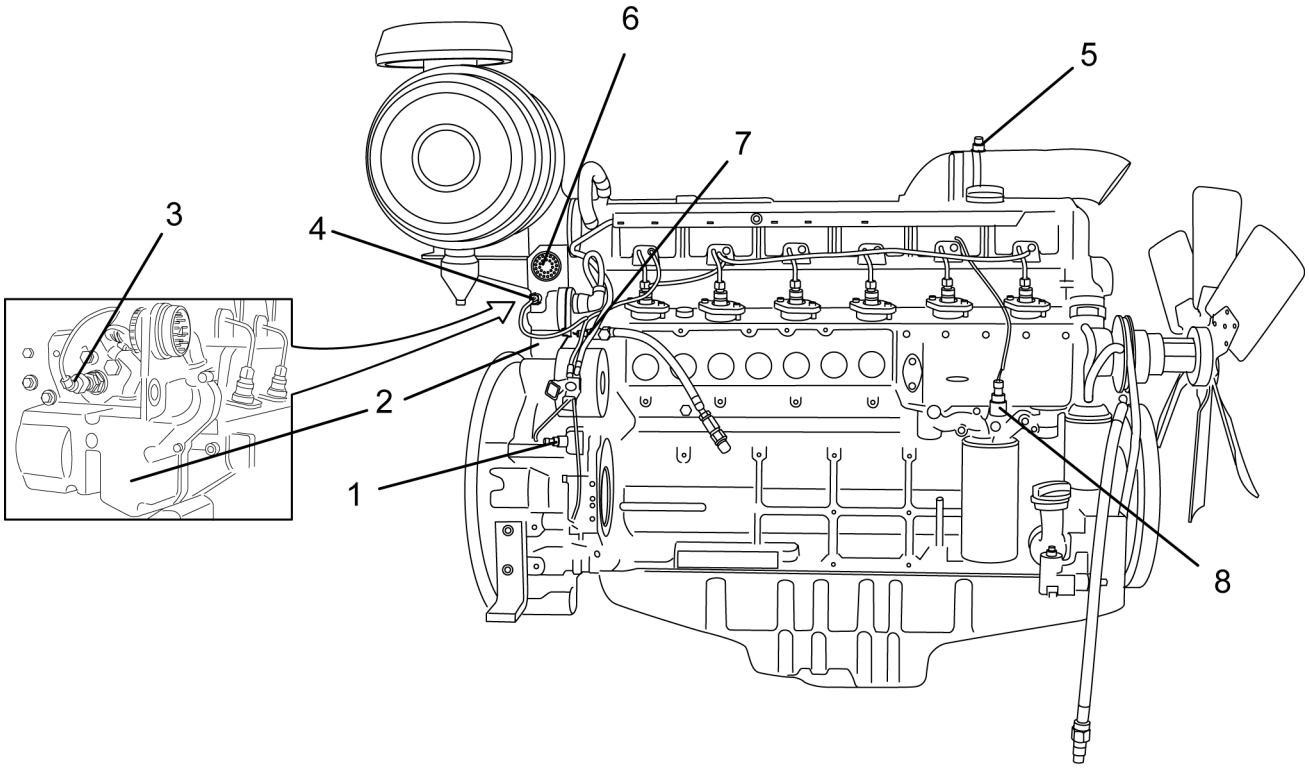
⚠ **IMPORTANT!** Observe the instruction manual for the battery charger carefully. To avoid the risk of electrochemical corrosion when an external charger is connected, the battery cables should be removed from the batteries before the charger is connected.

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 charge current **before** undoing the charging clamps. Never confuse the positive (+) and negative (-) poles on the batteries. This can cause serious arcing and can cause an explosion.

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

## Component location




1. Speed sensor, camshaft
2. Speed regulator / Actuator
3. Coolant temperature sensor
4. Charge pressure sensor, 3 pin*
5. Charge pressure sensor, 4 pin*
6. Connection to control unit
7. Fuel temperature sensor
8. Oil pressure sensor

* Only one type of sensor is used.

# Laying up

The engine must be laid up to prevent damage if it is not used for two months or more. It is important that this is done in the correct manner, and nothing is forgotten. For this reason, we have compiled a check list of the most important points.

Before laying up for a long period of time, an authorized Volvo Penta workshop should check over the engine and other equipment. Have any faults and deficiencies attended to, so that the equipment is in order, ready for the next start.

⚠ **WARNING!** Before you start to do any maintenance work, read the “Maintenance” chapter carefully. This contains instructions for doing work in a safe and correct manner.

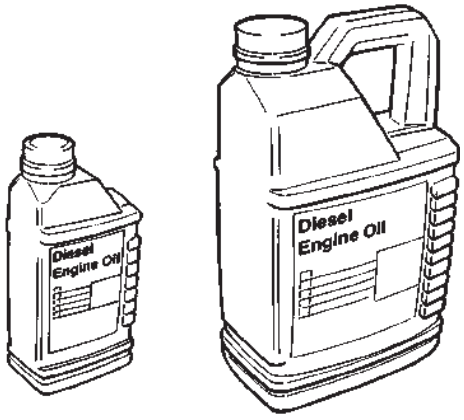
## Conservation

- Change engine oil and oil filter.
- Change the fuel filter. Also change the primary fuel filter, if fitted.
- Warm the engine up.
- Check that the coolant offers sufficient frost protection. Top up as necessary.

  ⚠ **IMPORTANT!** Anti-corrosion mixture does not offer any protection against frost. If there is any risk of frost, the system must be drained.
- Drain any water and contamination from the fuel tank. Fill the fuel tank completely, to avoid condensation.
- Clean the outside of the engine. Do not use a power washer. Touch up paint damage with Volvo Penta original paint.
- Disconnect the batteries. Clean and charge the batteries. NOTE! A poorly charged battery can freeze and burst.
- Spray the components of the electrical system with water-repellent spray.

## Removing conservation preparations

- Check the oil level in the engine. Top up as necessary. If special conservation oil has been put in, this must be changed together with the oil filter. For the correct grade: Please refer to the “Maintenance, lubrication system” chapter:
- Close/tighten drain taps/plugs.
- Check the drive belts.
- Check the condition of all rubber hoses, and retighten the hose clamps.
- Check the coolant level and anti-freeze. Top up as necessary.
- Connect the fully charged batteries.
- Start the engine. Check that there is no leakage of oil, fuel, coolant or exhaust gas, and that all controls function normally.



# Fault tracing

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

⚠ **WARNING!** Read through the safety advice for care and maintenance work in the “Safety information” chapter before starting work.

## Symptoms and possible causes

| | |
|---|---|
| ☼ The diagnosis button lamp flashes. | Please refer to the “Diagnostic information” chapter. |
| Engine can not 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 speed 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 |
| Too low lubrication oil pressure | 16 |
| Excessive coolant temperature | 17, 18, 19, 20 |
| Too low coolant temperature | 20 |
| No, or poor charge | 2, 23 |

1. Flat batteries
2. Poor contact/open circuit in cables
3. Main switch turned off
4. Faulty ignition lock
5. Faulty main relay
6. Faulty starter motor relay
7. Faulty starter motor/solenoid
8. Lack of fuel:
   – fuel taps closed
   – fuel tank empty/wrong tank connected
9. Blocked fuel filter/pre-filter (because of contamination, or paraffin fraction separation in fuel at low temperature).
10. Air in the fuel system
11. Water/contamination in fuel
12. Faulty injection pumps
13. Insufficient air supply to engine:
   – blocked air filter
   – air leakage between turbocharger and engine inlet pipe.
   – fouled compressor section in turbocharger
   – faulty turbocharger
   – poor engine bay ventilation
14. Excessive coolant temperature
15. Too low coolant temperature
16. Too low oil level
17. Coolant level too low
18. Air in the coolant system
19. Faulty circulation pump
20. Defective thermostat
21. Blocked intercooler
22. Too high oil level
23. Alternator drive belt slips
24. Water entry into engine
25. High back pressure in exhaust system
26. Break in “Pot+” cable to pedal
27. Incorrectly set engine speed regulator / actuator

# Diagnostic function

The diagnostic function monitors and checks that the EDC 4 system functions normally.

## Diagnostic function

The diagnostic function has the following tasks:

- Discover and localize malfunctions.
- Notify that malfunctions have been discovered.
- Give advice in fault finding.
- Protect the engine and ensure continued operation when serious malfunctions are discovered.

## Malfunction message

If the diagnostic function discovers a malfunction in the EDC 4 system, this is notified via the CAN bus or the diagnostic lamp lights up or starts to flash. At the same time, the fault is stored in the control unit memory. As soon as the fault has been attended to and the ignition is turned off and on, the fault code lamp goes out. Both rectified (passive) and un-rectified (active) faults are stored in the control unit and can be read by an authorized workshop.

## Fault tracing guide

If the diagnostic button is depressed (for 1-3 seconds) and then released, a fault code is flashed out from the diagnostic lamp. The fault code is found in the fault code list, with information about the reason, reaction and measures to be taken. Please refer to the “Fault codes” chapter.

## Effect on engine

The diagnostic function affects the engine in the following ways:

1. The diagnostic function has discovered a minor malfunction which does not damage the engine.

   **Reaction:** The engine is not affected. The diagnostic lamp lights up.

2. The diagnostic function has discovered a serious malfunction which makes it impossible to control the engine.

   **Reaction:** The diagnostic lamp starts to flash. Engine is shut off.

## Operation

### During starting

When the ignition is turned on, the diagnostic lamp lights up for two seconds, together with the warning lamps for oil pressure and coolant. This is to check the lamp function.

If the diagnostic lamp flashes after the two seconds, this indicates a serious fault and the engine can not be started. One or more fault codes can then be flashed out.

If the diagnostic lamp is lit, there are one or more less serious faults. One or more fault codes can then be flashed out.

**During operation**

If the diagnostic lamp starts to flash during operation:

1. Reduce engine speed to idling.
2. Press the diagnostic button (for 1-3 seconds).
3. Release the diagnostic button and make a note of the diagnostic trouble code (DTC) that is flashed out. Please refer to “Reading fault codes” below.
4. Look up the fault code in the fault code list and take the necessary measures. Please refer to the “Fault codes” chapter.

If the diagnostic lamp starts to flash, the engine will be emergency stopped.

⚠ **IMPORTANT!** In VE engines, there is a function in the system which makes it possible to start the engine again and run it for about 25 seconds. This is so that the vehicle can be moved from a railway level crossing etc.

## Reading fault codes

Fault codes can either be read via:

- The VODIA tool (including the Penta EDC4 software). Please refer to the “VODIA User’s Guide” for advice on use.
- Diagnostic lamp
- CAN

**Diagnostic lamp**

If the diagnostic lamp is illuminated or flashes, a fault code can be read by pressing the diagnostic button (for 1-3 seconds) and then releasing it. The diagnostic lamp goes out, and a fault code is then flashed out.

The fault code consists of three groups of flashes, separated by a pause of two seconds.

The first and third group consist of short flashes (0.4 s). The second group consists of long flashes (0.8 s).

A fault code is obtained by counting the number of flashes in each group.

**Example**: ☼ ☼ (2 short) pause ☼ ☼ (2 long) pause ☼ (1 short) = Fault code 2.2.1

The fault code is stored and can be read as long as the fault remains. You can find information about cause, reaction and actions in the fault code list. Please refer to “Fault codes”.

**Read as follows:**

1. Press the diagnostic button (for 1-3 seconds).
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 is repeated, all fault codes have been read out.

**When all faults have been rectified:**

1. Turn the ignition on and off.
2. Press the diagnostic button (for 1-3 seconds) to check whether any faults remain.
3. If there are no active faults, the diagnostic lamp will give two short flashes, in other cases the remaining non-rectified faults will be flashed out again.

# Fault codes

⚠ **WARNING!** Read through the safety advice for care and maintenance work in the “Safety information” chapter before starting work.

### Code 2.0.0 No faults

There are no active faults.

### PID 190, Code 2.1.1 Engine speed sensor, camshaft

**Reason:** Faulty sensor, connector, cables or incorrect distance to cam wheel. High frequency interference.

**Reaction:** Engine is shut off.

**Action:**

- Check that the engine speed sensor is installed with the correct distance to the camshaft.
- Check the cables for the engine speed sensor for breaks and short circuits.
- Check the connector for poor contact.
- Check engine speed sensor function. Change the sensor as necessary.

### PID 190, Code 2.1.4 Overspeed

**Reason:** The engine speed is or has been higher than the permissible limit.

**Reaction:** Fuel injection ceases and the fault code lamp lights up until the engine speed falls below the permissible limit again.

**Action:**

- Check the control rod for the injection pumps.
- Check the actuator, replace it if necessary.
- Check the cables for the actuator for breaks and short circuits.
- Check the number of teeth on the camshaft wheel.
- For VE engines, it may be necessary to check the function of the “limp home” mode

### PID 91, Code 2.2.1 Accelerator pedal sensor

**Reason:** Faulty sensor, connector or cable.

**Reaction:** The engine goes into “limp home” mode.

**Action:**

- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.

### PID 102, Code 2.2.3 Charge pressure sensor

**Reason:** Faulty sensor, connector or cable.

**Reaction:** A fault code is generated.

**Action:**

- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.

### PID 100, Code 2.2.4 Oil pressure sensor

**Reason:** Faulty sensor, connector or cable.

**Reaction:** A fault code is generated.

**Action:**

- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.

### PID 110, Code 2.2.5 Temperature sensor, coolant

**Reason:** Faulty sensor, connector or cable.

**Reaction:** A fault code is generated.

**Action:**

- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.

### PID 174, Code 2.2.7 Fuel temperature sensor

**Reason:** Faulty sensor, connector or cable.

**Reaction:** A fault code is generated.

**Action:**

- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.

### PID 100, Code 2.3.1 Warning, oil pressure

**Reason:** Oil pressure below specified limit value (depends on engine speed).

**Reaction:** A fault code is generated. The fault code disappears when the oil pressure exceeds the recuperation value.

**Action:**

- Check the oil level and oil pump.
- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.
- Check the limit value for oil pressure warning.

### PID 110, Code 2.3.2 Warning, coolant temperature

**Reason:** Excessive coolant temperature

**Reaction:** A fault code is generated. The fault code disappears when the coolant temperature falls below the recuperation value.

**Action**:

- Check the coolant.
- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.

### PID 111, Code 2.3.5 Warning, coolant level

**Reason:** Coolant level too low

**Reaction:** A fault code is generated.

**Action:**

- Check the coolant level.
- Check the sensor cable for breaks and short circuits.
- Check sensor function (if installed). Change the sensor as necessary.

NOTE! The engine is supplied without a coolant level sensor.

### PID 190, Code 2.3.6 Overspeed in limp home mode

**Reason:** When the limp home mode is activated and the engine speed is or has been higher than the permissible limit value.

**Reaction:** GE: Engine is shut off. A fault code is generated.

VE: Fuel injection ceases when the control rod returns to its home position and the fault code lamp lights up until the engine speed falls below the permissible limit again.

**Action:**

- Check the control rod for the injection pumps.
- Check the actuator, replace it if necessary.
- Check the cables for the actuator for breaks and short circuits.
- Check the number of teeth on the camshaft wheel.
- For VE engines, it may be necessary to check the function of the “limp home” mode

### PID 174, Code 2.3.7 Warning, fuel temperature

**Reason:** Excessive fuel temperature.

**Reaction:** A fault code is generated. The fault code disappears when the fuel temperature falls below the recuperation value.

**Action:**

- Check the fuel.
- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.

### PID 100, Code 2.3.1 Emergency stop, oil pressure

**Reason:** Oil pressure below specified limit value.

**Reaction:** Engine is emergency stopped.

**Action:**

- Check the oil level and oil pump.
- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.
- Check the limit value for engine shut-off due to oil pressure.

### PID 110, Code 2.3.2 Emergency stop, coolant temperature

**Reason:** Excessive coolant temperature

**Reaction:** Engine is emergency stopped.

**Action:**

- Check the coolant.
- Check the sensor cable for breaks and short circuits.
- Check sensor function. Change the sensor as necessary.
- Check the limit value for engine shut-off due to coolant pressure.

### PID 111, Code 2.3.5 Emergency stop, coolant level

**Reason:** Low coolant level

**Reaction:** The engine is emergency stopped and can not be re-started until the fault is rectified.

**Action:**

- Check coolant level.
- Check the sensor cable for breaks and short circuits.
- Check sensor function (if installed). Change the sensor as necessary.

NOTE! The engine is supplied without a coolant level sensor.

### SID 24, Code 2.5.1 Control rod position sensor

**Reason:** Actuator not connected. Faulty value from control rod position sensor in actuator.

**Reaction:** Engine is emergency stopped. Actuator can not be controlled.

**Action:**

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

### SID 24, Code 2.5.1 Control rod position sensor, reference

**Reason:** Actuator not connected. Faulty value from control rod position sensor in actuator.

**Reaction:** Engine is emergency stopped. Actuator can not be controlled.

**Action:**

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

### SID 23, Code 2.5.1 Control rod position sensor, difference

**Reason:** Injection pump/actuator has got stuck or is not connected. Difference between control rod current value and nominal value exceeds 10%.

**Reaction:** A fault code is generated. The fault code disappears when the difference between control rod current value and nominal value falls below 10%.

**Action:**

- Check the control rod for the injection pumps.
- Check the actuator, control rod and injection pumps. Change as necessary.
- Check the cables for the actuator for breaks and short circuits.

### SID 23, Code 2.5.2 Injection pump, auto calibration

**Reason:** Automatic actuator equalization is not possible. Faulty calibration.

**Reaction:** The engine is emergency stopped and can not be re-started until the fault is rectified. The regulator can not be activated.

**Action:**

- Check the actuator. Change as necessary.
- Check the actuator cables.
- Turn the ignition off and on, and check if the fault code remains.

### SID 231, Code 2.7.1 Communication fault, CAN bus

**Reason:** CAN controller for CAN bus is faulty.

**Reaction: --**

**Action:**

- Check the cables.
- Check the control unit.

### SID 252, Code 2.8.1 Parameter programming

**Reason:** Memory fault

**Reaction:** The engine is emergency stopped and can not be re-started until the fault is rectified.

**Action:**

- Turn the ignition off and on, and check if the fault code remains.

### SID 240, Code 2.8.1 Cyclical program test

**Reason:** Memory fault

**Reaction:** The engine is emergency stopped and can not be re-started until the fault is rectified.

**Action:**

- Turn the ignition off and on, and check if the fault code remains.

### PID 158, Code 2.9.1 Control unit, voltage supply

**Reason:** Voltage supplied to actuator exceeds permissible limit values.

**Reaction:** A fault code is generated. The fault code disappears when the voltage returns to within the permissible limit values.

**Action:**

- Turn the ignition off and on, and check if the fault code remains.

### PID 158, Code 2.8.2 Reference voltage 1

**Reason:** Reference voltage for actuator exceeds permissible limit values.

**Reaction:** A fault code is generated. The fault code disappears when the voltage returns to within the permissible limit values (5 V).

**Action:**

- Check the voltage supplied.
- Turn the ignition off and on, and check if the fault code remains.

### PID 158, Code 2.8.2 Reference voltage 2

**Reason:** Reference voltage for actuator exceeds permissible limit values.

**Reaction:** A fault code is generated. The fault code disappears when the voltage returns to within the permissible limit values (5 V).

**Action:**

- Check the voltage supplied.
- Turn the ignition off and on, and check if the fault code remains.

### PID 158, Code 2.8.2 Reference voltage 3

**Reason:** Reference voltage for actuator exceeds permissible limit values.

**Reaction:** A fault code is generated. The fault code disappears when the voltage returns to within the permissible limit values (5 V).

**Action:**

- Check the voltage supplied.
- Turn the ignition off and on, and check if the fault code remains.

### PID 48, Code 2.9.2 Atmospheric pressure

**Reason:** Air pressure is outside permissible values.

**Reaction:** A fault code is generated. The fault code disappears when the pressure returns to normal. Monitoring function for air pressure is activated.

**Action:**

- Turn the ignition off and on, and check if the fault code remains.

### SID 253, Code 2.10.1 Parameter fault

**Reason:** No data or incorrect data (fault only occurs during parameter setting or reset).

**Reaction:** Engine can not be started.

**Action:**

- Check parameter settings.
- Turn the ignition off and on, and check if the fault code remains.

### SID 240, Code 2.10.1 Stack overflow

**Reason:** Internal calculation fault.

**Reaction:** The engine is emergency stopped and can not be re-started until the fault is rectified.

**Action:**

- Turn the ignition off and on, and check if the fault code remains.

# Technical data

## General

| Type designation | TD420VE | TAD420VE | TAD620VE |
|---|---|---|---|
| Direction of rotation (seen from flywheel) | Anti- clockwise | Anti- clockwise | Anti- clockwise |
| No. of cylinders | 4 | 4 | 6 |
| Cylinder bore mm (inch) | 101 (3.97”) | 101 (3.97”) | 98 (3.86”) |
| Stroke mm (inch) | 126 (4.96”) | 126 (4.96”) | 126 (4.96”) |
| Cylinder volume liter (inch $^3$) | 4.04 (246.5) | 4.04 (246.5) | 5.7 (347.8) |
| No. of valves | 8 | 8 | 12 |
| Compression ratio: | | | |
| EPA 1 | 19:1 | 19:1 | 18.4:1 |
| COM 2, EPA2 | 19:1 | 19:1 | 18.4:1 |
| Injection sequence | 1-3-4-2 | 1-3-4-2 | 1-5-3-6-2-4 |
| Engine power kW (hp) | 74 (102) [1)] | 103 (140) [1)] | 155 (209) [1)] |
| Max torque Nm (lbf.ft) | 390 (288) | 493 (364) | 700 (516) |
| At engine speed rpm | 1500 | 1500 | 1500 |
| Low idle rpm | 800 | 800 | 800 |
| Highest full load speed rpm | 2000 – 2500 [1)] | 2000 – 2500 [1)] | 2000 – 2500 [1)] |
| Weight, dry (lb) | 380 (838) [2)] | 380 (838) [2)] | 495 (1091) [2)] |

| Type designation | TAD520VE |
|---|---|
| Direction of rotation (seen from flywheel) | Anti- clockwise |
| No. of cylinders | 4 |
| Cylinder bore mm (inch) | 108 (4.25”) |
| Stroke mm (inch) | 130 (5.12”) |
| Cylinder volume liter (inch $^3$) | 4.76 (290) |
| No. of valves | 8 |
| Compression ratio: | |
| EPA 1 | 18.1:1 |
| COM2, EPA2 | 19:1 |
| Injection sequence | 1-3-4-2 |
| Engine power kW (hp) | 118 (158) |
| Torque Nm (lbf.ft) | 545 (402) |
| At engine speed rpm | 1800 |
| Low idle rpm | 800 – 950 |
| Highest full load speed rpm | 2000 – 2300 [1)] |
| Weight, dry (lb) | 432 (952) [2)] |

[1)] See engine plate for specifications.
[2)] Weight according to DIN 70020-A
[3)] Extra weight TAD520GE SAE 2 (1800 rpm) 36 kg (80 lb)
[4)] Including clutch and frame

| Type designation ..... | **TAD720VE** | **TAD721VE** | **TAD722VE** |
|---|---|---|---|
| Direction of rotation, seen from flywheel: | Anti- clockwise | Anti- clockwise | Anti- clockwise |
| No. of cylinders ..... | 6 | 6 | 6 |
| Cylinder bore mm (inch) ..... | 108 (4.25”) | 108 (4.25”) | 108 (4.25”) |
| Stroke mm (inch) ..... | 130 (5.12”) | 130 (5.12”) | 130 (5.12”) |
| Cylinder volume liter (inch $^3$) ..... | 7.15 (436.3) | 7.15 (436.3) | 7.15 (436.3) |
| No. of valves ..... | 12 | 12 | 12 |
| Compression ratio: | | | |
| EPA1 ..... | 18.4:1 | 18.4:1 | — |
| COM2, EPA2 ..... | 19.0:1 | 19.0:1 | 19.0:1 |
| Injection sequence ..... | 1-5-3-6-2-4 | 1-5-3-6-2-4 | 1-5-3-6-2-4 |
| Engine power kW (hp) ..... | 174 (129) [1] | 195 (264) [1] | 220 (297) [1] |
| Torque Nm (lbf.ft) ..... | 854 (630) | 905 (668) | 1050 (775) |
| At engine speed rpm ..... | 1400 | 1700 | 1700 |
| Low idle rpm ..... | 800 – 950 | 800 – 950 | 800 – 950 |
| Highest full load speed rpm ..... | 2000 – 2300 [1] | 2000 – 2300 [1] | 2100 – 2300 [1] |
| Weight, dry (lb) ..... | 572 (1261) [2] | 572 (1261) [2] | 680 (1496) [2] |

| Type designation..... | **TD520GE** | **TAD520GE** | **TD720GE** | **TAD720GE** |
|---|---|---|---|---|
| Direction of rotation (seen from flywheel) | Anti- clockwise | Anti- clockwise | Anti- clockwise | Anti- clockwise |
| No. of cylinders ..... | 4 | 4 | 6 | 6 |
| Cylinder bore mm (inch) ..... | 108 (4.25”) | 108 (4.25”) | 108 (4.25”) | 108 (4.25”) |
| Stroke mm (inch) ..... | 130 (5.12”) | 130 (5.12”) | 130 (5.12”) | 130 (5.12”) |
| Cylinder volume liter (inch $^3$) ..... | 4.76 (290) | 4.76 (290) | 7.15 (436.3) | 7.15 (436.3) |
| No. of valves ..... | 8 | 8 | 12 | 12 |
| Compression ratio: | | | | |
| EPA1 ..... | 17.5:1 | 17.5:1 | 17.1:1 | 17.1:1 |
| EPA2 ..... | 17.5:1 | 17.5:1 | 17.1:1 | 17.1:1 |
| Injection sequence ..... | 1-3-4-2 | 1-3-4-2 | 1-5-3-6-2-4 | 1-5-3-6-2-4 |
| Engine power: | | | | |
| At 1500 rpm kW (hp) ..... | 85 (115) [1] | 102 (138) [1] | 128 (173) [1] | 153 (207) [1] |
| At 1800 rpm kW (hp) ..... | 89 (120) [1] | 110 (149) [1] | 134 (181) [1] | 163 (220) [1] |
| Torque Nm (lbf.ft) ..... | 493 (394) | 598 (441) | 745 (549) | 891 (657) |
| At engine speed rpm ..... | 1500 | 1500 | 1500 | 1500 |
| Torque Nm (lbf.ft) ..... | 432 (319) | 536 (395) | 653 (482) | 790 (586) |
| At engine speed rpm ..... | 1800 | 1800 | 1800 | 1800 |
| Low idle rpm ..... | 800 – 950 | 800 – 950 | 800 – 950 | 800 – 950 |
| Highest full load speed rpm ..... | 1500/1800 [1] | 1500/1800 [1] | 1500/1800 [1] | 1500/1800 [1] |
| Weight, dry (lb) ..... | 550 (1213) [2] | 575 (1268) [2,3] | 750 (1653) [2] | 760 (1674) [2] |
| Gross weight, dry (lb) ..... | 580 (1279) [2] | 606 (1336) [2,3] | 790 (1742) [2] | 804 (1773) [2] |

[1] See engine plate for specifications.
[2] Weight according to DIN 70020-A
[3] Extra weight TAD520GE SAE 2 (1800 rpm) 36 kg (80 lb)
[4] Including clutch and frame

# Lubrication system

**Oil**

Change volume, including filter change,

| | |
|---|---|
| TD420VE/TAD420VE: | 10 liter (2.64 US gal) |
| TD520GE/TAD520GE/TAD520VE: | 13 liter (3.43 US gal) |
| TAD620VE: | 16 liter (4.22 US gal) |
| TAD720VE/TAD721VE/TD720GE/TAD720GE: | 20 liter (5.28 US gal) |
| TAD722VE: | 23 liter (6.07 US gal) |

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

At rated engine speed:

| | |
|---|---|
| TD520GE/TAD520GE/TD720GE/TAD720GE: | 400 kPa (58 psi) |
| TD420VE/TAD420VE/TAD620VE/TAD520VE/ TAD720VE/TAD721VE/TAD722VE: | 450 kPa (65 psi) |

Idle (800 rpm), min:

| | |
|---|---|
| TD420VE/TAD420VE/TAD620VE/TAD520VE/ TAD720VE/TAD721VE/TAD722VE: | 80 kPa (11.6 psi) |
| TD520GE/TAD520GE/TD720GE/ TAD720GE: | 150 kPa (22 psi) |

Automatic stop at pressure less than:

| | |
|---|---|
| TD420VE/TAD420VE/TAD620VE/ TAD520VE/TAD720VE/TAD721VE/TAD722VE: | 50kPa (7.2 psi) |
| TD720GE/TAD720GE: | 150kPa (22 psi) |
| TD520GE/TAD520GE: | 200kPa (29 psi) |

Oil grade ..... .....Please refer to the specification under “Maintenance.

Viscosity ..... .....Please refer to the specification under “Maintenance.

**Oil filter**, full flow filter:

Quantity ..... ..... 1

(tighten ½ - ¾ turn after it just touches)

**Lubrication oil pump**

Type ..... .....Gear driven oil pump

# Fuel system

**Injection sequence**

| | |
|---|---|
| TD420VE/TAD420VE/TD520GE/ TAD520GE/TAD520VE: ..... | 1-3-4-2 |
| TAD620VE/TD720GE/TAD720GE/ TAD720VE/TAD721VE/ TAD722VE: ..... | 1-5-3-6-2-4 |

**Feed pump**

| | |
|---|---|
| Supply pressure: ..... | 0.5 MPa (72.5 psi) |
| Supply pressure after fuel filter at 1500 rpm: Min ..... | 0.28 MPa (40.6 psi) |

**By-pass valve**

| | |
|---|---|
| Opening pressure ..... | 360–440 kPa (52.2–63.8 psi) |

# Fuel specification

The fuel must comply with national and international standards for commercially supplied fuels, such as:

**EN 590** (with nationally adapted environmental and cold requirements)

**ASTM D 975 No 1-D and 2-D.**

**JIS KK 2204**

**Sulfur content:** Complying with legal requirements in each country.

Low density 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%.

## Cooling system

| | |
|---|---|
| Type | Pressurized, sealed |
| Pressure cap, max. opening pressure: | |
| TD420VE/TAD420VE/TAD620VE/ TD520GE/TAD520GE/ TAD520VE/TAD720VE/ TAD721VE/TAD722VE: | 90 kPa (13 psi) [1] |
| TD720GE/TAD720GE: | 60 kPa (8.7 psi) |

[1] Refers to VE engines which are not equipped with a pressure valve at the factory.

| | |
|---|---|
| Volume (engine) | |
| TD420VE/TAD420VE: | 4.7 liter (1.24 US gal) |
| TAD620VE: | 6 liter (1.58 US gal) |
| TD520GE/TAD520GE/TAD520VE: | 7.2 liter (1.9 US gal) |
| TAD720VE/TD720GE/ TAD720GE/TAD721VE/TAD722VE: | 9.8 liter (2.59 US gal) |
| Volume (engine + radiator and hoses) | |
| TD520GE: | 17.5 liter (4.62 US gal) |
| TAD520GE: | 19.7 liter (5.2 US gal) |
| TD720GE | 22 liter (5.8 US gal) |
| TAD720GE | 23.8 liter (6.3 US gal) |

**Thermostat**

| | |
|---|---|
| Quantity and type | 1 piston thermostat |
| Opening temperature | |
| TD420VE/TAD420VE/TAD620VE/ TD520GE/TAD520GE/ TD720GE/TAD720GE: | 83° C (181° F) |
| TAD520VE/TAD720VE/TAD721VE/TAD722VE: | 87° C (189° F) |
| Fully open at | |
| TD420VE/TAD420VE/TAD620VE/ TD520GE/TAD520GE/ TD720GE/TAD720GE: | 95° C (203° F) |
| TAD520VE/TAD720VE/TAD721VE/TAD722VE: | 102° C (216° F) |

**Coolant filter**

| | |
|---|---|
| Quantity | 1 |

## Electrical system

| | |
|---|---|
| System voltage | 24 V (standard), 12 V (option) |

# Notes

# Notes

ENG

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## Yes please,

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

**Publication number: 7745201**

Name

Address

Country

*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.*

42200/615001/155099900192

VOLVO PENTA

GER

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## Ja,

ich will kostenlos eine Betriebsanleitung in deutscher Sprache erhalten.

**Publikationsnummer: 7745203**

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.*

42200/615001/155099900192

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## Oui merci,

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

**Numéro de publication: 7745204**

Nom

Adresse

Pays

Noter que l'offre est valable 12 mois à partir de la date de livraison du moteur, puis seulement dans la mesure des stocks disponibles.

42200/615001/155099900192

VOLVO PENTA

SPA

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

**Sí gracias,**
deseo recibir gratuitamente un libro de instrucciones en español.

**Número de publicación: 7745205**

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.*

42200/615001/155099900192

VOLVO PENTA

ITA

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**Sì, grazie,**
desidero ricevere gratuitamente un manuale d'istruzioni in lingua italiana.

**Public. No.: 7745206**

Nome e Cognome

Indirizzo

Paese

*Notare che la validità dell'offerta è garantita solo per 12 mesi dalla consegna del motore, dopodiché si procederà fino ad esaurimento scorte.*

42200/615001/155099900192

VOLVO PENTA

SWE

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

**Ja tack,**
jag vill kostnadsfritt ha en instruktionsbok på svenska.

**Publikationsnummer: 7745201**

Namn

Adress

Land

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

42200/615001/155099900192

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## Ja graag,

Ik wil kosteloos een instructieboek in het Nederlands ontvangen.

**Publicatienummer: 7745208**

Naam

Adres

Land

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

42200/615001/155099900192

VOLVO PENTA

FIN

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## Kyllä kiitos,

haluan suomenkielisen ohjekirjan veloituksetta.

**Julkaisunumero: 7745207**

Nimi

Osoite

Maa

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

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## Sim, obrigado(a)!

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**Número de publicação: 7745209**

Nome

Endereço

País

*Notar que a oferta é válida por um período de 12 meses a partir da data de entrega do motor. Depois desse período, a oferta é válida consoante a disponibilidade.*

42200/615001/155099900192

VOLVO PENTA

GRE

**Ταχυδρομήστε αυτό το κουπόνι στην παρακάτω διεύθυνση ή στείλτε το με φαξ στον παρακάτω αριθμό φαξ:**

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**Θα ήθελα ένα αντίτυπο του εγχειριδίου χρήσης στην αγγλική γλώσσα χωρίς καμιά χρέωση.**
**Αριθμός έκδοσης: 7745210**

**Όνομα**

**Διεύθυνση**

**Χώρα**

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

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**Да, пожалуйста,**

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**Номер издания: 7745212**

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*К Вашему сведению, это предложение действительно в течение 12 месяцев от даты поставки двигателя; в дальнейшем оно зависит от наличия.*

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