

OPERATOR'S MANUAL

D12

ENG

An English version of this Operator's Manual may be ordered free of charge up to 12 months after delivery, via internet, mail or fax. Refer to the order form in the back of the book.

All information is stored internally at AB Volvo Penta and will not be passed on to third parties.

GER

Diese deutsche Version dieses Handbuches kann innerhalb von 12 Monaten ab Lieferung kostenlos online, per Brief oder per Fax bestellt werden. Bitte Bestellformular hinten im Buch verwenden.

Alle Angaben werden bei AB Volvo Penta gespeichert und nicht Dritten übermittelt.

FRE

Une version française de ce manuel d'instructions peut être commandée gratuitement, jusqu'à 12 mois après la date de livraison, via Internet, la poste ou par fax. Voir à la fin de ce document.

Toutes les informations sont stockées en interne chez AB Volvo Penta et ne sont divulguées à aucun tiers.

SPA

Hay disponible una versión en español gratuita de este manual de instrucciones, la cual puede pedirse, a través de Internet, correo postal o fax, en el plazo de 12 meses después de la entrega del producto. Véase el formulario de pedido en las últimas páginas del manual.

Todos los datos recibidos son almacenados de forma in-

ITA

Una versione in lingua italiana di questo manuale di istruzioni può essere ordinata gratuitamente, fino a 12 mesi dopo la consegna, via internet, per posta o via fax. Vedere il modulo per l'ordinazione alla fine del manuale.

Tutti i dati forniti saranno memorizzati internamente presso AB Volvo Penta e non saranno divulgati a terzi.

SWE

En svensk version av denna instruktionsbok kan beställas kostnadsfritt, upp till 12 månader efter leverans, via internet, post eller fax. Se beställningsformulär i slutet av boken.

Alla uppgifter lagras internt hos AB Volvo Penta och lämnas inte ut till tredje part.

DUT

Een Nederlandse versie van dit instructieboek kan kosteloos worden besteld tot 12 maanden na aflevering, internet, post of fax. Zie het bestelformulier achterin het boek.

Alle gegevens worden intern opgeslagen bij AB Volvo Penta en niet verstrekt aan derden.

DAN

En dansk version af denne instruktionsbog kan bestilles gratis, op til 12 måneder efter levering, via internet, post eller telefax. Se bestillingsformular i slutningen af bogen.

Alle oplysninger gemmes internt hos AB Volvo Penta og overgives ikke til tredje part.

FIN

Tämän ohjekirjan suomenkielisen version voi tilata veloitusetta 12 kuukauden sisällä toimituksesta internetistä, postin kautta tai faksilla. Katso tilauslomake kirjan lopusta.

AB Volvo Penta tallentaa kaikki tiedot sisäisesti eikä niitä luovuteta kolmannelle osapuolelle.

POR

Pode-se encomendar uma versão gratuita deste manual de instruções em português, até 12 meses após a entrega, através de Internet, correio ou fax. Consultar o formulário de encomenda no fim do manual.

Todas as informações são armazenadas internamente pela Volvo Penta e não são partilhadas com terceiros.

GRE

Εντός 12 μηνών από την παράδοση μπορείτε να παραγγείλετε μέσω Internet, ταχυδρομικής επιστολής ή φαξ μια ελληνική έκδοση του Βιβλίου χρήσης χωρίς χρέωση. Χρησιμοποιήστε το δελτίο παραγγελίας στο τέλος του βιβλίου.

Όλες οι πληροφορίες αποθηκεύονται από την AB Volvo Pen-

RUS

Вариант настоящего руководства по эксплуатации на русском языке можно заказать бесплатно в течение 12 месяцев после доставки по Интернету, электронной почте или по факсу. См. бланк заказа на обложке руководства.

Вся информация используется компанией AB Volvo Penta конфиденциально и не передается третьим сторонам.

TUR

Bu Kullanım Kılavuzunun Türkçe versiyonu teslimden 12 ay sonrasında kadar internet, posta veya faks yoluyla sipariş edilebilir. Kitabın arka kısmında bulunan sipariş formuna bakınız.

Tüm bilgiler AB Volvo Penta'da saklıdır ve üçüncü kişilere verilmez.

CALIFORNIA

Proposition 65 Warning

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

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Foreword

Volvo Penta marine engines are used all over the world. They are used in all possible operating conditions for professional as well as leisure purposes. This is not a coincidence. After 100 years as an engine manufacturer the Volvo Penta name has become a symbol of reliability, technical innovation, top of the range performance and long service life. We also believe that this is what you demand and expect of your Volvo Penta engine.

We would like you to read this operator's manual thoroughly and consider the advice we give on running and maintenance before your maiden voyage so that you will be ensured of fulfilling your expectations. Please pay attention to the safety instructions contained in the manual.

As owner of a Volvo Penta marine engine, we would also like to welcome you to a worldwide network of dealers and service workshops to assist you with technical advice, service requirements and replacement parts. Please contact your nearest authorized Volvo Penta dealer for assistance.

You will find your closest dealer at our home page on the Internet www.volvopenta.com - amongst other useful information about your Volvo Penta engine - we invite you to visit!

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 have received the correct instruction book before you read on. If not, please contact your Volvo Penta dealer.



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:

DANGER!

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

WARNING!

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

CAUTION!

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

IMPORTANT!

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

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



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.

Your new boat

Read the instruction books and other information carefully, which came with your new boat. Learn to handle the engine, controls and other equipment in a safe and correct manner.

If this is your first boat, or a type of boat you are not experienced in using, we recommend that you practice operating the boat in peace and quiet. Get to know the way the boat reacts to sea and to the controls under different speed, sea and loading conditions before you cast off for your first "real" maiden voyage. Remember that the captain of every boat is required by law to know and to observe applicable rules for traffic and safety at sea. Get to know the rules which apply to you and your waters, by contacting the relevant authority or sea safety organization.

It is a good idea to go on some kind of boat operation course. We recommend that you contact a regional boat or sea safety organization to find a suitable course.

Daily checks

Make it a habit to give the engine and engine bay a visual check before driving (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.

Manoeuvring

Avoid sudden or surprising rudder movements and gear shifting. There is a risk that passengers could fall over, or overboard.

A rotating propeller can cause severe injury. Check that there is nobody in the water before you engage forward / astern (reverse) drive. Never drive close to bathers or in areas where you could reasonably expect that people could be in the water.

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 serious malfunctions, power loss or stop the engine.

Do not start the engine

Do not start the engine if you suspect a fuel or LPG leak in the boat, close to explosive media, or if there is a spillage of explosive media. An explosive environment entails a risk of fire and/or explosion.

Accidents and near misses

Life saving statistics show that inadequate care of boats and engines, and deficiencies in safety equipment are frequent causes of accidents and near misses at sea.

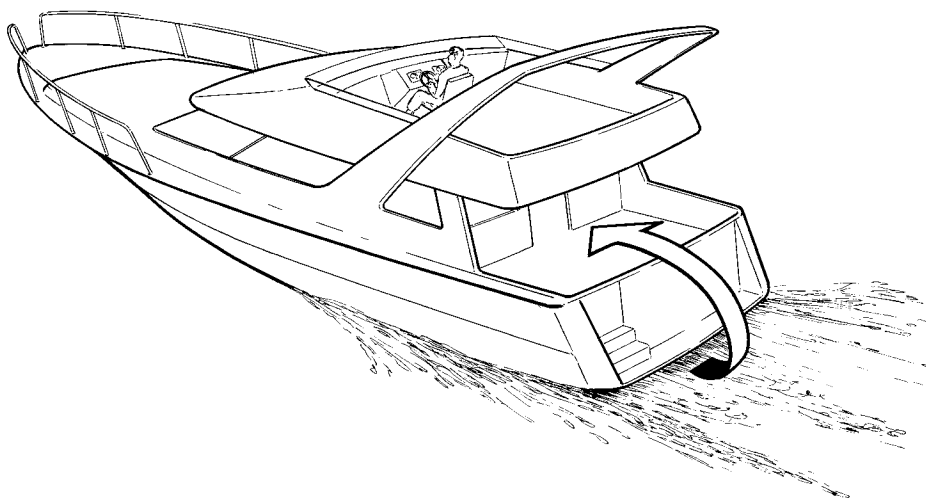
Make sure that your boat and engine are maintained in accordance with the advice in each instruction book, and that the necessary safety equipment is on board, and is in working condition.

Carbon monoxide poisoning

When a boat moves forwards, an area of low pressure air forms behind the boat. In adverse conditions, this low pressure can be so strong that the boat's own exhaust fumes are sucked into the cockpit or cabin, which entails a risk of carbon monoxide poisoning for all aboard.

The problem of low-pressure suction is worst in high, wide boats with a square transom. But even in other types of boats, low-pressure suction can be a problem in some conditions, such as if you drive with the hood up. Other factors which increase the low-pressure effect are wind conditions, load distribution, pitching, trimming, open windows and ventilators etc.

Most modern boats are designed so that the problem of low-pressure suction is very rare, however. If low-pressure suction does occur anyway, do not open hatches or ventilators in the forward part of the boat. Strangely enough, this makes the problem worse. Try changing speed, trimming or load distribution instead. Also try taking down/opening the hood or modifying it in some other manner. Ask your boat dealer for advice about the best solution for your particular boat.



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Remember

- Safety equipment: Life jackets for everybody aboard, communication equipment, emergency rockets, approved fire extinguisher, first aid kit, life buoy, anchor, paddle, torches etc.
- Spare parts and tools: Impeller, fuel filters, fuses, tape, hose clamps, engine oil, propeller and tools for the jobs you could be expected to have to do.
- Take your chart out and study your planned route. Calculate distance and fuel consumption. Listen to weather reports.
- Tell your friends/relatives about route plans if you undertake a long journey. Remember to notify changed plans or delays.
- Inform everybody aboard about where the safety equipment is located, and how it works. Make sure that there is more than one person aboard who can start and operate the boat safely.

This list can be extended, since the need for safety equipment varies with the type of boat, and where or how it is used etc. We recommend that you ask a regional boat or sea safety organization for more detailed maritime safety information.

Preparations

Knowledge

The operator's manual contains instructions on how to carry out general maintenance and service operations safely and correctly. Read the instructions carefully before starting work.

Service literature covering more complicated operations is available from your Volvo Penta dealer.

Never carry out any work on the engine if you are unsure of how it should be done, contact your Volvo Penta dealer who will be glad to offer assistance.

Stop the engine

Stop the engine before opening or removing engine hatches. Unless otherwise specified all maintenance and service must be carried out with the engine stopped.

To prevent accidental start of the boat engine, remove the ignition key, turn off the power supply to the engine at the main switches and lock them in the OFF position before starting work. Put up a warning sign in the control position that work on the engine is being carried out.

Approaching or working on an engine which is running is a safety risk. Loose clothing, hair, fingers or a dropped tool can be caught in the rotating parts of the engine and cause serious personal injury. Volvo Penta recommend that all servicing with the engine running should be undertaken by an authorized Volvo Penta workshop.

Lifting the engine

When lifting the engine, use the lifting eyes installed on the engine (reverse gear where installed). Always check that lifting equipment is in good condition and has sufficient load capacity to lift the engine (engine weight including reverse gear and any extra equipment installed). For safety's sake lift the engine using an adjustable lifting beam. All chains and cables should run parallel to each other and as perpendicular as possible in relation to the top of the engine. Bear in mind that extra equipment installed on the engine may alter its center of gravity. Special lifting equipment may then be required in order to maintain the correct balance and make the engine safe to handle. Never carry out work on an engine suspended on a hoist.

Before starting the engine

Reinstall all protective parts removed during service operations before starting the engine. Check that no tools or other items have been left on the engine.

Never start a turbocharged engine without installing the air cleaner (ACL). The rotating compressor in the Turbocharger unit can cause serious personal injury. Foreign objects can also be sucked in and cause mechanical damage to the unit.

Fire and explosion

Fuel and lubrication oil

All fuel, most lubricants and many chemicals are inflammable. Read and follow the instructions on the packaging.

When carrying out work on the fuel system, make sure the engine is cold. A fuel spill onto a hot surface or electrical components can cause a fire.

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

Do not smoke when filling fuel, oil or in proximity of a filling station or in the engine room.

Non-original components

Components used in the fuel and electrical systems on Volvo Penta products are designed and constructed to minimize the risk of fire and explosion.

Using spare parts other than by Volvo Penta approved spare parts can result in fire or explosion on board.

Batteries

The batteries contain and emit oxyhydrogen gas, especially during charging. This gas is easily ignited and highly volatile.

Do not under any circumstances smoke or use naked flame or allow sparks in the vicinity of the batteries or battery compartment.

An incorrect connection of a battery terminal cable or jump-start cable can cause a spark which in its turn can be sufficient to cause an explosion.

Start spray

Never use start spray or similar agents to start an engine equipped with air pre-heating (glow plugs/ starter element). This may cause an explosion in the inlet manifold. Danger of personal injury.

Hot surfaces and fluids

There is always a risk of burns when working with a hot engine. Beware of hot surfaces. For example: the exhaust pipe, turbo unit, oil pan, charge air pipe, starter element, hot coolant and hot oil in oil lines and hoses.

Carbon monoxide poisoning

Only start the engine in a well-ventilated area. If operating the engine in an enclosed space, ensure that there is proper ventilation in order to remove exhaust gases and crankcase ventilation emissions from the working area.

Chemicals

Most chemicals such as anti-freeze, rustproofing agent, inhibiting oil, degreasing agent etc. are hazardous to health. Read and follow the instructions on the packaging.

Some chemicals such as inhibiting oil are inflammable and dangerous if breathed in as well. Ensure good ventilation and use a protective mask when spraying. Read and follow the instructions on the packaging.

Store chemicals and other hazardous materials out of the reach of children. To protect the environment, please dispose of used or leftover chemicals at a properly designated disposal site for destruction.

Cooling system

There is a risk of flooding when working on the seawater system. Turn off the engine and close the sea cock (where installed) before starting work on the system.

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

If work must be carried out with the engine at operating temperature and the coolant filler cap or a cock open or a coolant hose disconnected, open the coolant filler cap carefully and slowly to release pressure before removing the cap completely. Note that the coolant may still be hot and can cause burns.

Lubrication system

Hot oil can cause burns. Avoid skin contact with hot oil. Ensure that the lubrication system is not under pressure before commencing work on it. Never start or operate the engine with the oil filler cap removed, oil can spray out.

Fuel system

Always use protective gloves when tracing leaks. Liquids ejected under pressure can penetrate body tissue and cause serious injury. There is a danger of blood poisoning.

Always cover the generator if it is located under the fuel filter. The generator can be damaged by spilled fuel.

Electronic Vessel Control (EVC)

The boat has a advanced control system. Never cut or modify connectors, wiring or splice of the components.

Installing non Volvo Penta components may cause the system to malfunction.

Service must be done by approved workshops.

Electrical system

Cutting off power

Always stop the engine and break the current using the main switches before working on the electrical system. Isolate shore current to the engine block heater, battery charger, or accessories mounted on the engine.

Batteries

The batteries contain an extremely corrosive electrolyte. Protect your skin and clothes when charging or handling batteries. Always use protective goggles and gloves.

If battery electrolyte comes into contact with unprotected skin, wash off immediately using plenty of water and soap. If battery acid comes into contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.

Introduction

This Operator's Manual has been prepared to give you the greatest possible benefit from your Volvo Penta marine engine. It contains the information you need to be able to operate and maintain the engine safely and correctly. Please read the Operator's Manual carefully and learn to handle the engine, controls and other equipment in a safe manner before you cast off on your maiden voyage.

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

The Operator's Manual describes the engine and equipment sold by Volvo Penta. The illustrations in this book covers several varieties and might differ, the essential information is always correct though. Installations with e.g. different controls and instrumentation might occur, in these cases we refer to this products manual.

Warranty

Your new Volvo Penta marine 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, 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 honour 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.

Environmental care

All of us want to live in a clean, healthy environment. Where we can breathe clean air, see healthy trees, have clean water in lakes and seas, and be able to enjoy the sunlight without fearing for our health.

Unfortunately, this is not self-evident these days, it is something all of us must work hard for.

As a manufacturer of marine engines, Volvo Penta has particular responsibility and for this reason, environmental care is a core value in our product development. Volvo Penta has a wide engine programme 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 Operator's Manual 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.

Moderate your speed and distance so that wake and noise do not disturb or damage animal life, moored boats, jetties etc. Leave the archipelago and harbours in the same state you would like to find them. Remember to always hand in drained oil, coolant, paint and wash residue, used batteries etc. for destruction at a recycling station.

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 running in period. For this reason, check the oil level more frequently than normally recommended.

After the first period of operation, the specified warranty inspection "First service inspection" can be done. For more information: Please refer to the Maintenance Schedule.

Fuel and oils

Only use the fuels and oils recommended in the Operator's Manual. Other grades can cause malfunctions, increased fuel consumption and eventually even shorten the life of the engine.

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

Service and spare parts

Volvo Penta marine engines are designed for high reliability and long life. They are built to withstand a marine environment, but also to have the smallest possible environmental impact. Through regular service and use of by Volvo Penta approved spare parts, these qualities are retained.

Volvo Penta's world-wide network of authorised dealers is at your service. 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 Operator's manual, and remember to note the engine/transmission identification number when you order service and spare parts.

Certified engines

If you own or operate an emission certified engine 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:

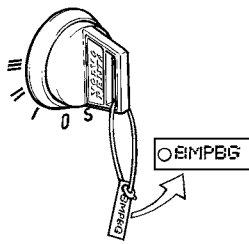
- Maintenance and service intervals recommended by Volvo Penta must be complied with.
- Only Volvo Penta original spares may be used.
- Service on injection pumps, pump settings and injectors must always be done by an authorised Volvo Penta workshop.
- The engine must not be converted or modified, except for the accessories and service kits which Volvo Penta has approved for the engine.
- Installation changes to the exhaust pipe and engine air inlet ducts must not be done.
- No seals may be broken by unauthorised personnel.

The general advice in the Operator's manual about operation, care and maintenance apply.

Late or inadequate maintenance/service or the use of spare parts not approved by Volvo Penta will invalidate AB Volvo Penta's responsibility for the engine specification being in accordance with the certificated variant. Volvo Penta accepts no responsibility or liability for any damage or costs arising due to the above.

Instruments and Controls

This chapter describes the instruments, panels and controls Volvo Penta sells for your engine. If you would like to complement your instrumentation, or if your boat is equipped with instruments not described here, we ask that you contact your Volvo Penta dealer.



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Ignition Lock

The start keys are supplied with a plate bearing the key code to be used when ordering spare keys. Keep the code beyond the reach of unauthorized people.

- S** = Stop position.
- 0** = The key can be inserted or removed.
- I** = Operating position. System voltage is connected.
- II** = Not used.
- III** = Start position. Start motor is engaged.

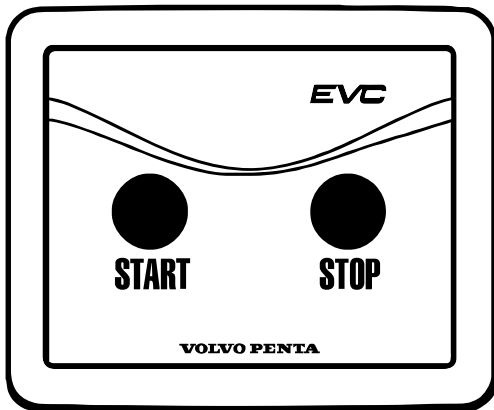
Read the starting instructions in chapter *Starting* page 28 to ensure you use the correct start procedure.

Start/Stop Panel

The start/stop panel is used for starting and stopping the engine.

To start the engine it is necessary for the start key at the main station to be in the "I" operating position. The engine can only be stopped from an activated control panel.

Read the starting instructions in chapter *Starting* page 28 to ensure you use the correct start procedure.



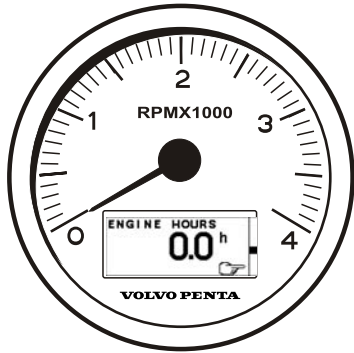
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Gauges

Tachometer

The tachometer displays engine speed; multiply the value shown on the dial by 1,000 to get the number of engine revolutions per minute.

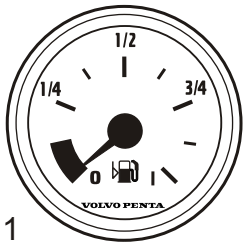
Boat and engine information is displayed in the tachometer window. Information displayed depends on engine type, the number of sensors and which accessories are installed.



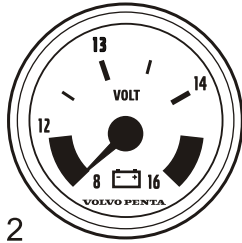
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Optional instruments

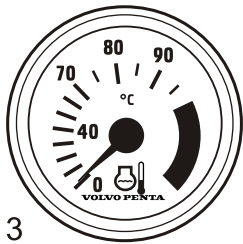
These instruments are sold as engine options by Volvo Penta.



1



2



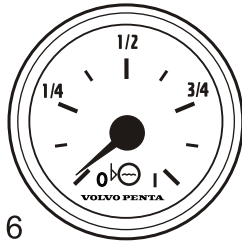
3



4



5



6



7

1 Fuel level gauge

The fuel level gauge shows the quantity of remaining fuel.

2 Voltmeter, battery charging

The meter shows the alternator charge current. During operations the charge voltage should be around 14 V. When the engine is stopped and electrical power switched on the battery voltage should be around 12 V.

If a 24 V system is installed, the charge voltage should be around 28 V during operations.

3 Coolant temperature gauge

The instrument shows engine coolant temperature. During operations coolant temperature should normally be between 75-90°C (167-194°F).

4 Oil pressure gauge

The oil pressure gauge displays engine oil pressure. During operations the oil pressure gauge should normally show 4-5.5 bar. At idle, lower values are normal.

5 Rudder position indicator

The instrument shows rudder position.

6 Fresh water level sensor

Freshwater tank level gauge.

7 Alarm monitor

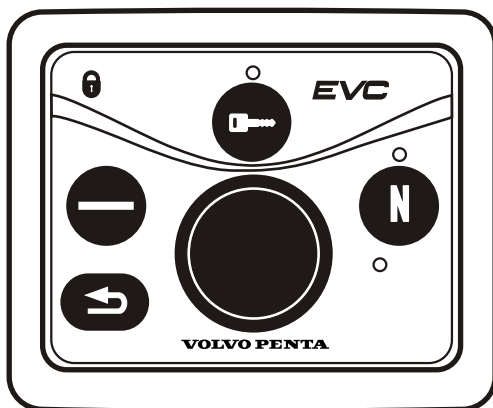
The alarm monitor gives a visual warning to call attention to any alarms that occur.

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Control Panel

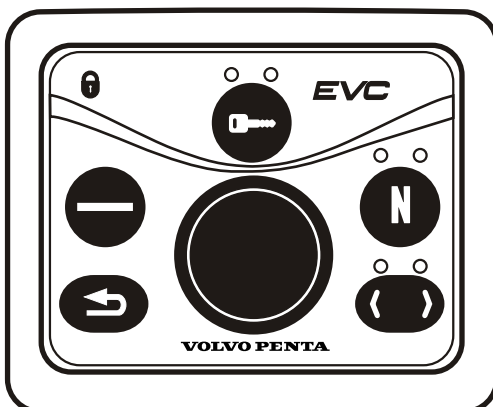
The control panel is used for station handling, disengaging the gear/drive and to navigate the EVC system menu. There is one control panel for single installations and one for twin installations.

Always push the buttons firmly and for at least one second.



P0002663

Control panel single installation



P0002664

Control panel twin installation

🔑 Activation button

The control panel and station are activated by pushing the activation button once. Push twice to lock the station. On boats with only one station, this is always active.

The lamp above the activation button shows the status of the station.

Red lamp: Active station

Lamp off: Station not activated.

Lamp flashing: A fault that limits the function of the station has been detected.

🔒 Padlock

The padlock symbol lights when the station is locked with the activation button or if change of stations is under way, please refer to section *Helm Stations* page 34.

Lit: The station is locked and the boat can only be controlled from this station.

Flashing: Another station is locked.

Ⓝ Neutral button

The neutral button is used to disengage the drive/gear enabling the engine rpm to increase without affecting the drive/gear, to warm up the engine. The lamp above the neutral button shows the status of the station.

Green lamp: Gear in neutral. The drive/gear is in neutral position and the engine runs at idle speed.

Lamp off: The drive/gear is engaged for movement forward/astern.

Flashing lamp: The drive/gear is disengaged and the engine speed can be adjusted.

🌀 Knob

Navigate the display menu by turning the knob.

Push the knob to confirm a selection or acknowledge an alarm.

🕒 Tachometer Display Selection

Boats with twin installations with one tachometer for port engine and one for starboard can choose which engine menu to handle from the station. The lamp

above the button shows which engine is chosen, green lamp for starboard engine and red lamp for port engine.

Lamp off: Menu inactivated.

Lamp lit: Menu activated.

⊖ Multifunction Button

With the multifunction button the instruments and panels backlighting is adjusted.

Push the button for over a second to turn the backlighting on or off. The backlighting can be adjusted in five stages by repeatedly pushing the multifunction button quickly (less than 1 second).

If the button is pressed on an inactive station, operating information is shown on the display(s) and the menu structure is activated.

↶ Back Button

Used to return a step up in the menu structure.

EVC System Display

In the EVC system display it is possible to show multiple windows with different information. There are four display modes which can be chosen using the buttons on the instrument.

Button 1–4 shows the different display modes. Button 5 is used to adjust the contrast and to access the configuration menu, please refer to section *Configuration menu*.

The EVC menu can be shown in the display by entering System information, refer to section *Multi, button 2*, or the Configuration menu. In this mode the display works the same way as the display in the tachometer and is handled via the separate control panel, please refer to section *Instruments and Controls page 19*.

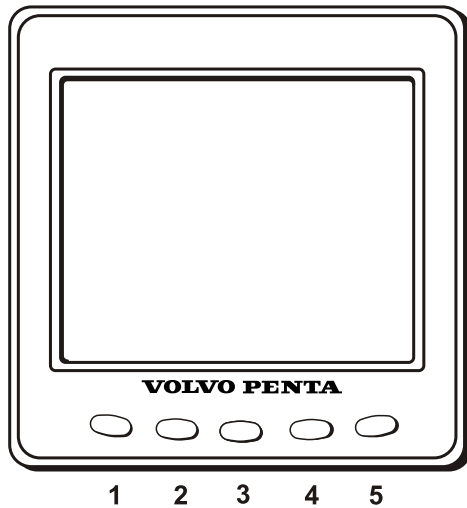
If no tachometer is installed the *EVC menu* can be reached by pressing the knob on the control panel. To get back to the display modes, press **↶**.

At start up, the display performs a self-test. If a constant signal is heard, the system has discovered a malfunction. The display will work but may act in an unexpected way.

NOTICE! Only installed functions will be shown in the display.



P0002383



P0002382

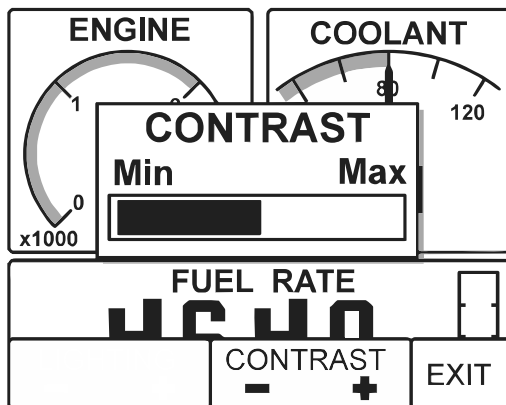
Display modes

Press button 1–4 to view the function menu for the buttons, appearing in the lower part of the display.

Press button 1–4 to choose the desired display mode.

- 1 Engine
- 2 Multi
- 3 Trip
- 4 Graph

To leave the menu, wait a few seconds or press button 5 (EXIT).

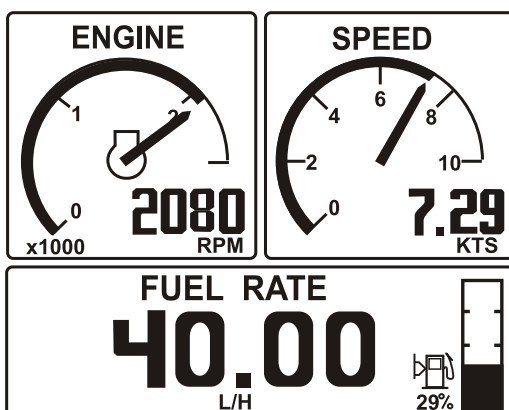


P0002403

Contrast

In the display modes Engine, Trip and Graph, it is possible to adjust the contrast.

Press button 5 when outside the menu and then + (button 4) and – (button 3).



P0002401

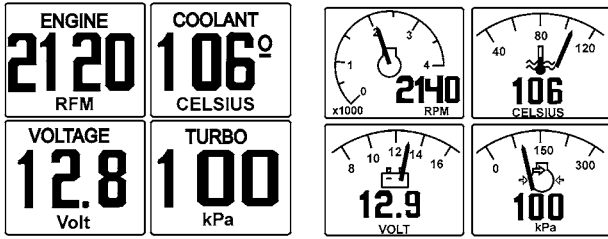
Engine, button 1

Rpm and speed is shown in the upper part of the display. In the lower part it will show trip computer and a fuel level indicator, if these functions are installed.

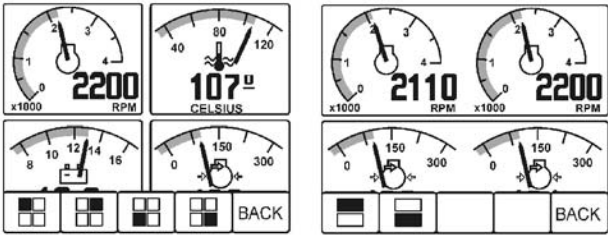
If speed information is missing, coolant temperature will be shown instead.

Navigate in the trip computer by repeatedly press button 1.

- **Fuel Rate**, fuel consumption per hours
- **Fuel Economy**, fuel consumption per distance
- **Trip Fuel**, fuel used since last reset
- **Fuel Remaining**, remaining fuel in tank
- **Dist. to Empty**, remaining distance until tank is empty, based on fuel consumption per distance
- **Trip Distance**, trip distance since last reset



P0002965



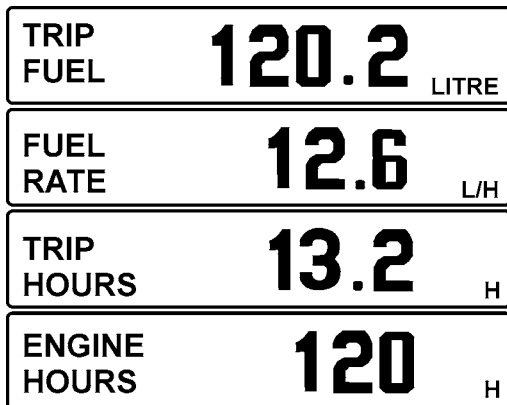
P0002417

Multi, button 2

In the multi mode the information can be shown in several windows, analogue or digital. The display can show windows with different information or be divided to show windows and system information. To handle the system information, see section *Instruments and Controls page 19*. To go between the different display modes, press button 2 repeatedly.

By pressing button 5 (the right arrow) you can choose which information to be shown in the different windows. Press repeatedly on the button which correspond to the window, until desired information is shown.

Trip, button 3



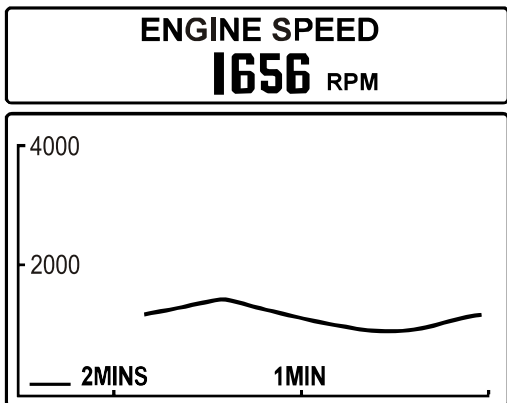
P0002418

- Trip Fuel**, since last reset
- Fuel Rate**, fuel consumption
- Trip hours**, since last reset
- Engine hours**, total amount of operating hours

The display works as trip computer and shows:
Reset by pressing button 3 for three seconds until a beep is heard.

For twin installations the values are summarized, except for engine hours that are shown for each engine.

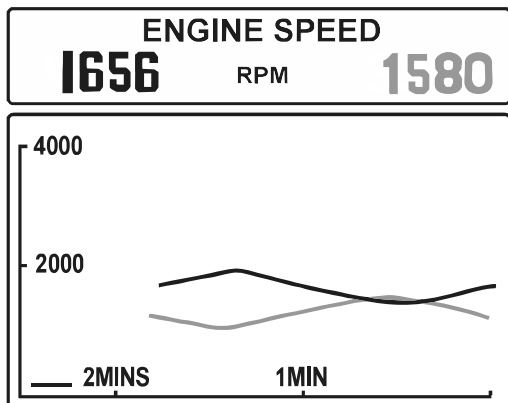
Graph, button 4



P0002420

The information is shown as graphs. Press button 4 repeatedly to choose which information will be shown. The time interval is set in the *Configuration menu*. If the connection is broken there will be a straight line in the display.

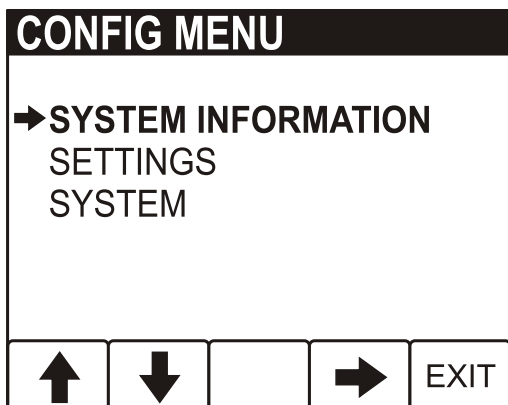
Single installation



P0002421

Twin installation

In a twin installation the port engine is shown as a black line and the starboard engine as a grey line.



P0002625

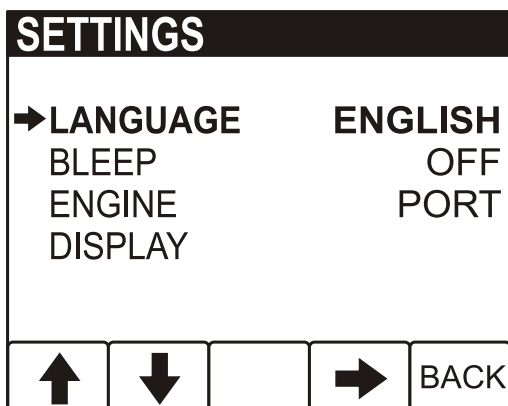
Configuration menu

Press button 5 for five seconds to enter the *Configuration menu*. Navigate with the up and down arrows, select with the right arrow.

NOTICE! The port engine, or both engines, must have the ignition on when display settings are made.

System information

System information shows the *EVC-menyn* and is handled by the knob on the control panel. For more information, see *Instruments and Controls page 19*.



P0002408

Settings

- **Language:** Setting of what language the information is to be presented in are made in the EVC menu, see *Instruments and Controls page 19*.
- **Bleep:** On/Off, setting if pressing the instrument buttons will be followed by a beep or not.
- **Engine:** Setting of what kind of installation the display is a part of and which engine is to be shown in the display.

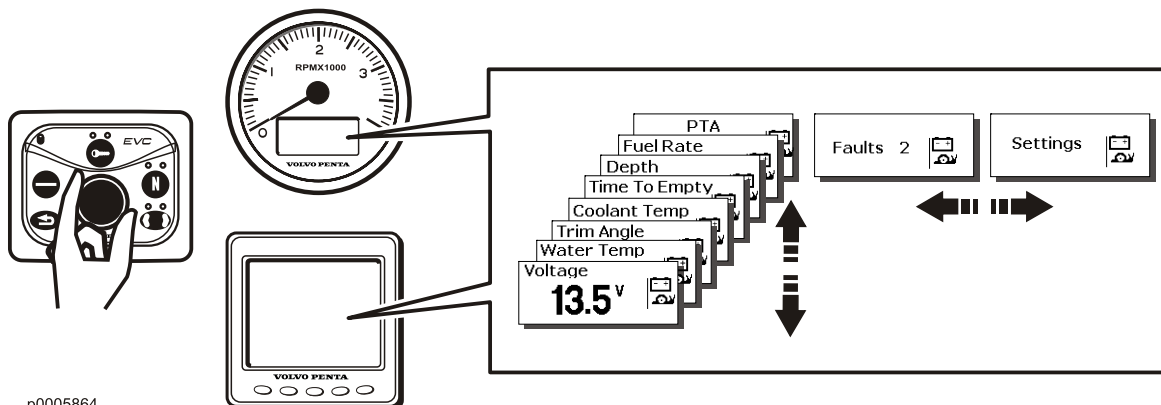
UNITS	
SPEED	KM/H
→ DISTANCE	KM
OIL PRESSURE	kPa
TURBO PRESSURE	kPa
FUEL RATE	L/H

↑	↓		→	BACK
---	---	--	---	------

P0002409

- **Display:** Setting of intervals (unit settings are made in the EVC menu, see *Instruments and Controls page 19*):
Rpm interval, 2500–9000 rpm, in steps of 500 rpm
Speed, on/off
Speed interval, 10–100 knots, in steps of 10 knots
Graph interval, 2 min, 10 min, 30 min, 60 min, 2 h, 4 h or 8 h

EVC menu



p0005864

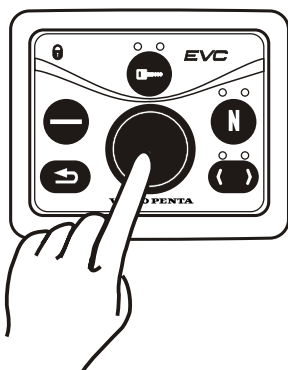
The EVC menu can be shown in both the EVC system display and the tachometer display. The main menu shows operating information, the settings menu and the fault menu (only shown when a fault in the system is detected).

Only installed functions are shown in the menu.

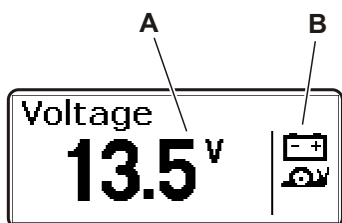
Turn the knob to navigate through the menus.

Press the knob to access sub menus and to confirm selections in the settings menu.

It is always possible to return to the previous menu by pressing . Press repeatedly to return to the main menu; alternatively, hold down the button for a couple of seconds.



P0005872



P0001006

A This field displays engine operating data.

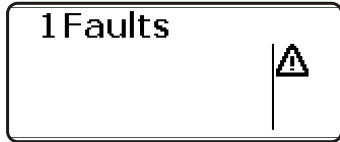
B This field displays warning symbols and active function symbols.



P0001015

Settings

Turn the control panel wheel until the start screen for the settings menu is displayed. Press the wheel to reach the sub menus.
Turn to move between the available setting functions. For further information, refer to section *Settings menu page 91*.



P0001315

Fault

The fault window is only shown in the main menu if a fault has been detected. For further information, refer to section *Fault Handling page 39*.

Controls

This section describes the controls Volvo Penta sells for your engine. Contact your dealer if your boat is equipped with controls other than those described here, and you feel uncertain about their function.

Single Lever Control

Maneuvering

A single-lever control operates both gearshift and throttle functions with the same lever.

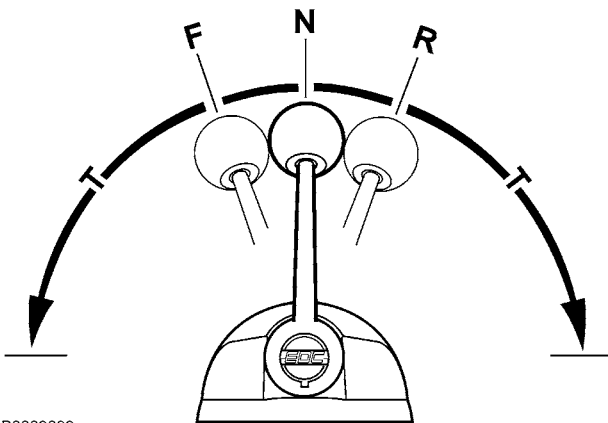
The engine can only be started with the control lever in the neutral position.

N = Neutral position. Reverse gear/drive disengaged and engine at idle.

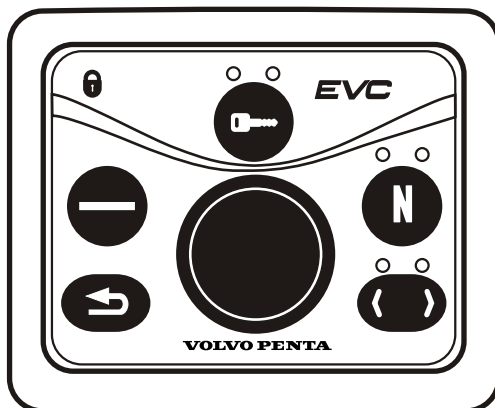
F = Reverse gear/drive engaged for forward motion.

R = Reverse gear/drive engaged for rearward motion.

T = Engine rpm control (throttle).



P0003093



P0002664

Disconnecting the gearshift function

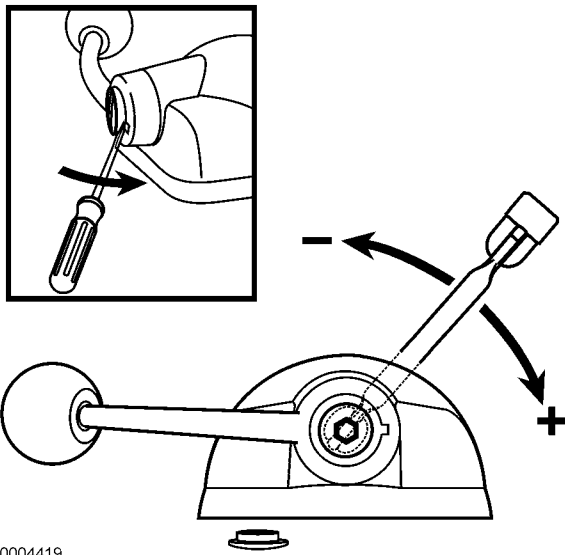
The gearshift function can be disconnected so that the control lever only operates the throttle.

- 1 Put the control lever in neutral (**N**).
- 2 Depress the neutral button (**N**) and keep it depressed at the same time as the lever is moved forwards to the gearshift position (**F**).
- 3 Release the neutral button. The green indicator will flash as confirmation that the gearshift function is disconnected and the that lever will only affect engine revolutions.

The gear shift function is reconnected automatically when the lever is returned to the neutral position. This is confirmed by the green indicator shining continuously.

CAUTION!

Take care not to engage the gear by mistake.



P0004419

Adjusting the friction brake

The control lever is fitted with a friction brake that can be adjusted to apply more or less resistance to lever movement. The friction brake only affects movement of the throttle control lever.

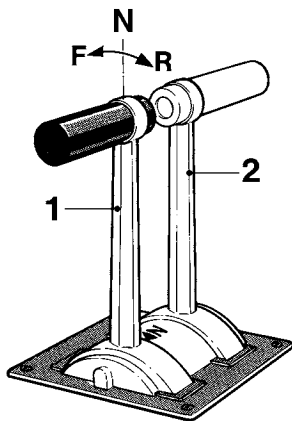
- 1 Stop the engine.
- 2 Move the control lever forward so that the groove in the lever hub is accessible.
- 3 Remove the plug with the aid of a screwdriver.
- 4 Adjust the friction brake (wrench, 8 mm) by turning the bolt clockwise (+) for stiffer lever movement, and counterclockwise (-) for easier movement.
- 5 Reinstall the plug.

Dual lever control

Maneuvering

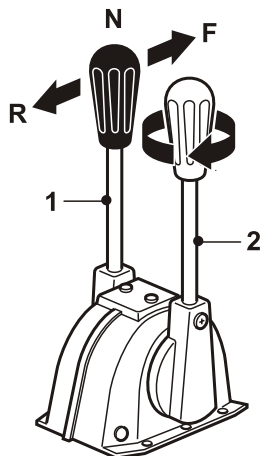
A twin-lever control has separate levers for the gear-shift function (1) and rpm control (throttle) (2). The engine can only be started with the control lever in the neutral position.

Black lever (1)



P0003056

Control A



P0003019

Control B

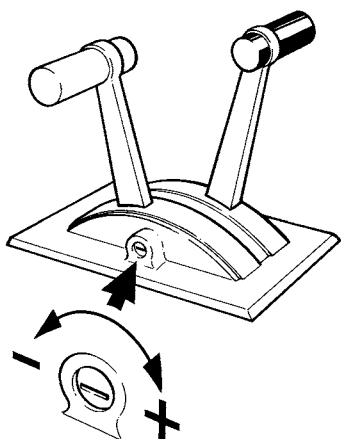
- N** = Neutral position. Reverse gear/drive disengaged and engine at idle.
- F** = Reverse gear/drive engaged for forward motion.
- R** = Reverse gear/drive engaged for rearward motion.

Red lever (2)

Engine rpm control (throttle).

Adjusting the friction brake

The control lever is fitted with a friction brake that can be adjusted to apply more or less resistance to lever movement. Adjust the friction brake by turning the screw (control A), or by twisting the lever (control B). Turn clockwise (+) for stiffer lever movement, and counterclockwise (-) for easier movement.



P0003030

Trolling


The Volvo Penta trolling function is available for engines with some versions of hydraulic reverse gear. Trolling requires two control levers, one for throttle/gear, and the other to control the slip function. Trolling makes it possible to use higher engine power without increasing boat speed.


WARNING!

If engine speed exceeds the maximum permissible engine speed for trolling (approx. 1000 rpm, depending on reverse gear), the EVC system automatically disengages trolling and full propeller effect returns. Depending on the position that the control lever is in when automatic disengagement occurs, the boat speed can increase rapidly.

Engage the trolling function

- 1 Move the throttle/gear lever to a position where the engine speed is within the permissible engine speed range and move the slip control lever to a slip position.

Active trolling is indicated by the symbol  in the display.

If trolling initializing symbol  shows in the display trolling is not ready to use. Gear shifting as normal until trolling is activated.

Delay in gear shifting may occur when Trolling is active.

At maximum slip there is no propeller effect.

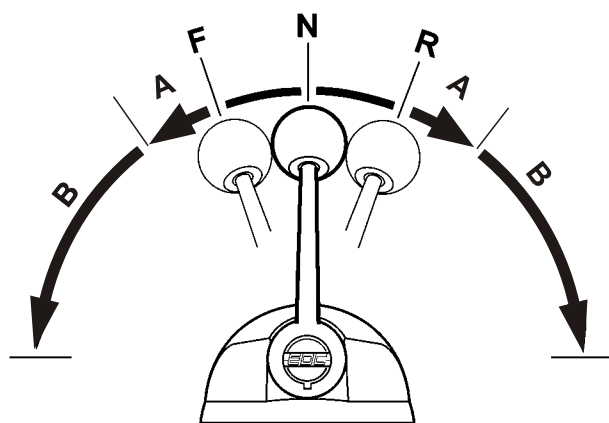
Disengaging the trolling function

- 1 To disengage the trolling function, move the slip control lever to minimum slip position. The indication in the tachometer display disappears.

Low speed

The Lowspeed function is available for engines with some hydraulic reverse gear.

Boats with powerful engines can have high speed even at idle. The Lowspeed function reduces the boat speed.



P0003008

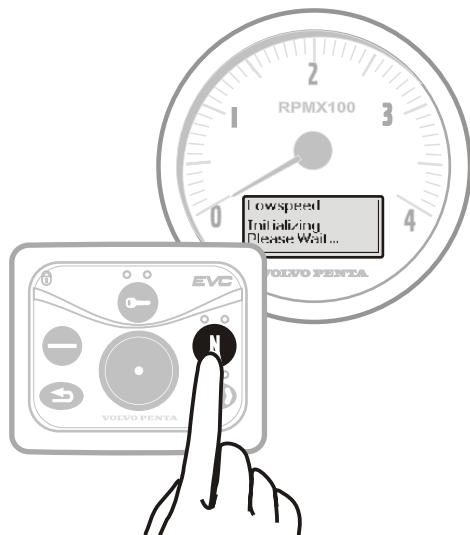
N = Neutral. Reverse gear is disengaged and engine runs at idle speed.

F = Forward idling.
Reverse gear engaged for movement ahead and engine runs at idle speed. Maximum slip in reverse gear.

R = Reverse idling
Reverse gear engaged for movement astern and engine runs at idle speed. Maximum slip in reverse gear.

A = Lowspeed active.
Propeller rpm is increased with increase of throttle, engine rpm is not affected.

B = Lowspeed deactivated.
Propeller rpm is increased with engine rpm, engine rpm will increase with throttle.



A Lowspeed
Initializing
Please Wait...

B Coolant Temp
89°C (oil icon)

C Lowspeed
Activated

D Coolant Temp
89°C (oil icon)

E Lowspeed
Deactivated

Engaging Lowspeed

- 1 Move the lever to neutral position.
- 2 Press the neutral button (N) to activate Lowspeed. If the message “Lowspeed initierate” (A) followd by the snail symbol (B) in the display the lowspeed function is not ready. Normal gear shifting until Lowspeed is activated. When Lowspeed is engaged “Lowspeed acti- vated” (C) shows on the display.
- 3 Active Lowspeed is indicated by the snail symbol on the display.

Delay in gear shifting may occur when Lowspeed is active.

Disengaging Lowspeed

- 1 Move the lever to neutral position.
- 2 Press the neutral button (N) to disengage the low- speed function. The message “Lowspeed deactivated” (E) shows in the dispaly.

P0005941

Propeller Shaft Brake

In certain operational circumstances the propeller may cause the propeller shaft to rotate when the engine is stopped. This passive rotation is uncomfortable and can be harmful to the reverse gear as its oil pump, which is driven by the input shaft, will not operate when the engine is stopped.

The propeller shaft may be allowed to rotate with a stopped engine up to 6–8 hours. After this, the engine must be started and run for at least five minutes for lubrication and cooling of the reverse gear.

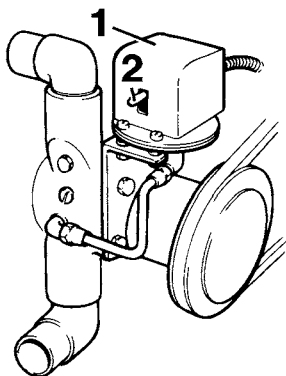
In cases where the propeller shaft may rotate faster than in normal operations, e.g. boat under sail, a temperature gauge should be installed for monitoring the oil temperature.

Max. permissible temperature for ZF reverse gears is 95°C (203°F).

When the above-mentioned regulations cannot be met, or when the shaft needs to be stopped or reasons of comfort, a shaft brake must be fitted. On isolated occasions the propeller shaft flange may be locked in a suitable manner instead.

Bilge pump

The bilge pump has a vacuum switch (1) that automatically disconnects the pump when water is no longer drawn in. The flushing / bilge pump is connected and disconnected by a switch usually situated at the main helm station. The bilge pump can also be connected manually by holding down the lever (2) for around 20 seconds.



P0003032

Starting

Make a habit of visually checking the engine, engine bay and transmission before start. This will help you to discover quickly if anything abnormal has happened, or is about to happen. Also check that instruments and warning displays show normal values when you have started the engine.

To minimize cold start smoke we recommend the installation of an engine heater or engine bay heater if temperatures below +5° C are encountered.

WARNING!

Never use start spray or similar products as starting aid. Explosion risk!

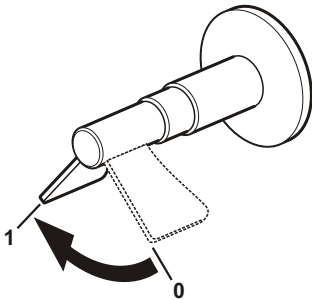
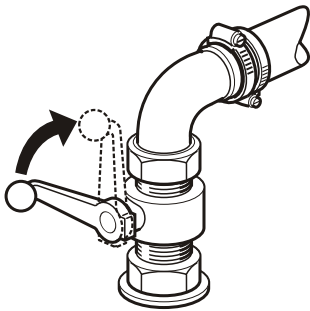
Before Starting

- Open the fuel cock.
- Open the sea cock where fitted.
- Check the engine and transmission oil level.
- Check the coolant level.
- Turn the main switches on.

IMPORTANT!

Never disconnect the current with the main switches when the engine is running. The alternator and electronics could be damaged.

- Start the engine bay fan, where fitted, and allow it to run for at least four minutes.
- Check that there is sufficient fuel for the planned trip.



P0005850

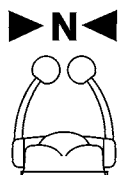
Starting the Engine

Shifting, adjusting speed and performing EVC settings and calibrations is only possible at an active station. On a boat with one station the station is always active. On a boat with two or more stations the main station automatically becomes active when the EVC system is started up with the ignition key(s). If the engine(s) is/are started from another station this station automatically becomes active instead.

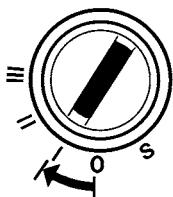
Put the reverse gear in neutral

Put the reverse gear in neutral by moving the control lever(s) to neutral at all stations.

Two lever control: Also check that the engine speed lever is in the idling position.



P0003087



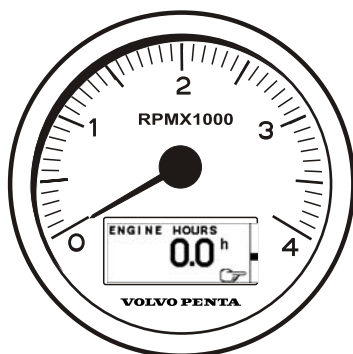
P0003022

Turn the ignition on

Turn the starter key to position I to switch the ignition on.

Check the tachometer display

If a fault is registered it will be shown in the tachometer display, please refer to *Fault Handling page 39* for further information and recommended actions.



P0002372



P0002435

Check lamps

Each time the ignition is turned on, all lamps in the alarm instrument are illuminated. Check that all lamps light up and go out. If a lamp flashes a fault has been registred, please refer to section *Fault Handling page 39* for further information and recommended actions.

If the boat has more than one station, it has to be activated before the lamps can vbe checked.

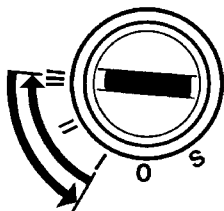
Start the engine

If a station is locked the engines can only be started and stopped from this station

Start using the ignition switch

Turn the key to position **III**. Release the key and let it spring back to position **I** as soon as the engine has started.

If repeated start attempts are needed, the key must be turned back to position **0** first.



Starting with the starter button

Press the starter button. Release the button as soon as the engine has started.

If you start from a secondary station, the starter key at the main control station must be in position **I**.

Overheating protection

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



P0005860

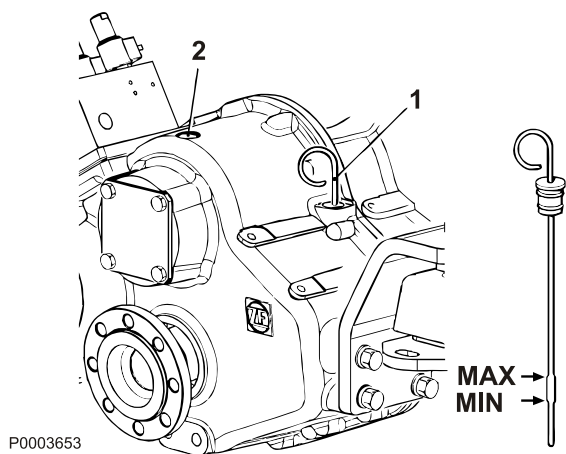
Read the instruments and warm the engine up

Allow the engine to idle for the first ten seconds. Check that instruments and warning displays show normal values. Check that no alarms are displayed and no warning lamps are flashing. If an alarm is registred, please refer to section "Fault Handling" for further information and recommended actions.

Warm the engine up at low speed and low load, so normal operating temperature is reached before full power is used.

IMPORTANT!

Never race the engine when it is cold.

**Check the oil level in the reverse gear**

Check the oil level when the reverse gear has reached operating temperature, please refer to the section "Maintenance, Reverse Gear".

Operation

Learn to handle the engine, controls and other equipment in a safe and proper manner before casting off on your maiden voyage. Remember to avoid sudden and extreme rudder maneuvers and gear shifts. There is a risk for passengers and crew falling over or falling overboard.

WARNING!

A rotating propeller can cause serious injury. Check that nobody is in the water before engaging ahead or astern. Never drive near bathers or in areas where people could be in the water.

Reading the Instruments

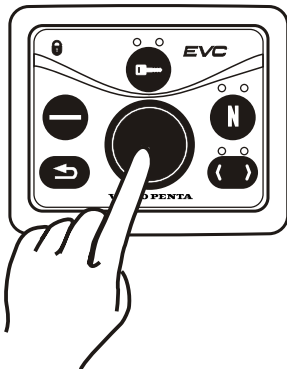
Read all instruments and alarm displays directly after starting, and then regularly during the voyage. Values from the analog instruments are also shown in the tachometer display.

Alarms

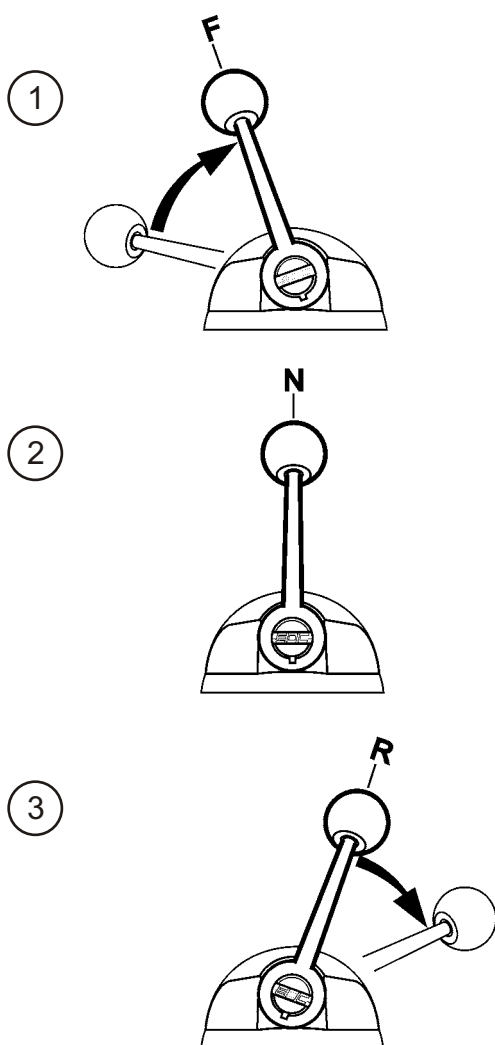
Alarms and messages are shown in the display, some alarms do also have a sound alarm. Is there an alarm instrument installed the lamp in question will flash. If a malfunction is discovered the sound alarm starts and the lamp in question in the alarm instrument flashes. The display will show a fault message.

- 1 Read the alarm/fault message.
- 2 Acknowledge the alarm by pressing the knob on the control panel.
- 3 Take the indicated actions, see chapter *Fault Code Register* page 44.

The fault will be stored as long as the fault remains. It is possible to read out the fault code at an upcoming service.



P0005872



P0005856

Maneuvering

Shifting between forward and reverse should be done at idling. Shifting at higher engine speeds can be uncomfortable for passengers and cause unnecessary stress on the stern drive/reverse gear, or cause the engine to stop.

If you attempt to shift gear at an excessive engine speed, a safety function cuts in automatically, and delays shifting until engine speed has fallen to 1000 rpm.

Always do a forwards/reverse operation as follows:

- 1 Reduce engine speed to idle and let the boat more or less lose way.

! WARNING!

Never shift to reverse when the boat is planing.

- 2 Move the control lever to neutral with a rapid, distinct movement. Make a brief pause.
- 3 Then move the control lever to reverse with a rapid, distinct movement and increase engine speed.

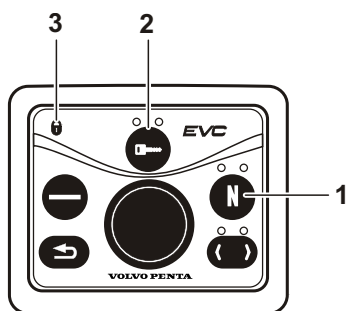
IMPORTANT!

It is important all engines are running during reversing maneuvers to avoid the risk of water entry via the exhaust pipe into the stationary engine.

Helm Stations

Changing and activating stations

Changing stations



P0006366

- 1 Put the gear in neutral.
The lamp above the neutral button (1) is lit when the gear is in neutral.
- 2 Unlock, if locked, the station you leave by pushing the activation button (2).
- 3 Activate the station you change to by pressing the activation button (2).
The lamp above the activation button lights when the station is active.

An active station is indicated by the lit lamp above the activation button.

If the light above the activation button is off, the station is inactive.

If the padlock sign (3) flashes the station can not be activated. Another station is either active and locked, or active with the gear engaged (not in neutral)

A flashing light above the activation button (2) indicates a fault that limits the functionality of the station. The fault is also indicated by a pop-up appearing in the display, please refer to section "Fault handling".

Locking/Unlocking station

If a station is locked it is only possible to start or stop the engine and change stations from this station.

Lock an active station by pressing the activation button (2). Unlock an active, locked station by pressing the activation button (2). The padlock sign (3) on the control panel indicates whether the station is locked (lit) or not (off).

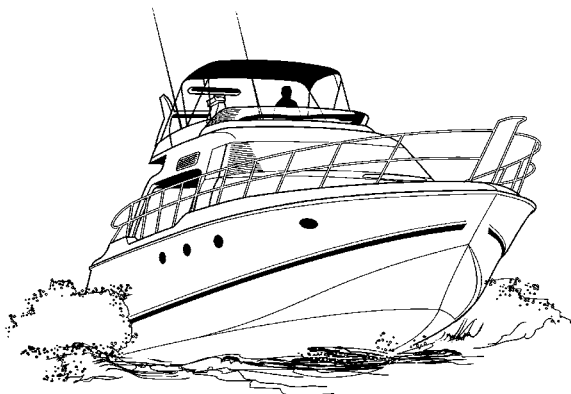
Cruising Speed

For best fuel economy operations at full must be avoided. We recommend a cruising speed that is at least 10% below the maximum engine revolutions at top speed (full throttle).

Depending on hull type, the choice of propeller, the load and sea state etc., the maximum revolutions at top speed may vary, but they should be within the full throttle range; refer to the "Technical data" chapter.

If the engine does not reach its maximum throttle range it can depend on a number of factors mentioned in the "Fault tracing" chapter.

Select a propeller with greater pitch if actual engine revolutions exceed the full throttle range. Contact your Volvo Penta dealer for advice.



P0003088

Synchronizing Engine Speed

When driving with twin engines, both the operating economy and comfort will be increased when the engines are operating at the same engine speed (rpm). When the synchronization function is activated, the engine speed (rpm) of the starboard engine is automatically adjusted to that of the port engine. The synchronization function is activated automatically if the following conditions are met.

- 1 The engine speed levers for both engines are in (approximately) the same position.
- 2 The engine speed on both engines exceeds 800 rpm.

NOTICE! The synchronizer is disengaged as soon as the conditions are no longer met.

Engine Shutdown

Allow the engine to run at low idle, in neutral, for a few minutes after operations are completed. In this way after-boiling is avoided at the same time as temperature equalization takes place. This is especially important when the engine has been run at high rpm or under heavy load.

Stop the Engine

If a station is active and locked the engine(s) can only be started and stopped from that station.

IMPORTANT!

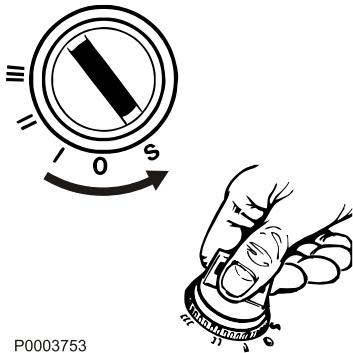
Never disconnect the current with the main switches when the engine is running. The alternator and electronics could be damaged.

IMPORTANT!

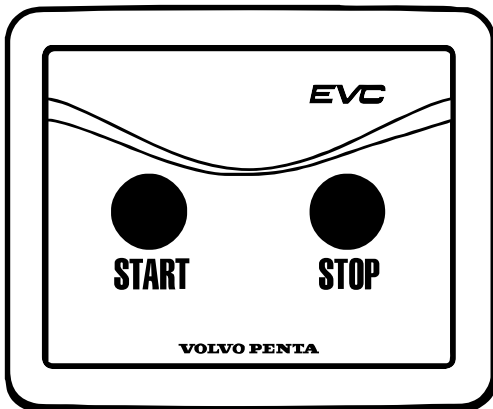
Make sure the starter key is in 0-position or removed before main switches are switched off. Otherwise the alternator and electronics could be damaged.

Stop with key

- 1 Disengage the reverse gear by putting the control lever in neutral.
- 2 Turn the key to stop position "S". Keep the key turned until the engine stops. The key will automatically return to the "0" position when it is released and can then be removed. The starter key must be in the "0" position or removed before main switches are switched off.



P0003753



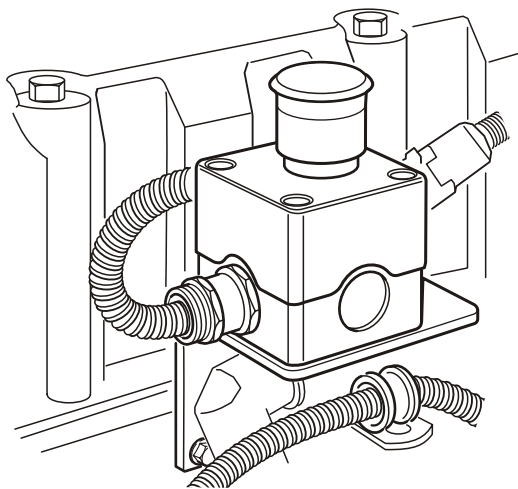
P0002360

Stopping with the stop button

- 1 Disengage the reverse gear by putting the control lever in neutral.
- 2 Push the stop button(s). Release the button(s) when the engine(s) has/have stopped.

Auxiliary stop

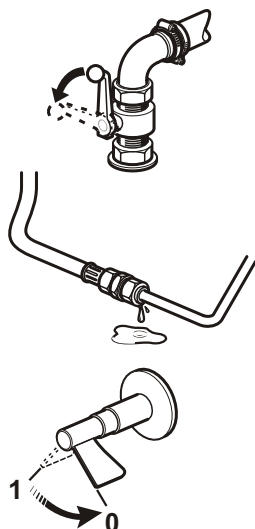
If the engine cannot be stopped in a normal procedure, it is possible to stop the engine via auxiliary stop mounted on the side of the engine.



P0005904

After Engine Shutdown

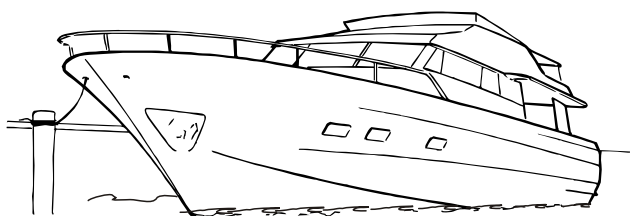
- Check the engine and engine bay for leakages.
- Close the fuel tap.
- Close the sea cock where fitted.
- Take an hour meter reading and carry out preventive maintenance according to the maintenance schedule.
- Turn off the main switch before any long stoppage.



P0005914

Operation break with the boat in water

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

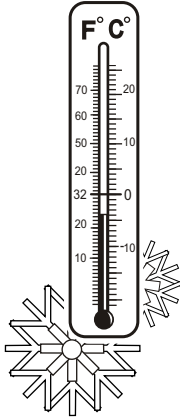


P0003077

Cold Weather Precautions

If the engine bay cannot be kept frost free, the raw water system must be drained and the freshwater system coolant must have sufficient frost protection to prevent frost bursting; refer to the sections *Seawater System, Draining page 75* and *Maintenance page 70* respectively for more detailed information.

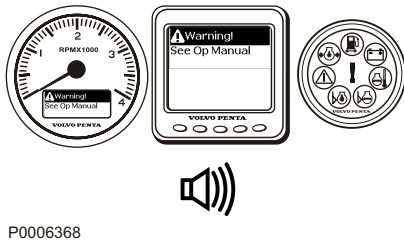
Check the charge status of the battery. A poorly-charged battery can freeze and burst.



P0005905

Fault Handling

Despite regular maintenance according to the maintenance schedule and perfect operation conditions faults may occur which must be attended to before the boat can travel further. This chapter describes alarms and fault handling.



Alarm handling

Fault information from engine and EVC system

If a malfunction is discovered the driver is warned by a buzzer sounding and a pop-up showing in the display. The pop-ups will toggle between cause of fault and tasks to perform.

Information regarding "cause of fault" and "measures to take" is found in chapter *Fault Code Register* page 44.

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

- Minor malfunction which does not damage the engine or transmission.
Affect on engine: None.
- Serious malfunction which will not immediately damage the engine or transmission e.g. high coolant temperature.
Affect on engine: Engine power is reduced until faulty value becomes normal.
- Serious malfunction which will cause serious damage to engine or transmission.
Affect on engine: Engine power is reduced.
- Serious malfunction which makes it impossible to control the engine or transmission.
Affect on engine: Transmission is disengaged and engine speed is reduced.
It is possible to perform emergency shifting, please refer to *In Case of Emergency* page 55.
- Serious malfunction on transmission or in the engine fuel injection system.
Affect on engine: Engine is stopped.
It is possible to perform emergency shifting, please refer to *In Case of Emergency* page 55. In emergency situations it is also possible to start the engine with gear engaged after acknowledging the alarm.

Acknowledging alarm

- 1 Push the knob on the control panel to acknowledge the alarm. The buzzer becomes silent.
- 2 Read the alarm or message in the pop-up.
- 3 Push the knob on the control panel again and the pop-up disappears.

NOTICE! The alarm has to be acknowledged before the engine can be started.

Popup windows

There are three levels of fault messages showing in the pop-up: danger, warnign and caution.

Danger

If the Danger pop-up is shown during operation, a serious fault has occurred.

Acknowledge the alarm and stop the engine immediately.

Warning

If the Waring pop-up is shown during operation, a fault has occurred.

Acknowledge the alarm and stop the engine at once.

Caution

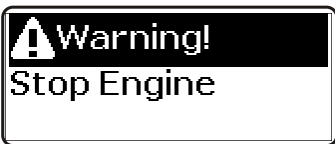
If the Caution pop-up is shown during operation, a fault has occurred.

Acknowledge the alarm.



P0004987

DANGER! Stop the engine immediately.



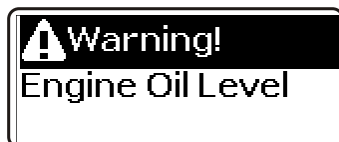
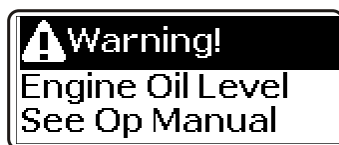
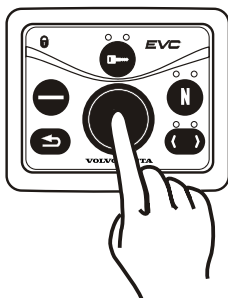
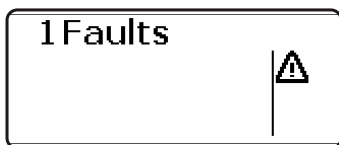
P0004986

WARNING! Stop the engine.



P0004985

CAUTION! See operator's manual.



P0004375

Faults list

Is a fault registered the display shows Faults in the EVC menu along with the number of faults.

Push the knob on the control panel to open the menu. Turn the knob to see all faults registered.

The popup toggles between cause of fault and tasks to perform.

Erasing faults in faults list

Acknowledged faults that has been stored automatically erased every time the starter key is turned to the stop position (S).

Stop the engine and check that the ignition key(s) is (are) in position 0 in all control positions.

When system voltage is switched on again, the diagnostic function checks whether there are faults in the EVC system. If this is the case, new fault pop-ups are shown.

Faults which have been attended to or have disappeared are automatically erased.

Faults which have not been attended to must be acknowledged every time the system voltage is switched on.

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 problems occur which you can not solve by yourself.

NOTICE! Read through the safety advice for care and maintenance work in the *Safety Information page 6* chapter before starting work.

Symptoms and possible causes

Pop-ups are shown in the tachometer display	See chapter <i>Fault Code Register page 44</i>
Engine can not be stopped	2, 4, 5, 7
Starter motor does not rotate	1, 2, 3, 4, 5, 6, 8, 9, 10, 36, 39
Starter motor rotates slowly	1, 2
Starter motor rotates normally but engine does not start	1, 11, 12, 13, 14, 38
Engine starts but stops again	1, 11, 12, 13, 14, 19, 37
Engine does not reach full operating speed at full throttle	12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 34, 37, 38
Engine runs unevenly	14, 15, 40
Engine vibrates	24
High fuel consumption	16, 17, 21
Black exhaust smoke	19
Blue or white exhaust smoke	20, 21, 34
Lubrication oil pressure too low	22
Coolant temperature too high	25, 26, 27, 28, 29, 30, 31, 32
Coolant temperature too low	31
No charge or poor charge	2, 35

1. Flat batteries
2. Poor contact/open circuit in cables
3. Main switch turned off
4. One of the circuit breakers in the distribution box has tripped
5. Faulty key switch
6. Control lever not in neutral/control position not activated
7. Faulty stop relay
8. Faulty main relay
9. Faulty starter relay
10. Faulty starter motor relay
11. Faulty starter motor/solenoid
12. Lack of fuel:
 - fuel taps closed
 - fuel tank empty
 - wrong tank connected
13. Blocked fine fuel filter/pre-filter
(caused by contamination or fuel stratification at low temperature)
14. Air in the fuel system
15. Water/contamination in fuel
16. Boat abnormally loaded
17. Fouling on hull/propeller
18. Faulty unit injectors (nozzles)

-
19. Insufficient air supply to engine:
 - blocked air filter
 - air leakage between turbocharger and engine inlet manifold
 - fouled compressor section in turbocharger
 - faulty turbocharger
 - poor engine bay ventilation
 20. Excessive coolant temperature
 21. Too low coolant temperature
 22. Too low oil level
 23. Faulty / wrong propeller
 24. Faulty engine mounting
 25. Coolant level too low
 26. Air in the freshwater system
 27. Faulty circulation pump
 28. Closed seawater inlet
 29. Blocked seawater inlet/pipe/filter
 30. Defective impeller in seawater pump
 31. Defective thermostat
 32. Blocked heat exchanger insert
 33. Blocked after cooler
 34. Too high oil level
 35. Alternator drive belt slips
 36. Water entry into engine
 37. High back pressure in exhaust system
 38. Stored fault codes
 38. Check that the emergency stop button is in the running position (not pressed down)
 40. Engine drive belt slips

Fault Code Register

CAUTION!

Read the safety precautions for maintenance and service in the Safety Information chapter before starting work.

When a malfunction is discovered the driver is warned by a sound alarm and at the same time a pop-up window is shown in the display. The fault message gives information about what has caused the fault and what actions to take.

This chapter gives a more detailed description of cause and actions.

Explanation of fault message

- A Description of current fault, affect on the system and measures to take.
- B Current warning lamp which flashes during an alarm. O/R means that an orange or red lamp flashes.
- C Audible warning.
- D Fault pop-up which is shown on the EVC tachometer display.

A.

Explanation:

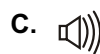
Battery voltage too low.

Symptom:

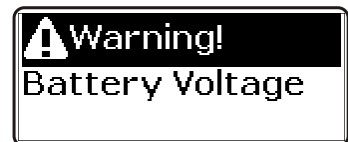
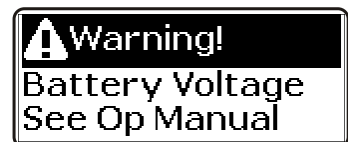
None.

Action:

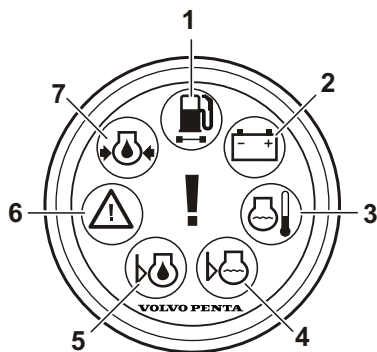
- Check the batteries fluid level.
- Check belt tension.
- Please contact a Volvo Penta workshop if the fault remains.



D.



P0005024



P0004761

- 1 Is the orange "water in fuel" lamp lit there is too much water in the water separator on the fuel pre-filter.
- 2 Is the charging lamp lit the alternator has stopped charging.
- 3 Is the coolant temperature lamp lit the coolant temperature is too high.
- 4 Is the orange coolant level lamp lit during operation the coolant level is too low.
- 5 Is the orange oil level lamp lit during operation the engine oil level is too low.
- 6 Is the red (R) warning lamp lit during operation a serious malfunction has been discovered.
Is the orange (O) warning lamp lit during operation a malfunction has been discovered.
- 7 Is the red oil pressure lamp lit during operation the engine oil pressure is too low.

Engine Speed

Explanation:

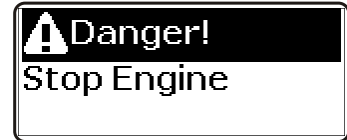
Fault in engine speed sensor.

Symptom:

Engine power is reduced.

Action:

Please contact a Volvo Penta workshop.



P0005008

DANGER! Engine Speed See Operator's Manual
Stop engine

Water in Fuel

Explanation:

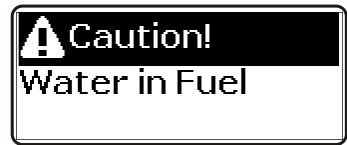
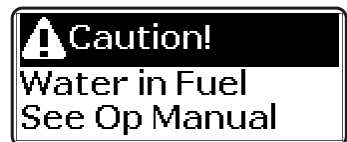
Water in water trap in fuel filters.

Symptom:

None.

Action:

- Empty the water trap underneath the fuel filters. See *Maintenance page 65*.
- Please contact a Volvo Penta workshop if the fault remains.



P0001200

CAUTION! Water in Fuel
See Operator's Manual

Sea Water Pressure

Explanation:

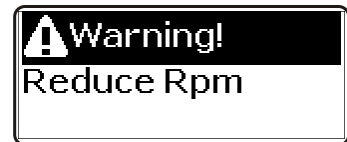
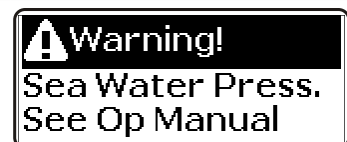
Sea water pressure too low.

Symptom:

Engine power is reduced.

Action:

- Check that the seawater filter is not blocked. See *Seawater Filter, Check and Cleaning page 77*
- Check the impeller in the seawater pump. See *Impeller, Check and Change page 77*.
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.



P0005010

WARNING! Sea Water Pressure
See Operator's Manual
Reduce rpm

Coolant Level

Explanation:

Coolant level too low.

Symptom:

None.

Action:

- Check coolant level. Se *Coolant Level, Checking and Topping Up* page 71.
- Check that no coolant leakage occurs in auxiliary equipment connected to the engine cooling system.
- Please contact a Volvo Penta workshop if the fault remains.



P0005012

WARNING! Coolant Level See Operator's Manual

Coolant Temperature

Explanation:

Coolant temperature too high.

Symptom:

Engine power is reduced.

Action:

- Check coolant level. Se *Coolant Level, Checking and Topping Up* page 71.
- Check that the seawater filter is not blocked. Se *Seawater Filter, Check and Cleaning* page 77.
- Check the impeller in the seawater pump. Se *Impeller, Check and Change* page 77.
- Check that no leakage occurs.
- If the cooling water flow ceases, the exhaust hose should be inspected internally and replaced if the hose shows signs of damage.
- Please contact a Volvo Penta workshop if the fault remains.



P0005014

WARNING! Coolant Temperature See Operator's Manual Reduce rpm

Fuel Pressure

Explanation:

Fuel pressure too low.

Symptom:

None.

Action:

- Check fuel level.
- Open the fuel taps and check that no leakage occurs.
- Check that the fuel filters are not blocked. Replace filters if necessary. Se *Maintenance* page 65.
- Please contact a Volvo Penta workshop if the fault remains.



P0005015

WARNING! Fuel Pressure See Operator's Manual Reduce rpm

Engine Oil Level

Explanation:

Oil level too low.

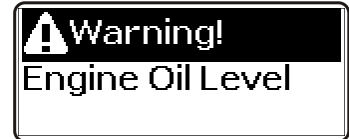
NOTICE! In rough following seas or head seas, the system can incorrectly sense that the engine oil level is too low. If this happens, acknowledge the fault, and check the points below for safety reasons.

Symptom:

None.

Action:

- Check the oil level in the engine. *Se Oil level, checking and topping up page 62.*
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.



P0005017

WARNING! Engine Oil Level See Operator's Manual

Engine Oil Pressure

Explanation:

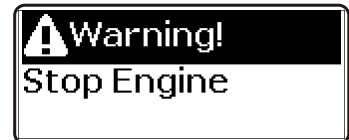
Oil pressure too low.

Symptom:

Engine power is reduced.

Action:

- Check the oil level in the engine. *Se Oil level, checking and topping up page 62.*
- Check that the oil filters are not blocked. Replace filters if necessary.
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.



P0005018

WARNING! Engine Oil Pressure See Operator's Manual Stop Engine

Engine Oil Filter

Explanation:

Oil pressure difference too large.

Symptom:

Engine power is reduced.

Action:

- Check that the oil filters are not blocked. Replace filters if necessary.
- Please contact a Volvo Penta workshop if the fault remains.



P0005020

WARNING! Engine Oil Filter See Operator's Manual

Transmission Oil Pressure

Explanation:

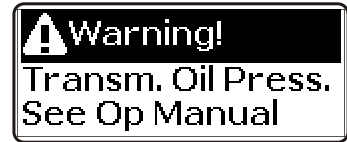
Reverse gear oil pressure too low.

Symptom:

None.

Action:

- Check the oil level. Se *Oil level, checking and topping up page 84.*
- Check that the oil strainer is not blocked.
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.



P0005023

WARNING! Transmission Oil Pressure
See Operator's Manual

Crankcase Pressure

Explanation:

Crankcase pressure too high.

Symptom:

Engine power is reduced.

Action:

- Check that the crankcase ventilation is not blocked.
- Please contact a Volvo Penta workshop if the fault remains.



P0005021

WARNING! Transmission Oil Pressure
See Operator's Manual
Stop engine

Battery Voltage

Explanation:

Battery voltage too low.

Symptom:

None.

Action:

- Check the batteries fluid level.
- Check belt tension.
- Please contact a Volvo Penta workshop if the fault remains.



P0005024

WARNING! Battery Voltage See Operator's Manual

Emergency Stop Switch

Explanation:
External stop signal.

Symptom:
Engine stops or can not be started.

Action:

- Check emergency stop button if any. Reset if necessary. Se *Engine Shutdown page 36*.
- Please contact a Volvo Penta workshop if the fault remains.



P0005025

WARNING! Emergency Stop Switch
See Operator's Manual

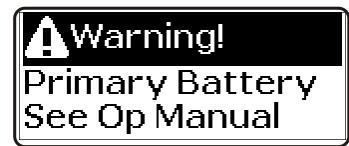
Primary Battery

Explanation:
Poor batteries or charging.

Symptom:
None.

Action:

- Check the batteries fluid level. Se *Battery, Maintenance page 80*.
- Check belt tension. Se *Drive Belt, Check and Change page 61*.
- Please contact a Volvo Penta workshop if the fault remains.



P0005026

WARNING! Primary Battery See Operator's Manual

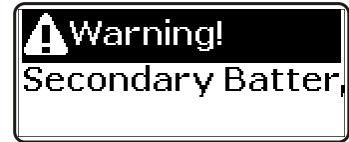
Secondary Battery

Explanation:
Poor batteries or charging.

Symptom:
None.

Action:

- Check the batteries fluid level. Se *Battery, Maintenance page 80*.
- Check belt tension. Se *Drive Belt, Check and Change page 61*.
- Please contact a Volvo Penta workshop if the fault remains.



P0005027

WARNING! Secondary Battery See Operator's Manual

Extra Supply Fuse

Explanation:

The fuse has blown.

Symptom:

None.

Action:

Please contact a Volvo Penta workshop.



P0005030

WARNING! Extra Supply Fuse See Operator's Manual

Check control lever

Explanation:

Fault in control lever.

Symptom:

Engine in emergency mode. Gear to neutral.

Action:

- Restart engine(s).
- If the engine can not be operated from the chosen station, use an alternative station.
- Please contact a Volvo Penta workshop if the fault remains.



P0005031

WARNING! Check control lever See Operator's Manual



P0005032

CAUTION! Check control lever See Operator's Manual

Lever Calibration

Explanation:

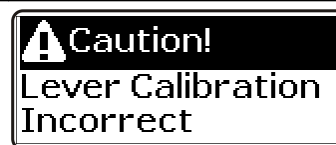
Incorrect lever calibration.

Symptom:

Impossible to select active station.

Action:

- Restart engine(s).
- Please contact a Volvo Penta workshop if the fault remains.



P0005033

CAUTION! Lever Calibration Incorrect-See Operator's Manual

Check EVC system

Explanation:

Internal fault in EVC system.

Symptom:

Engine power is reduced.

Action:

- Restart engine(s).
- If the engine can not be operated from the chosen station, use an alternative station.
- Please contact a Volvo Penta workshop if the fault remains.



P0005034

WARNING!Check EVC systemSee Operator's Manual



P0005035

CAUTION!Check EVC systemSee Operator's Manual

Check Engine

Explanation:
Miscellaneous system faults.
Symptom:
None.
Action:

- Restart engine(s).
- Please contact a Volvo Penta workshop if the fault remains.

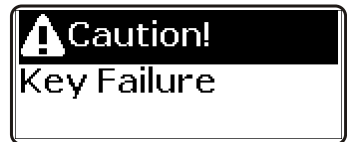


P0005036

CAUTION! Check Engine See Operator's Manual

Key Failure

Explanation:
Key or start panel out of order.
Symptom:
None.
Action:
Please contact a Volvo Penta workshop.



P0001199

CAUTION! Key Failure See Operator's Manual

Check Multilink

Explanation:
Fault in multilink communication.
Symptom:
Possible loss of engine synchronization or loss of display(s).
Action:
Please contact a Volvo Penta workshop.



P0001204

CAUTION! Check Multilink See Operator's Manual

In Case of Emergency

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

When certain faults occur safety functions engage to protect the engine. The following may occur:

- Engine cannot be started.
- The gear is in neutral and engine rpm is limited.
- The engine stops.

If a fault occurs, confirm any fault alarm and take the necessary measures. Refer to this chapter, and the “Fault catalogue” chapter.



P0002107

Starting Using Auxillary Batteries

WARNING!

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

WARNING!

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

- 1 Check that the auxiliary battery has the same voltage as the engine system voltage.
- 2 Connect the red positive cable to the plus (+) terminal on the discharged battery and then to the plus terminal on the auxiliary battery.
- 3 Connect the black start cable to the minus (-) terminal on the auxiliary battery and to a place a little distance away from the discharged battery, e.g. the start motor's negative terminal.

WARNING!

Under no circumstances may the black jumper cable (-) come in contact with the positive connection on the starter motor.

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

 **WARNING!**

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

 **WARNING!**

Do not touch the connections during the start attempt:
Risk of arcing.

Do not bend over any of the batteries either.

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

Emergency Shifting

The descriptions refer to electrically shifted reverse gear.

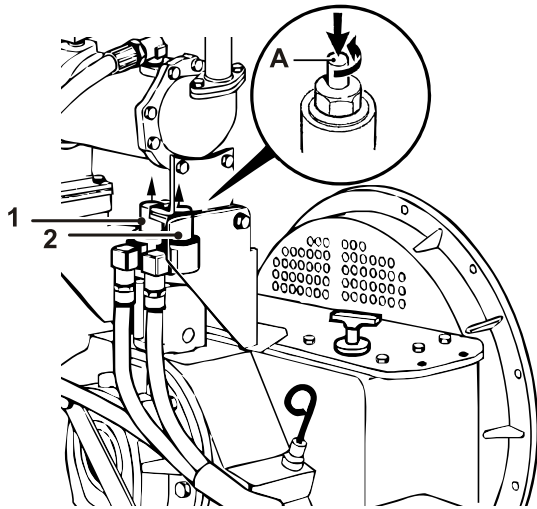
If a fault occurs which prevents the reverse gear from being operated (shifted) with the control lever, it is possible to shift manually, using the description below.

WARNING!

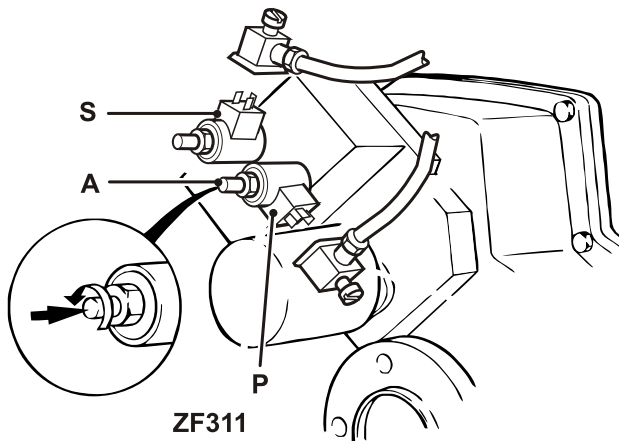
In emergency shifting, the unit is locked in forwards operation. Please note that the reverse gear can not then be disengaged with the control lever. Forward motion can only be cut off by stopping the engine with the ignition key or stop button.

- 1 Stop the engine and remove the start key from the key switch.
- 2 Note the valve (**P** or **S**) to which the cable marked "Primary" is connected. Then undo the connectors from the solenoid valves.
- 3 Remove the cap nut from the valve which was connected to the "Primary" cable.
- 4 Press the valve (**A**) on the valve.
- 5 Turn the button a 1/2 turn anti-clockwise (the button is forced out by spring action).

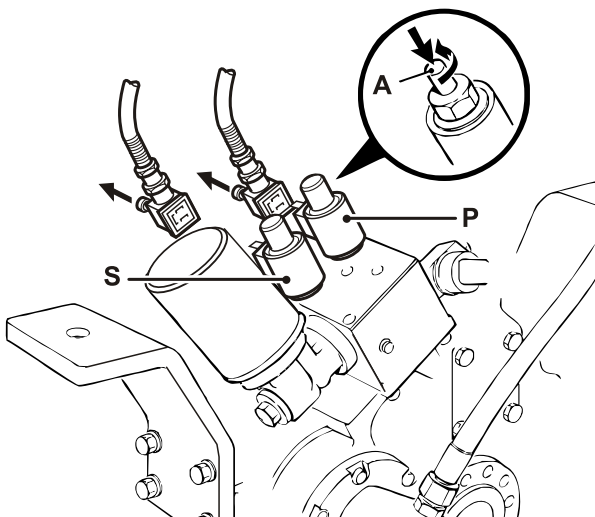
The reverse gear is now connected for forward motion and cannot be disengaged by the control lever.



Twin Disc 5114SC



ZF311



ZF325

P0006713

Maintenance Schedule

Your Volvo Penta engine and its equipment are designed for high reliability and long life. The engines are built to withstand the marine environment, but also to have the smallest possible environmental impact. If the engine and transmission are serviced regularly according to the schedule, these qualities will be retained and unnecessary malfunctions will be avoided.

Warranty inspection

During the initial period of use a special warranty inspection - a First service inspection - must be carried out by an authorized Volvo Penta workshop. Instructions regarding how this must be done can be found in the **Warranty and service book**.

Maintenance Schedule

- C = Clean
- R = Replace
- A = Adjust
- L = Lubricate
- I = Inspect (Clean, Adjust, Lubricate or Replace if necessary)

- FSI, S2 = First time Service Inspection
- A, B, C, D, E = Type of service (regular service)

FSI

First Service Inspection, after 50–100 running hours¹⁾	
Primary Fuel Filter, Draining Water / Contamination	I
Coolant Level	I
Seawater filter	I
Reverse gear, oil and filter	R
Reverse gear, oil strainer	C
Start and warm up engine	
Fault codes (if any)	I
Engine and reverse gear, oil / fuel / water leakage	I
Engine and reverse gear, noises	I
Stop Engine	
Engine Oil and Oil Filters / By-pass filter	R
Restart engine	
Oil pressure / oil leakage	I

S2

After the First 1000 Hours	
Valve clearance	I

Every 50 Hours / at Least Every 12 Months	
Primary Fuel Filter, Draining Water / Contamination	I
Seawater filter	I

Every 50–500 Hours / at Least Every 12th Month	
Engine Oil and Oil Filters / By-pass filter ^{2) 3)}	R
<p>1) Or within 180 days of the date of delivery, or the end of the first season, whichever comes first.</p> <p>2) Oil change intervals vary, depending on engine type, oil grade and sulfur content of the fuel. See <i>Technical Data page 100</i>.</p> <p>3) Change the filters during each oil change.</p>	

A

Every 500 Hours / at Least Every 12th Month	
Drive Belts	I
Pressure drop indicator, air filter	I
Seawater pump impeller	I
Zink anodes	I
Seawater filter	I
Inspection with VODIA (Diagnostic Tool)	I
Reverse gear, oil and filter (ZF)	R
Reverse gear, oil strainer (ZF)	C
Batteries, electrolyte level	I

B

Every 1000 Hours / at Least Every 12 Months	
Fuel fine filter	R
Fuel pre-filter, filter insert	R
Reverse gear, oil and filter (Twin Disc)	R
Reverse gear, oil strainer (Twin Disc)	C
Air filter insert	R
Coolant Filter	R
Engine and revers gear, inspection for leakage	I
Engine and reverse gear, inspect hoses and cable clamping	I
Engine and revers gear, cleaning / painting	I
Flush pump / Bilge pump, impeller	I

C

Every 2000 Hours	
Valve clearance	I

D

Every 2000 Hours / at Least Every 24th Month	
Turbo	I
Drive Belts ⁴⁾	I
Seawater pump impeller	R

E

Every 4000 hour / at Least Every 24 month	
Drive Belts	R
Coolant	R

4) Drive belt and belt tensioner.

Maintenance

This chapter contains general technical information and instructions on how the prescribed maintenance items must be carried out. Read through the instructions carefully before starting work. The times when maintenance items must be carried are indicated in the *Maintenance Schedule page 56*.

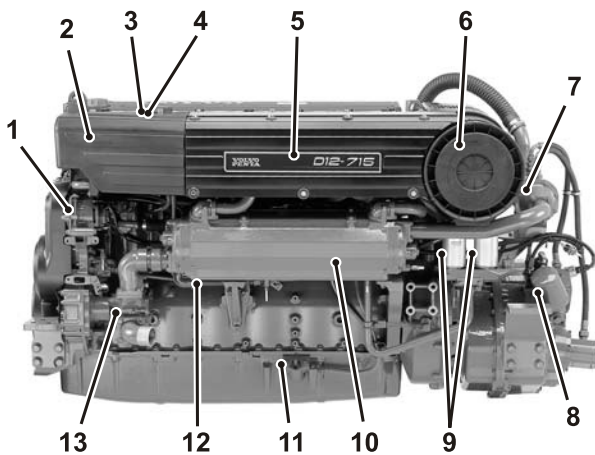
Read through the safety precautions for maintenance and service in the *Safety Information page 4* chapter before work on the engine is begun.

WARNING!

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

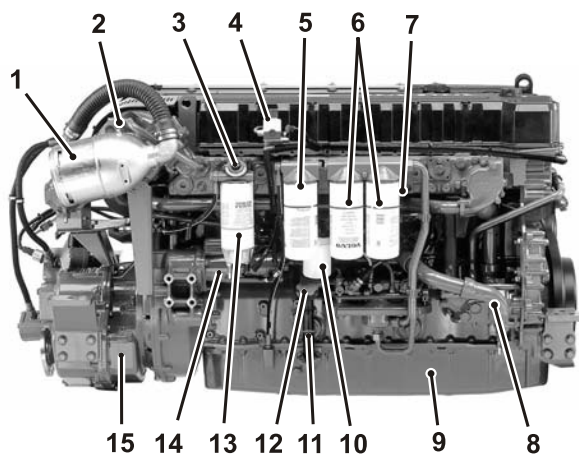
Orientation

D12D-E MP



P0006567

- 1 Alternator
- 2 Expansion tank
- 3 Level glass, coolant
- 4 Coolant filler cap
- 5 Aftercooler (located beneath cover)
- 6 Air filter
- 7 Oil cooler, reverse gear
- 8 Crankcase breather filters
- 9 Heat exchanger
- 10 Connection for oil scavenging pump (alt. location of oil filler cap and dipstick)
- 11 Control unit and power module (located behind heat exchanger)
- 12 Seawater pump

D12D-E MP

P0006566

- 1 Water-cooled exhaust pipe bend (optional)
- 2 Turbocharger
- 3 Fuel feed pump (hand pump)
- 4 AUX stop
- 5 By-pass filter for lubrication oil
- 6 Lubrication oil filter
- 7 Oil cooler, engine (loc. in engine block)
- 8 Coolant pump
- 9 Oil sump
- 10 Coolant filter
- 11 Oil dipstick, engine*
- 12 Oil filler cap*
- 13 Fine fuel filter with water trap
- 14 Starter motor
- 15 Reverse gear ZF 325A-E

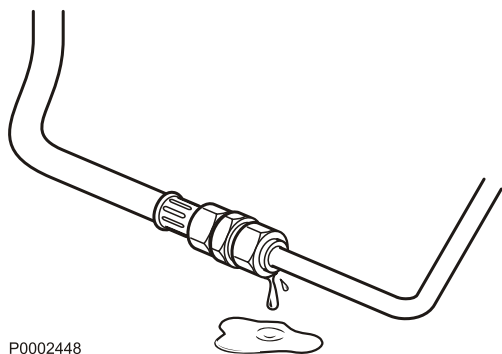
* Can also be located on left side of engine.

Engine, General

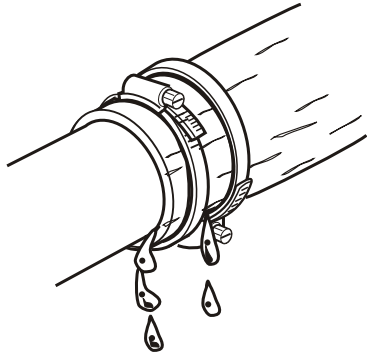
General inspection

Make a habit of visually checking the engine and engine bay before starting, and after operations when you have stopped the engine. This will help you to discover abnormalities quickly, or if something is about to happen.

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



P0002448



P0002455

⚠ WARNING!

Accumulations of fuel, oil and grease on the engine or in the engine room is a fire hazard and must be removed immediately they are detected.

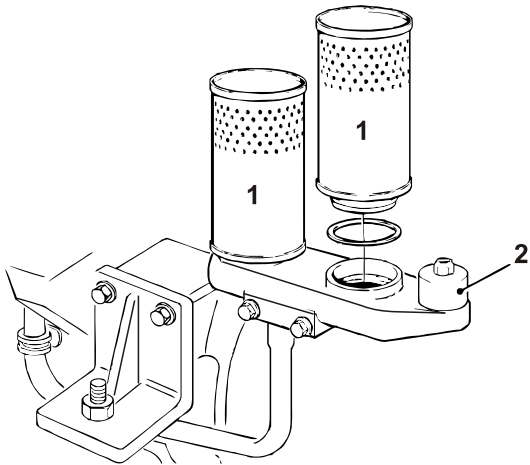
⚠ WARNING!

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

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

Crankcase Ventilation. Filter Change

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



IMPORTANT!

Change both filters at the same time.

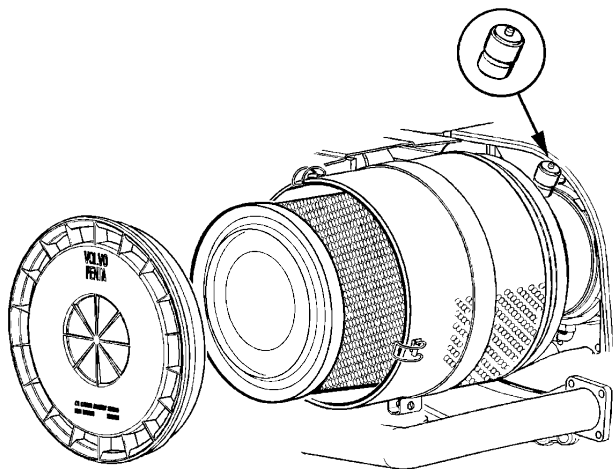
- 1 Remove the old filters by unscrewing them anti-clockwise.
- 2 Check the rubber seals, change as necessary. Screw the new filters on by hand.

IMPORTANT!

Scrap the old filter. It must not be cleaned.

Air Filter, Change

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



P0003091

IMPORTANT!

Scrap the old filter. It must not be cleaned.

Drive Belt, Check and Change

WARNING!

Stop the engine before doing any maintenance work.

Check belt tension and condition regularly.

A belt which is too tense can damage the bearings and a belt which is too loose can slip.

IMPORTANT!

Always change a belt which looks worn or cracked.

Belts which operate in pairs must be changed together.

Alternator belt(s)

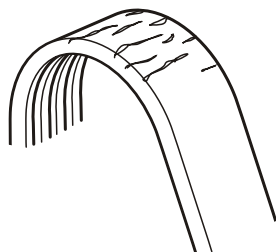
The standard alternator, plus the extra alternator if installed, are driven by a Poly-Vee belt each, for best function and service life. The belts are tensioned in the same way.

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

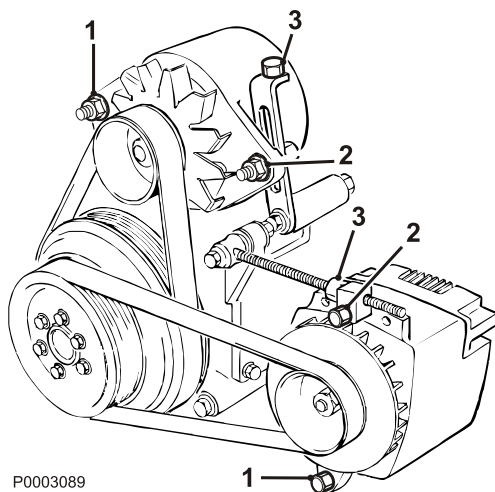
Other belts

The flushing and bilge pump etc. are driven by traditional drive belts. In general, it should be possible to press these belts down 10 mm (0.4") between the pulleys when the tension is correct.

When you change a drive belt: Clean the belt grooves before installing the new drive belt.



P0003090



P0003089

Lubrication System

Oil change intervals can vary depending on oil grade and sulphur content of the fuel, please refer to *Technical Data page 99*.

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

If you want longer oil change intervals than given in the table *Technical Data page 99*, the condition of the oil must be checked by the oil manufacturers through regular oil testing.



P0002089

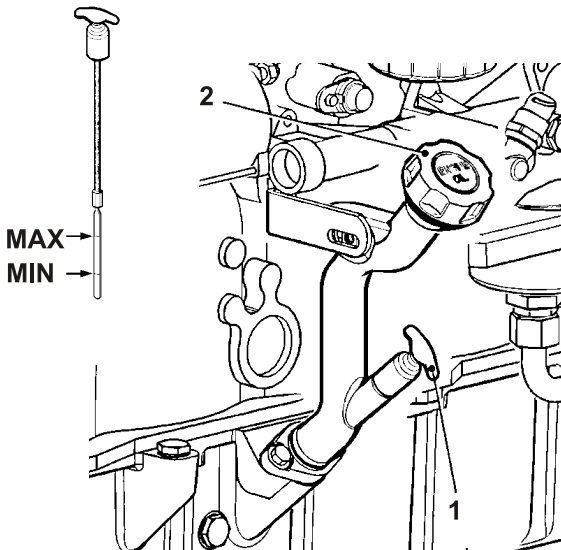
Oil level, checking and topping up

The oil level must be inside the marked area on the dipstick (1) and should be checked daily before the first start.

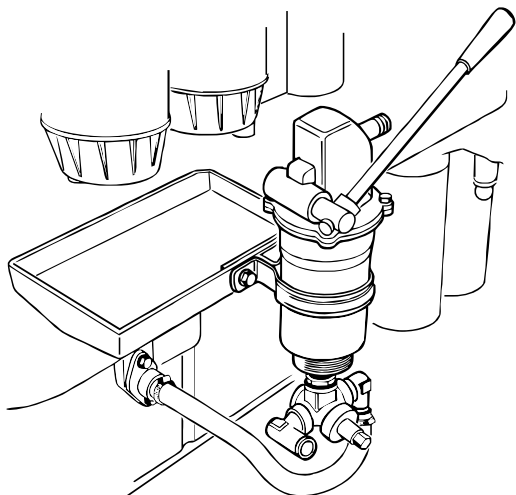
Top up the oil through the filling hole on the side of the engine (2). Check that the correct level has been achieved. Wait a few minutes to allow the oil to run down into the sump.

IMPORTANT!

Do not fill up above the maximum oil level. Only use a recommended grade of oil, please refer to *Technical Data page 99*.



P0003092



Engine Oil, Change

Always observe the recommended oil change interval.

⚠ WARNING!

Hot oil and hot surfaces can cause burns.

⚠ WARNING!

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

- 1 Warm the engine up (this makes it easier to suck the oil up from the sump). Then stop the engine.
 - 2 Connect the suction pipe of the oil drain pipe to the drain pipe. Pump up the oil.
 - 3 Change the oil filter and bypass filter at each oil change, please refer to *Oil Filter/By-pass Filter, Change page 64*.
 - 4 Fill up with oil to the correct level through the filling hole on the side of the engine please refer to *Technical Data page 99*.
- IMPORTANT!**
Only use a recommended grade of oil, please refer to *Technical Data page 99*.
- 5 Start the engine and let it idle. Check that the low oil pressure warning lamp goes out and that no leakage occurs by the filters.
 - 6 Stop the engine. Wait a few minutes before checking the oil level. Top up as necessary.

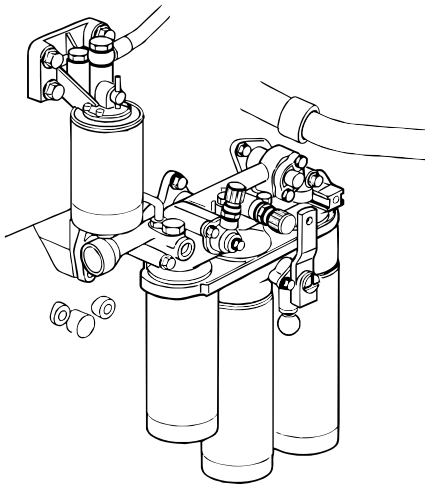
NOTICE!

Hand the old oil in to a re-cycling station.

Switchable oil filters

IMPORTANT!

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



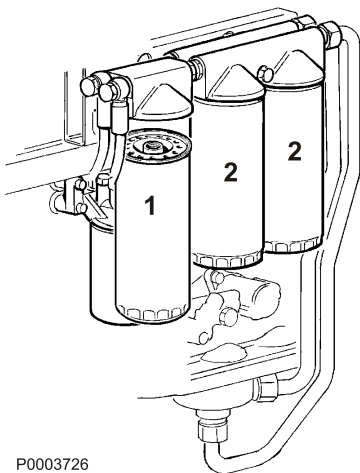
- 1 Clean the filter bracket.
- 2 Disconnect the left filter by turning the lever to the right-hand end position. To unlock the lever, pull the knob beneath the lever downwards.
- 3 Unscrew the left-hand oil filter and discard it. Use a filter wrench if necessary.
- 4 Check that the mating surfaces on the filter bracket are clean, and that no traces of the seal from the old filter remain.
- 5 Oil the rubber seal for the new filter.
- 6 Screw the filter on by hand until the rubber seal just touches the mating surface of the filter bracket. Then tighten the filter a further 3/4 of a turn.
- 7 Turn the lever to the left-hand end position and change the right-hand oil filter in the same way.
- 8 Put the lever in operating position (straight up).
- 9 If necessary, top up the system with lubrication oil at first stop. Refer to section *Engine Oil, Change* page 63.

Oil Filter/By-pass Filter, Change

Change the oil filter and bypass filter during each oil change. Remember to hand the old filters in to a re-cycling station.

⚠ WARNING!

Hot oil and hot surfaces can cause burns.



P0003726

- 1 Put a suitable vessel underneath the filters to avoid oil spillage.
- 2 Clean the filter bracket.
- 3 Unscrew the bypass filter (1) and the oil filters (2) with a suitable extractor.
- 4 Check that the mating surfaces on the filter brackets are clean, and that no residue from the old seals remains.
- 5 Moisten the seals on the new filters with engine oil.
- 6 Screw the filters on by hand until the rubber seals just touch the mating surface on the filter brackets. Then tighten a further 1/2 to 3/4 turn.
- 7 Start the engine (low idle) and check that no leakage occurs. Check the oil level once the engine has stopped.

Fuel System

Only use the grades of fuel recommended in the fuel specification, see *Technical Data page 100*. Always observe the greatest cleanliness during re-fuelling and work on the fuel system.

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

WARNING!

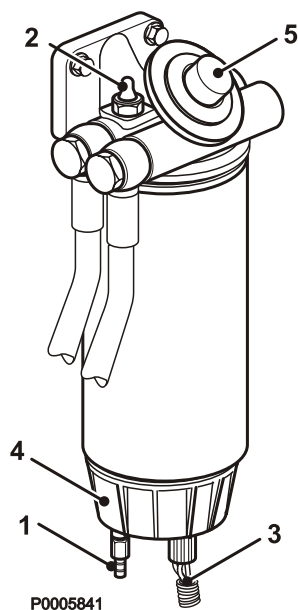
Fire hazard. When carrying out work on the fuel system make sure the engine is cold. A fuel spill onto a hot surface or an electrical component can cause a fire. Store fuel soaked rags so that they can not cause fire.

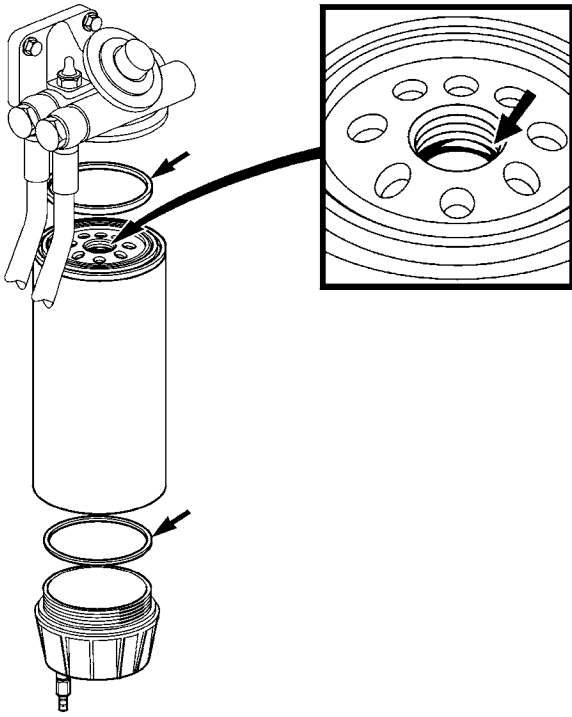
Engine Fuel Filter Replacement

Stationary engine:

Single filter and Switchable filters

- 1 Close the fuel valve/valves.
- 2 Clean the filter bracket and put a suitable vessel under the filter.
- 3 Relieve pressure inside the filter by first opening the drain tap (1) at the bottom of the water trap and then the venting nipple (2) to drain the filter of fuel.
- 4 Remove the cables (3) from the water trap (4) and unscrew the water trap from the filter.





P0003743

- 5 Unscrew the filter, use a filter wrench if needed.
- 6 Clean the sealing surfaces of the filter bracket. Make sure the filter is absolutely clean and the sealing surfaces are undamaged. Moisten the sealing rings with engine oil, including the inner rubber seal located inside the threaded hole in the center of the filter.

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

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

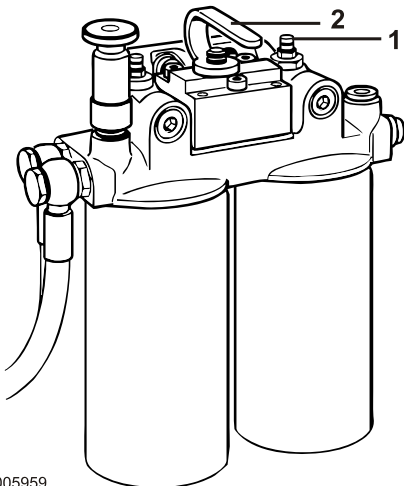
Running engine

Switchable filters only:

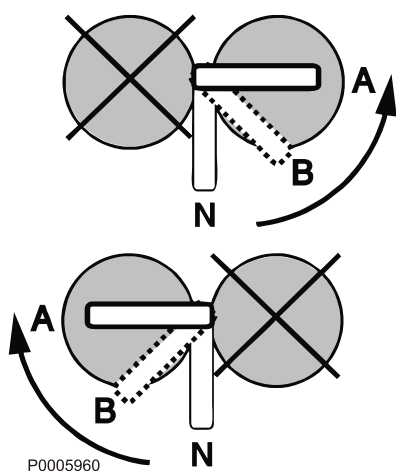
⚠ WARNING!

Hot fuel can cause burns.

- 1 Clean the filter bracket and put a suitable vessel under the filter.
- 2 Remove the protective cap from the venting nipple (1) on the filter bracket. Connect a transparent plastic hose to the nipple and lower this into the vessel.



P0005959



P0005960

- 3 Shut off the fuel flow to one of the filters by lifting the handle (2) and turning it to its end position (A).
- 4 Unscrew the water trap and filter, use a filter wrench if needed.
- 5 Clean the sealing surfaces of the filter bracket. Make sure the filter is absolutely clean and the sealing surfaces are undamaged. Moisten the sealing rings with engine oil, including the inner rubber seal located inside the threaded hole in the center of the filter.
- 6 Screw the new filter on by hand until the seal just touches the mating surface. Then tighten a further 1/2 turn. Reinstall the water trap and the cables. Close the drain tap.
- 7 Vent by turning the handle (2) to venting position (B). This allows a reduced flow of fuel through the filter and evacuates air through the vent. Tighten the venting nipple when air-free fuel flows out.
- 8 Remove the hose and put the protective cap back on the venting nipple.
- 9 Repeat with the other filter.
- 10 Turn the handle to normal operating position (N). Check for leakages.

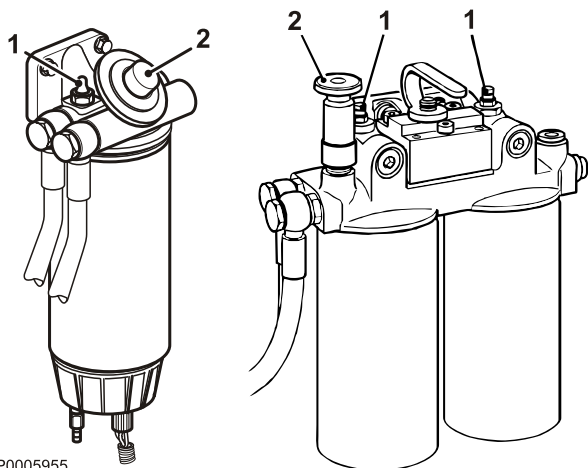
Fuel system, bleeding

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

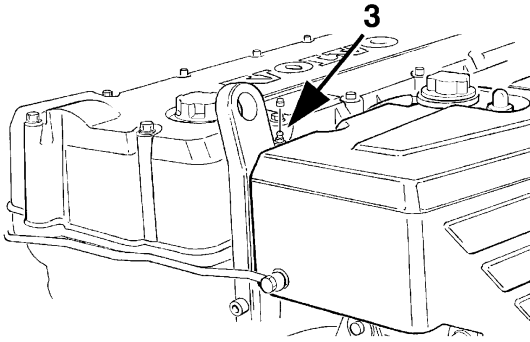
Stationary engine:

Single filter and Switchable filters

- 1 Put a suitable vessel underneath the fuel filter.
- 2 Remove the protective cap from the bleeding nipple (1) on the filter bracket. Connect a transparent plastic hose to the nipple and lower this into the vessel.
- 3 Open the bleeding nipple and pump up fuel with the hand pump (2) until air-free fuel flows out. Tighten the nipple while fuel is flowing out. Repeat with the second switchable filter.
- 4 Remove the hose and put the protective cap back on the bleeding nipple.



P0005955



P0003664

- 5 If the tank has been run dry or if the engine, for some reason, has been emptied of fuel, open the nipple (3) at the front of the engine block and bleed in the same way.
- 6 Run the engine at idling speed for a couple of minutes to allow any remaining air out of the system. Then close the nipple (3) on the engine and make sure there are no leaks..

Fuel filter

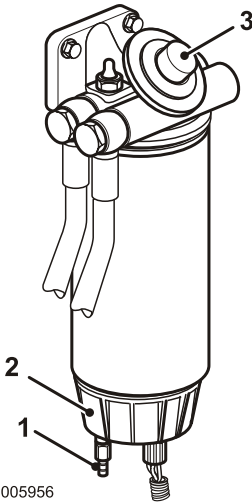
Drain

⚠ WARNING!

Hot fuel can cause burns.

Stationary engine:

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



P0005956

Primary fuel filter

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

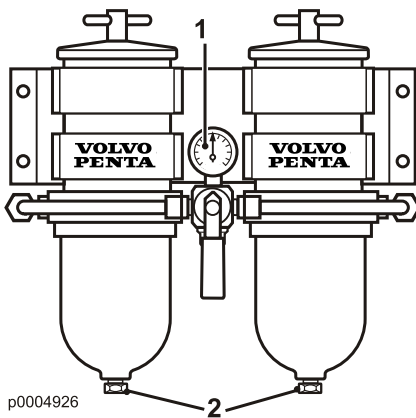
Checks

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

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

⚠ WARNING!

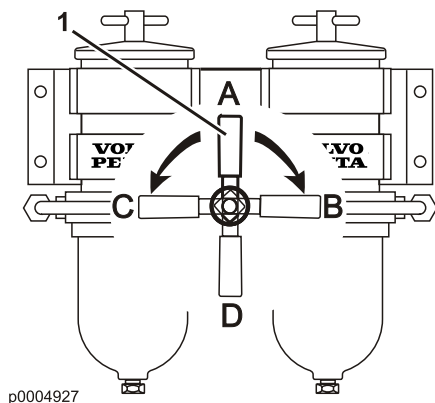
Working with, or going close to a running engine is a safety risk. Watch out for rotating components and hot surfaces.



p0004926

Draining

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



p0004927

Replacing filter cartridges

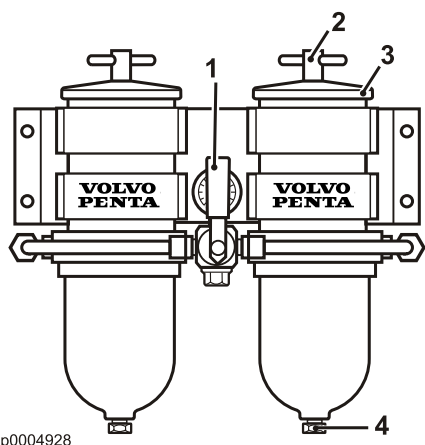
Double filter cartridges can be replaced while the engine is running, by shutting off the fuel flow to one filter holder at a time.

Fuel flow is controlled by moving the lever (1) to the following positions:

- A Normal operating position (both filters connected).
- B Left filter cartridge can be replaced.
- C Right filter cartridge can be replaced.
- D Both filters shut off.

Replacing filter cartridge

If the engine is stopped, begin by shutting the fuel taps at the tank before replacing the filters. If the engine is running the fuel flow to the filter to be replaced must be shut off using the lever (1).



p0004928

- 1 Place a vessel under the filters and shut off the filter to be replaced.
- 2 Undo the T-bolt (2) and remove the cover (3).
- 3 Carefully remove the cartridge with a turning movement.
- 4 Empty the water and sediment through the drain hole (4).
- 5 Insert a new filter cartridge and fill the holder with clean fuel.
- 6 Replace the cover gasket and the T-bolt O-ring. Moisten the gasket and the O-ring with fuel before they are installed.
- 7 Install the cover and tighten it by hand.
- 8 Dry up any fuel spills.
- 9 Replace the other filter in the same way.
- 10 Open the fuel taps and put the lever in the normal operating position. Check that there are no leaks.

Freshwater System

The freshwater system is the engine's internal cooling system that ensures that the engine operates at the correct temperature. It is a closed system that must always be filled with a mixture of concentrated coolant and water in order to protect the engine against internal corrosion, cavitation and frost bursting.

We recommend "Volvo Penta Coolant, Ready Mixed", or "Volvo Penta Coolant" (concentrated) mixed with pure water according to specifications. Refer to the table *Water Quality page 101*. Only coolant of this grade is suitable for, and approved by, Volvo Penta. The use of anti-corrosion agents alone is not permitted in Volvo Penta engines. Never use water alone as the coolant.

IMPORTANT!

Coolant of a suitable chemical composition must be used all year round. This applies even when there is no risk for frost damage, so that the engine always has complete corrosion protection. Future warranty claims related to engine and accessories may be refused if an unsuitable coolant has been used, or if the instructions for coolant mixture have not been followed.



P0002092

The corrosion protection additives become less effective over time, which means that the coolant must be changed at regular intervals; refer to the *Maintenance Schedule page 56*. The cooling system must be flushed whenever the coolant is changed, refer to the *Freshwater system, Flushing page 74* section.

"Volvo Penta Coolant" is a concentrated coolant that must be mixed with water. It has been prepared to work best with Volvo Penta engines and offers excellent protection against corrosion, cavitation damage and frost bursting.

"Volvo Penta Coolant, Ready Mixed" is a ready-mixed coolant, 40 % "Volvo Penta Coolant" and 60 % water. This mixture protects the engine from corrosion damage, cavitation damage and frost bursting down to $-28\text{ }^{\circ}\text{C}$ ($-18\text{ }^{\circ}\text{F}$).

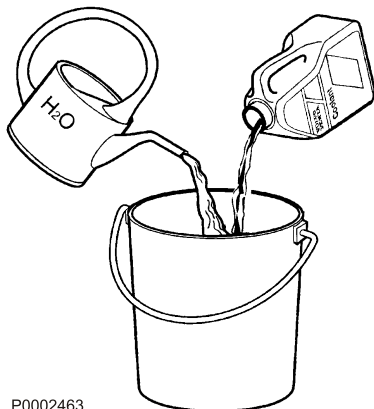
Coolant, Mixing

WARNING!

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

IMPORTANT!

Volvo VCS coolant (yellow in color) must **not** be used in Volvo Penta engines. Different kinds of coolant must not be mixed with each other!



P0002463

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

This mixture protects against internal corrosion, cavitation and frost bursting down to $-28\text{ }^{\circ}\text{C}$ ($-18\text{ }^{\circ}\text{F}$). At 60 % glycol concentration, the freezing point is lowered to $-54\text{ }^{\circ}\text{C}$ ($-65\text{ }^{\circ}\text{F}$).

Never mix more than 60 % concentrate (Volvo Penta Coolant) in the coolant. A greater concentration provides reduced cooling effect with the risk for overheating and reduced frost protection.

The coolant must be mixed with distilled, deionized water. The water must fulfill the requirements specified by Volvo Penta; refer to *Water Quality page 101*.

It is extremely important that the system is filled with the correct coolant concentration. Mix in a separate clean vessel before filling the cooling system. Make sure that the liquids mix.

Coolant Level, Checking and Topping Up

Coolant level, Inspection

NOTICE!

Coolant level can be checked through a level glass on top of the expansion tank.

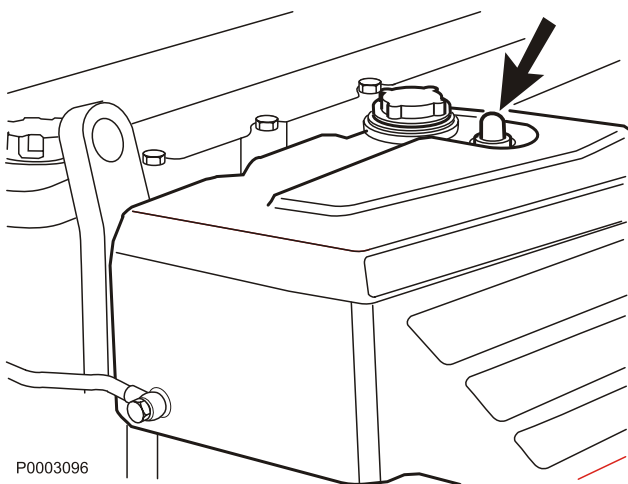
The green float must be visible in the level glass.

⚠ WARNING!

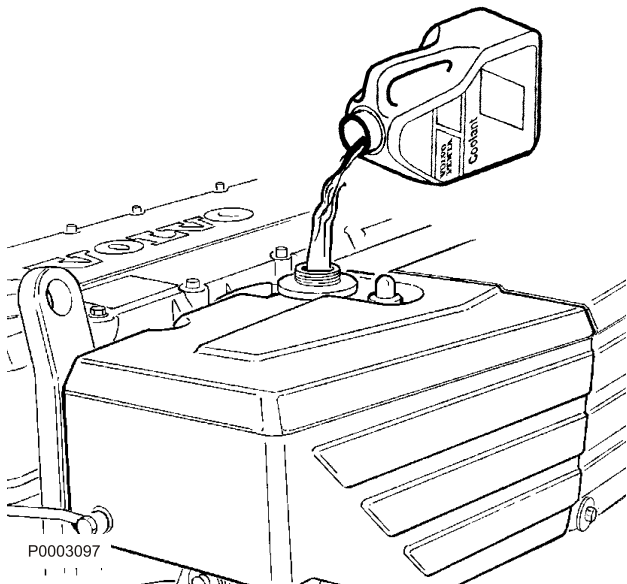
Do not open the coolant filler cap when the engine is warm, except in emergencies, this could cause serious personal injury. Steam or hot fluid could spray out.

The coolant level should be about 5 cm (2”) below the pressure cap sealing plane in the expansion tank.

If a separate expansion tank is installed, the coolant level must be between the MAX and MIN markings. Top up the coolant as necessary, following the description below.



P0003096



P0003097

Coolant, Filling

⚠ WARNING!

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

IMPORTANT!

Top up with the same type of coolant as already used in the system.

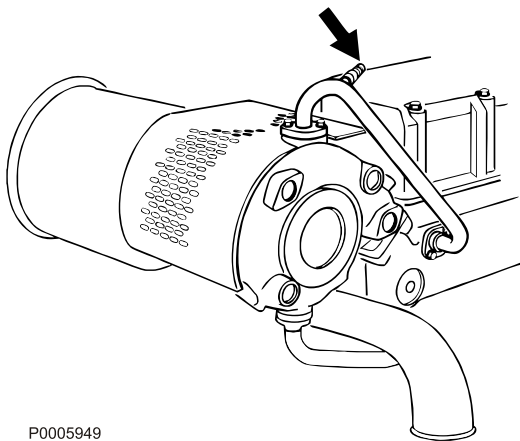
Topping up

Fill up with coolant to the correct level via the filling hole on the expansion tank. Fill slowly, to allow the air which is forced out a chance to flow out of the filling hole.

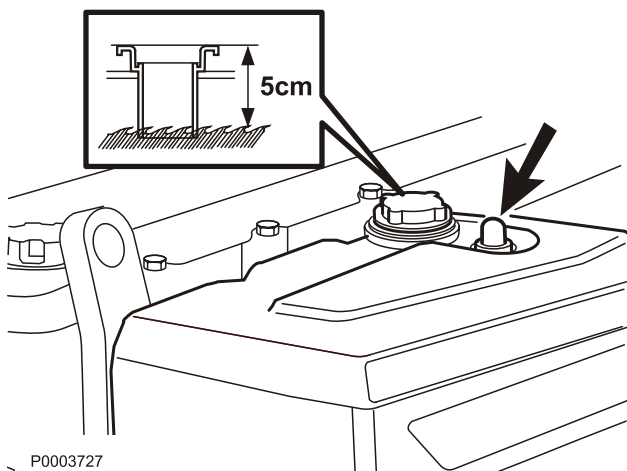
When you fill up an empty system, or if the coolant has fallen so low for any reason that it is no longer visible through the filling hole, fill up as in the description for "Filling a completely empty system".

Filling a completely empty system

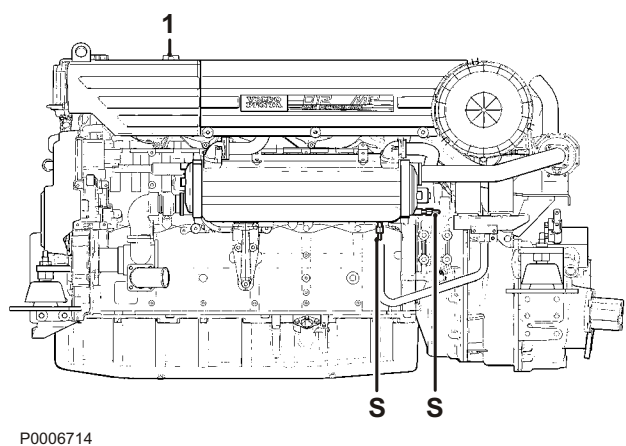
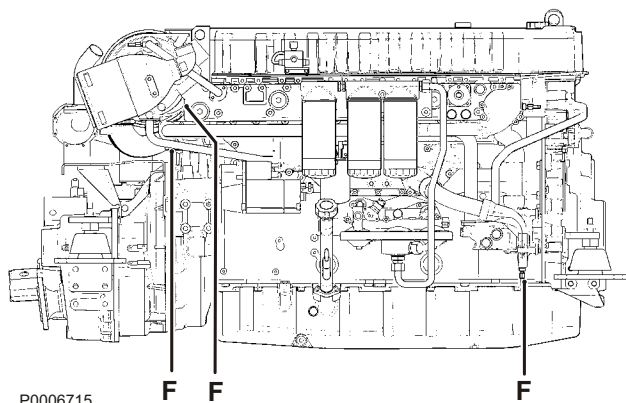
- 1 Mix a sufficient quantity of coolant in a vessel before filling. Please note that a heating system, tap water heater etc. if connected to the engine cooling system, mean that a correspondingly greater amount of coolant will be needed.
- 2 Open the vent tap by the turbocharger.
- 3 Also ensure that the heating system, tap water heater etc. if connected to the engine cooling system, are also vented (open the heater control valve).
- 4 Fill up with coolant via the filling hole on the expansion tank. Fill slowly, to allow the air which is forced out a chance to flow out of the vent tap(s) and filling hole.
- 5 Close the vent tap(s) as and when air-free coolant flows out.
- 6 Fill up with coolant to about 5 cm (2") below the filling cap seal plane.
- 7 Warm the engine up. **IMPORTANT!** Do not start the engine until the system is vented and completely filled.
- 8 Stop the engine and let it cool. Check the coolant level. Top up as necessary.



P0005949



P0003727



Coolant, Draining

⚠ WARNING!

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

⚠ WARNING!

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

Drain the coolant via taps (F).

- 1 Remove the filling cap (1) from the expansion tank.
- 2 Open the vent tap (V) by the turbocharger.
- 3 Connect a suitable hose to each drain tap. Open the tap and allow the coolant to drain off into a suitable vessel.

IMPORTANT!

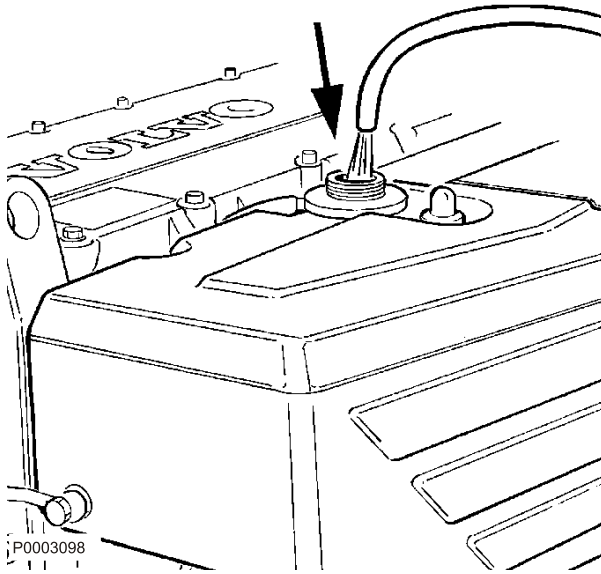
Check that all coolant really does drain out. Deposits may need to be cleared away, inside the drain plug(s)/tap(s).

- 4 Continue with all the drain points until all five have been opened and all coolant has been drained off.
- 5 Also drain the heating system, tap water heater etc., if connected to the engine's freshwater system.
- 6 Close all drain taps.
- 7 Collect the old coolant and hand it to a re-cycling station for destruction.

Freshwater system, Flushing

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

- 1 Drain the coolant, please refer to section *Coolant, Draining* page 73.
- 2 Put a hose into the filling hole in the heat exchanger and flush with fresh water.
- 3 Flush until the water which runs out of the drain points is clean.
- 4 Close all drain points when all coolant has run out.
- 5 Fill up with coolant, please refer to section *Coolant Level, Checking and Topping Up* page 71.



Coolant Filter, Change

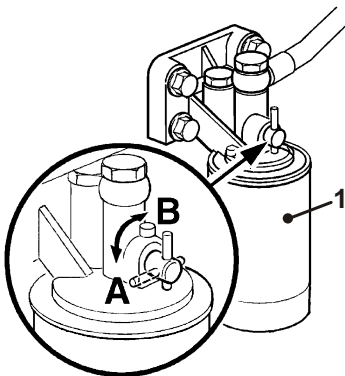
IMPORTANT!

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

⚠ WARNING!

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

- 1 Clean the filter bracket.
- 2 Close the filter tap (1), position (A).
- 3 Unscrew the filter with a suitable extractor.
- 4 Clean the filter mating surface on the filter bracket.
- 5 Moisten the seals on the new filter with engine oil and screw the filter on by hand until the rubber seal just touches the mating surface on the filter bracket. Then tighten a further ½ turn.
- 6 Open the filter tap, position (B).
- 7 Start the engine and check for leakage.



P0005835

Seawater System

The seawater system is the engine's external cooling system. The seawater system sucks in water through the seawater inlet and pumps it through the heat exchanger and the reverse gear oil cooler. The system is protected from galvanic corrosion by means of zinc anodes located in the heat exchanger and the reverse gear oil cooler.

WARNING!

Risk of water entry. Water will flow into the boat if any hose, plug etc. located below the waterline is removed when the boat is in the water. Always close the sea cocks. If the boat does not have sea cocks the water flow must be blocked in a safe manner. If this is not possible, the boat must be drawn up on land before work starts.

Seawater System, Draining

The seawater system must be drained in cold weather, if there is a risk of frost, to prevent frost damage.

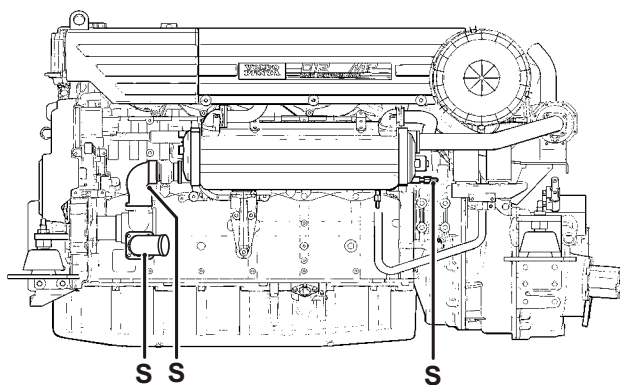
WARNING!

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

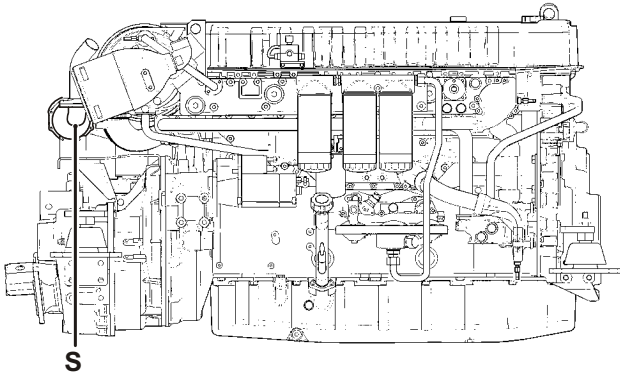
An alternative to draining is to keep the engine bay above freezing temperature, by means of a fan heater which is approved for outdoor use.

Draining:

- 1 Close the sea cock.
- 2 Connect a hose to each drain tap before opening the tap (one at a time).
- 3 Open the drain taps/remove the drain plugs (**S**) and allow the water to run out.



P0006716



P0006718

Drain points:

- tap on reverse gear oil cooler
- tap at rear of heat exchanger
- tap above seawater pump
- plug below seawater pump

IMPORTANT!

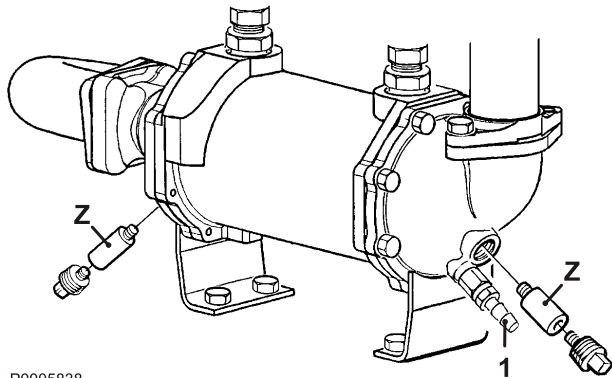
Check that all water really does drain out. Deposits may need to be cleared away, inside the drain plug/tap.

- 4 Also drain/empty any auxiliary equipment such as the seawater filter, flushing/bilge pump etc.
- 5 Install the lid on the flushing/bilge pump if fitted. Connect all hoses.
- 6 Close/install all drain taps and plugs before you leave the boat.

Zinc Anodes, Check and Change

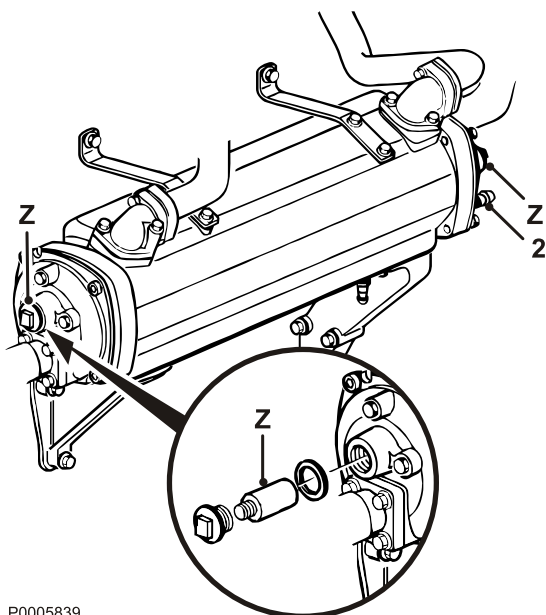
⚠ WARNING!

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



P0005838

- 1 Close the sea cock.
- 2 Open the drain tap (1) on the reverse gear oil cooler, and the tap (2) on the heat exchanger, and drain off the seawater.
- 3 Remove the zinc anodes (Z) in the heat exchanger (2 pcs.) and in the reverse gear oil cooler (2 pcs.)
- 4 Check the zinc anodes and replace them if more than 1/3 of their original size has been used up. If not, clean the zinc anodes with emery cloth to remove the oxide layer before re-installing them.

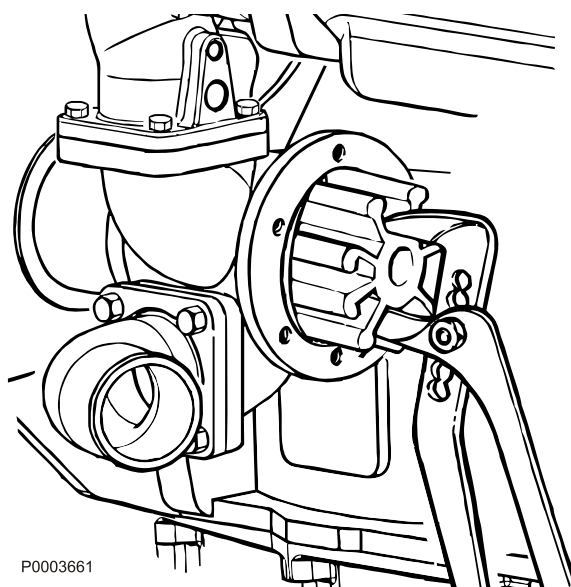


P0005839

IMPORTANT!

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

- 5 Install the zinc anodes. Make sure that good metallic contact is obtained between the anode and the casting.
- 6 Close the drain taps (1 and 2).
- 7 Open the sea cock before starting the engine.
- 8 Check that no leakage occurs.



P0003661

Impeller, Check and Change**⚠ WARNING!**

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

- 1 Remove the seawater pump lid, and pull the impeller out with water pump pliers.
- 2 Check the impeller. If any cracks or other defects are visible, the impeller must be changed.
- 3 Lubricate the pump housing and the inside of the lid with water-resistant grease (which is not aggressive to rubber). The impeller will be easier to work with if it is put in hot water prior to fitting.
- 4 Press the impeller in with a circular motion (counter clockwise). The shaft of the pump has an internal thread (M8). Screw a stud into the end of the shaft and press the impeller in using a washer and nut. Fit the cover, using a new O-ring.
- 5 Open the sea cock.

IMPORTANT!

Always carry a spare impeller on board.

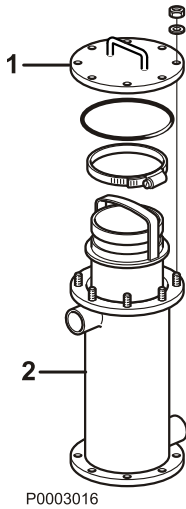
Seawater Filter, Check and Cleaning

The seawater filter is optional equipment.

If the water where the boat is operated contains a lot of contamination, weed etc., check the filter more frequently than specified in the maintenance schedule. There is otherwise a risk that the filter would be blocked, which would make the engine overheat.

⚠ WARNING!

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



- 1 Close the sea cock.
- 2 Remove the lid (1) and lift up the insert.
- 3 Clean the insert and the housing (2).
- 4 Install the components as in the illustration. Check the seals. Change as necessary.
- 5 Open the sea cock and check carefully that no leakage occurs.

Inlet Manifold, Checking the Drain Hole

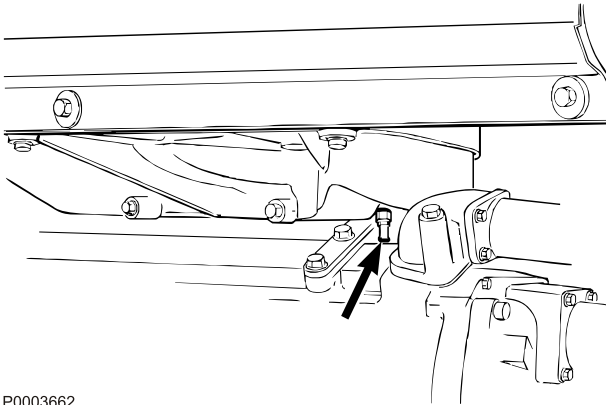
Water can condense in the aftercooler during operation. The condensate is drained via a hose connected to a nipple under the rear of the inlet manifold.

Check that the nipple is not blocked.

IMPORTANT!

If a large amount of water flows out of the drain hole, from the inlet manifold, the aftercooler must be removed and pressured tested.

This task must be done by an authorised workshop.



P0003662

Electrical System

WARNING!

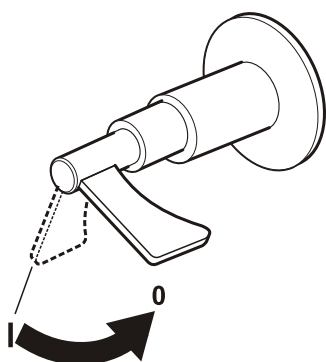
Always stop the engine and break the current using the main switches before working on the electrical system. Isolate shore current to the engine block heater, battery charger or accessories mounted on the engine.

Main Switch

IMPORTANT!

Never disconnect the current with the main switches when the engine is running, the alternator and electronics could be damaged

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



P0002576



P0002479

Electrical Connections

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



P0002107

Battery, Maintenance

WARNING!

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

WARNING!

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

WARNING!

The battery electrolyte contains extremely corrosive sulfuric acid. Protect your skin and clothes when charging or handling batteries.

Always use protective goggles and gloves. If battery electrolyte comes into contact with unprotected skin wash off immediately using plenty of water and soap. If battery acid comes in contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.

Connecting and disconnecting the battery

Connecting

- 1 Connect the + cable (red) to the + pole on the battery.
- 2 Connect the – cable (black) to the – pole on the battery.

Disconnecting

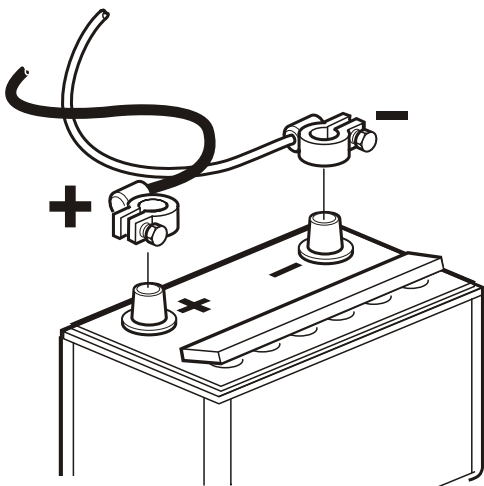
- 1 Remove the – cable (black).
- 2 Remove the + cable (red).

Cleaning

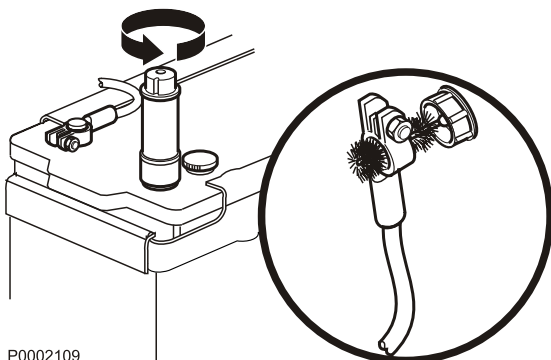
Keep the batteries clean and dry. Contamination and oxide on the batteries and battery poles can cause stray currents, voltage drop and discharge, especially in wet weather. Remove oxidation from the battery poles and terminals, using a brass brush. Tighten the terminals securely and grease them with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

Filling

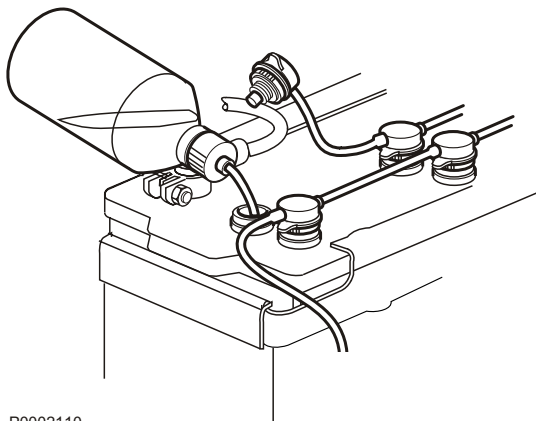
The electrolyte level should be 5–10 mm (0.2– 0.4”) above the cell plates in the battery. Top up with distilled water as required.



P0002108



P0002109



P0002110



P0002107

After filling, the battery should be charged for at least 30 minutes by running the engine at idle.

Some maintenance-free batteries have special instructions, which must be followed.

Battery, Charging

WARNING!

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

WARNING!

The battery electrolyte contains extremely corrosive sulfuric acid. Protect your skin and clothes when charging or handling batteries.

Always use protective goggles and gloves. If battery electrolyte comes into contact with unprotected skin wash off immediately using plenty of water and soap. If battery acid comes in contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.

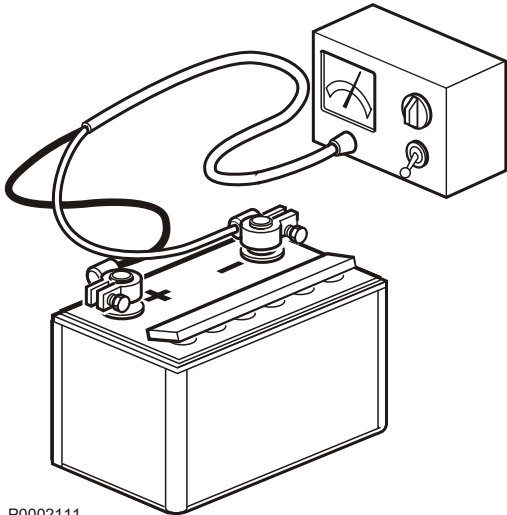
WARNING!

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

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.

Always switch off the charging current before the charging clips are removed.



P0002111

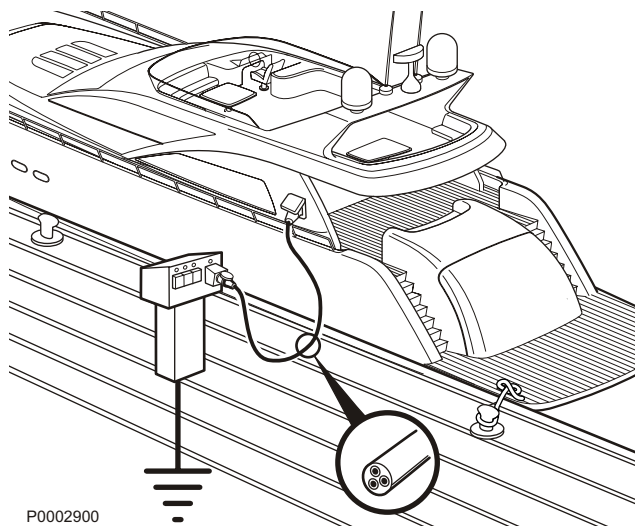
- Charge batteries if they have become discharged. During charging, unscrew the cell plugs but leave them in the plug holes. Ventilate well, especially if the batteries are charged in an enclosed space.
- If the engine is not used for a longer period of time, the batteries should be fully charged, then 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.
- Special instructions apply to **boost charging**. Boost charging can shorten battery life, and should therefore be avoided.

Electrical Installations

An incorrectly-carried-out electrical installation may generate leakage current from the electrical system. Leakage current can in turn render galvanic protection insufficient in respect of propellers, propeller shafts, rudder posts, keel etc and may cause damage through electrochemical corrosion.

WARNING!

Work on the low voltage circuits in the boats should be done by a person with electrical training or knowledge. Installation or work on land current equipment must only be done by a competent electrician, in accordance with local regulations for mains electricity.



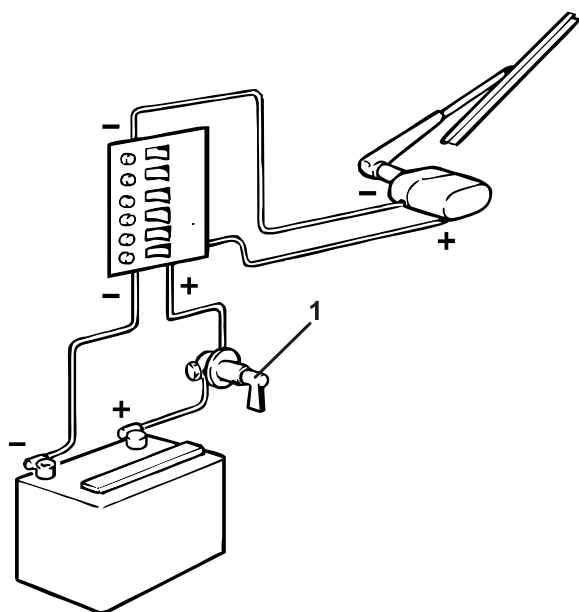
P0002900

Always consider the following:

- 1 If shore power is connected it must always be ground protected ashore, never in the boat. Furthermore, the shore power installation should be equipped with a ground fault interrupter. The shore power installation (transformer, inverter, battery charger etc.) must be designed for marine use **where the high-tension side is galvanically separated from the low-tension side.**
- 2 Electrical cables must be run and clamped such that there is no risk of exposure to chafing, damp or bilge water.
- 3 Ground protection for radios, navigation instruments, rudder, boarding ladders or other equipment where separate cables for ground protection are present, must be clustered to a common ground connection that is not connected to the engine or reverser gear.

IMPORTANT!

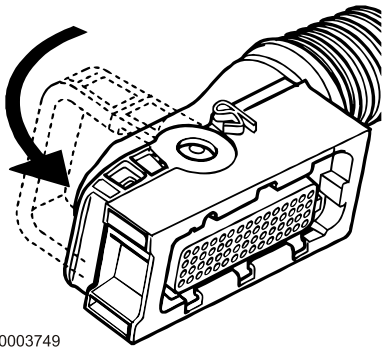
The engine and reverse gear must never be used as earth planes.



P0002486

- 4 The start battery must have a main switch (1) connected to the battery's plus (+) side. The main switch must break the circuit to all equipment and be switched off when the boat is not in use.
- 5 If an auxiliary battery is used a main switch must be placed between the auxiliary battery's plus (+) terminal and the circuit breaker panel for the boat's electrical equipment. The main switch must break the circuit to all equipment connected to the auxiliary battery and must be switched off when power is no longer required. All equipment connected to the auxiliary battery must have separate main switches.

For simultaneous charging of two independent battery circuits a separate charging distributor (accessory) should be installed on the standard alternator.



P0003749

Electrical Welding

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

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

Also remove the connector for the EVC system from the control unit. Press the locking arm down and pull out the connector.

IMPORTANT!

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

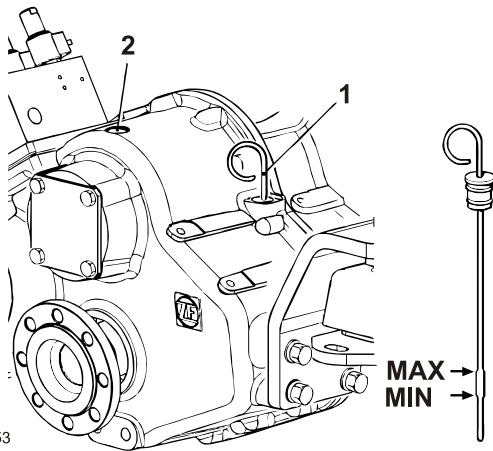
Reverse Gear

Oil level, checking and topping up

Checking – ZF reverse gear

Check the oil level with the engine stopped, at least 2 minutes after stopping the engine.

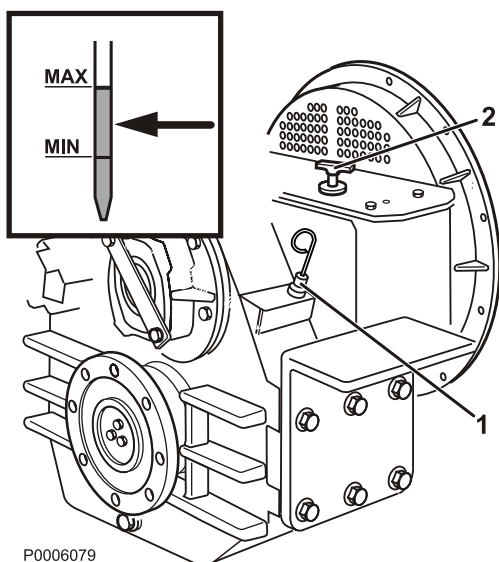
- 1 Remove the dipstick (1), wipe it off and put it back into the reverse gear.
- 2 Remove the dipstick again and check the oil level. The correct oil level is between the MAX and MIN marks.
- 3 Start the engine and let it run on idle a few minutes with control lever in neutral. Stop the engine and check the oil again.



P0003653

WARNING!

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



Checking – Twin Disc reverse gear

Check the oil level when the reverse gear has reached operating temperature, with the engine idling and the control lever in neutral.

- 1 Remove the dipstick (1), wipe it off and put it back into the reverse gear.

⚠ WARNING!

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

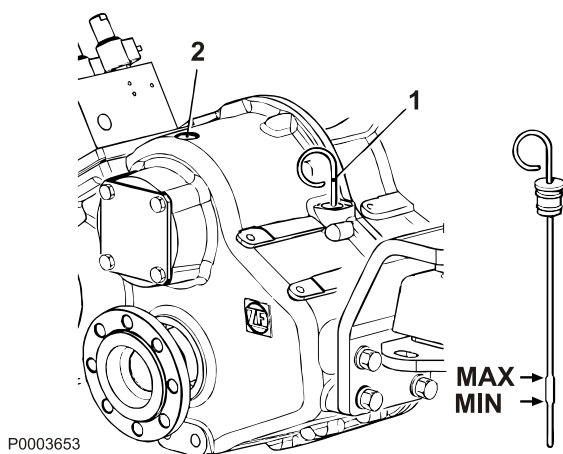
- 2 Remove the dipstick again and check the oil level. The correct oil level is between the MAX and MIN marks.

Filling

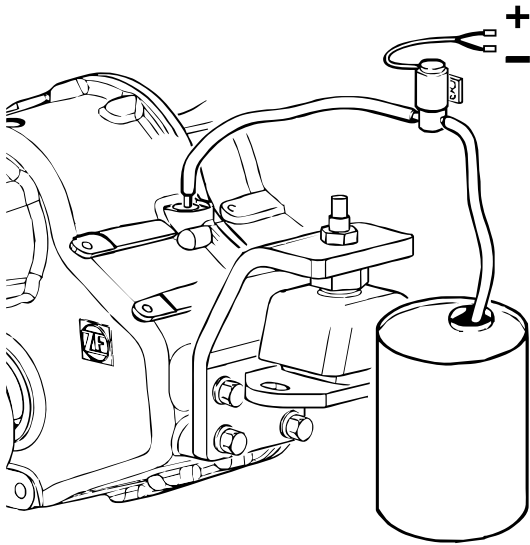
If necessary, top up with oil through the filler hole (2) on top of the reverse gear. Please refer to section *Technical Data page 102* for oil grade and volume.

IMPORTANT!

Never over-fill the reverse gear. The oil level must always be within the recommended range.



Transmission Oil, Change

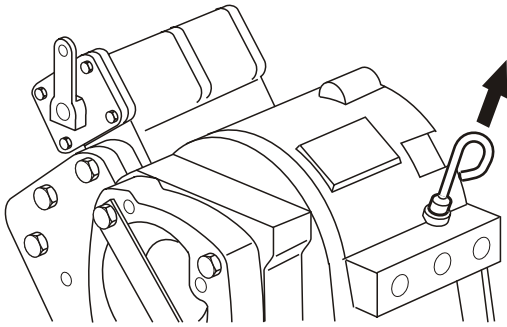


- 1 Remove the dipstick. Connect a hose from the oil scavenging pump to the dipstick tube.
- 2 Suck the oil up and put the dipstick back.
- 3 Fill up with oil to the correct level. Oil grade and volume: Please refer to *Technical Data* page 102.

IMPORTANT!

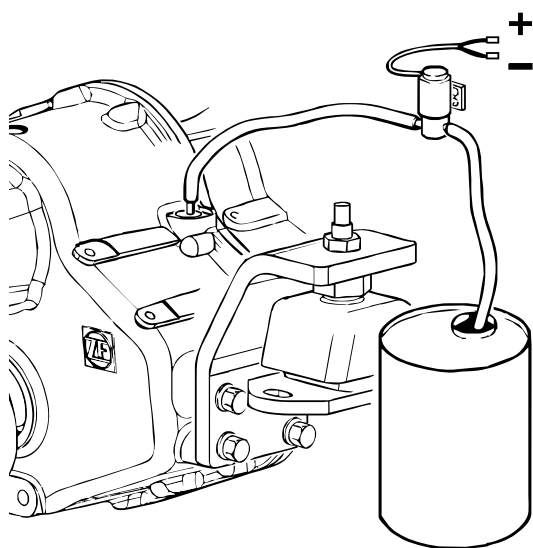
Never over-fill the reverse gear. The oil level must always be within the recommended range.

- 4 Start the engine and run until the reverse gear has reached operating temperature.
- 5 Check the oil level please refer to *Oil level, checking and topping up* page 84.



P0006719

Transmission Oil, Change

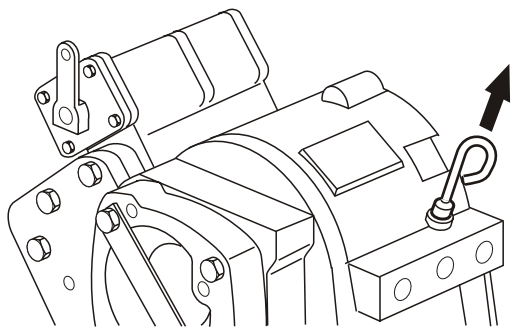


- 1 Remove the dipstick. Connect a hose from the oil scavenging pump to the dipstick tube.
- 2 Suck the oil up and put the dipstick back.
- 3 Fill up with oil to the correct level. Oil grade and volume: Please refer to *Technical Data page 102*.

IMPORTANT!

Never over-fill the reverse gear. The oil level must always be within the recommended range.

- 4 Start the engine and run until the reverse gear has reached operating temperature.
- 5 Check the oil level please refer to *Oil level, checking and topping up page 84*.

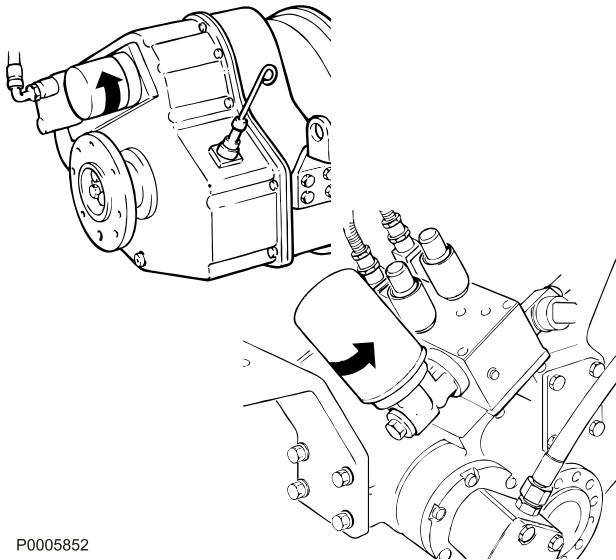


P0006719

Oil filter, Change

WARNING!

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



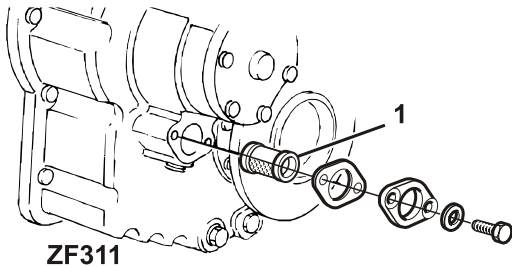
P0005852

- 1 Put a suitable vessel beneath the filter, to avoid oil spillage.
- 2 Unscrew the oil filter with a suitable extractor.
- 3 Clean the filter mating surface on the filter bracket.
- 4 Lubricate the seal on the new filter with engine oil.
- 5 Screw the filter on by hand until the rubber seal just touches the mating surface on the filter bracket. Then tighten a further 3/4 turn.
- 6 Top up with oil.
- 7 Start the engine and check that no leakage occurs.
- 8 Check the oil level, please refer to *Oil level, checking and topping up* page 84.

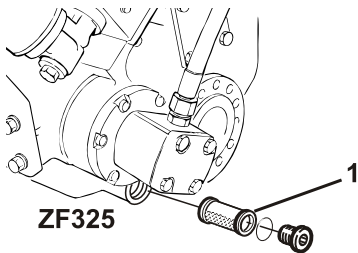
Oil Strainer, Cleaning

WARNING!

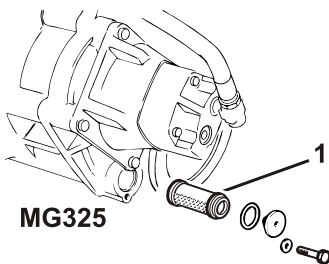
Working with, or going close to a running engine is a safety risk. Watch out for rotating components and hot surfaces.



ZF311



ZF325



MG325

P0006746

- 1 Remove the lid/plug and carefully remove the strainer (1) from the housing.

IMPORTANT!

Cleanliness. Dirt must not be allowed to get into the reverse gear.

- 2 Clean the strainer and other components in paraffin (kerosene).
- 3 Carefully put the components back again.
- 4 Tighten the plug/screw.
- 5 Start the engine and check carefully that no leakage occurs.

Storage

The boat must be laid up to prevent damage to the engine and other equipment if the boat 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 the boat is taken out of service for a long period of time, an authorised Volvo Penta workshop should 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.

⚠ CAUTION!

Read the chapter on Maintenance before starting work. It contains instructions on how to carry out maintenance and service operations in a safe and correct manner.

Some conservation oils are flammable. Some are also dangerous to breathe. Ensure good ventilation. Use a face mask when spraying.

IMPORTANT!

Observe the following when cleaning with a high pressure washer: Never aim the water jet at seals, rubber hoses or electrical components. Never use a high pressure washer for engine cleaning.



P0002089

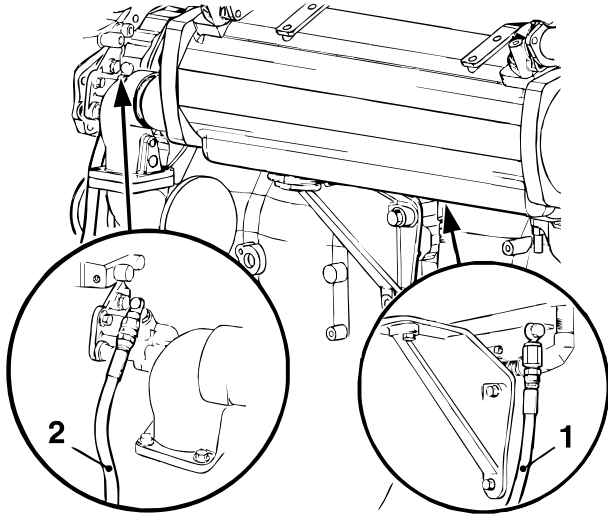
Inhibiting

- Warm the engine up to normal operating temperature and check that the oil level in the reverse gear reaches the MAX mark on the dipstick. Stop the engine.
- **Max 8 month's stoppage:**
Change the oil and oil filter on the engine, then warm it up afterwards.
- **More than 8 month's stoppage:**
Conserve the lubrication and fuel systems with conservation oil. Please refer to section "Bringing out of storage".
- Check that the coolant offers sufficient frost protection. Top up as necessary.
Alternatively, you can drain the coolant (also drain the coolant filter).
- Close the sea cock and drain the water from the seawater system.
- Remove the impeller from the seawater pump.
Store the impeller in a sealed plastic bag, in a cool place.
- Drain any water and contamination from the fuel filters and fuel tank. Fill the fuel tank completely, to avoid condensation.
- Disconnect the battery cables, clean and charge the batteries. Trickle charge the batteries while the boat is laid up. **A poorly charged battery can freeze and burst.**
- Clean the outside of the engine. Do not use a high pressure washer for engine cleaning. Touch up paint damage with Volvo Penta original paint.
- Check and rust-proof any control cables.
- Put a note on the engine with the date, type of conservation and the conservation oil used.
- Cover over the engine air inlet, exhaust opening and engine if necessary.

Bringing out of storage

- Remove any covers from the engine, air inlet and exhaust pipe.
- Top the engine up with the correct grade of oil, if necessary. Install a new oil filter if the filter was not changed during conservation.
- Check that there is oil in the reverse gear.
- Install new fuel filters and vent the fuel system.
- Check the drive belt(s).
- Check the condition of all rubber hoses, and re-tighten the hose clamps.
- Close the drain taps and install the drain plugs.
- Insert the impeller in the seawater pump, using a rotating movement (anti-clockwise).
- Check the coolant level and anti-freeze. Top up if necessary.
- Connect the fully charged batteries.
- Open the sea cocks.
- Start the engine (if the boat is in the water) and warm up at a fast idle before loading the engine.
- Check that no oil, fuel or coolant leakage occurs.
- Check the oil level in the reverse gear. Top up if necessary.

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

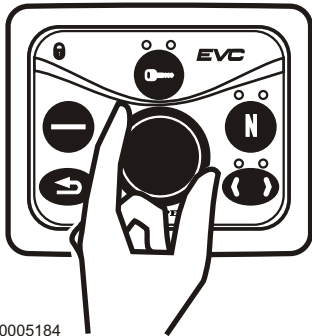


P0005967

- Drain the oil from the sump and engine and fill the engine up with **conservation oil*** to just above the MIN marking on the dipstick.
- Connect the fuel supply (1) and return fuel pipes (2) to a jerrican filled with 1/3 **conservation oil*** and 2/3 diesel fuel.
- Vent the fuel system.
- Start the engine and run at a fast idle until about 2 litres (0.5 US gals.) have been used. Stop the engine and connect the ordinary fuel pipes.
- Empty the conservation oil out of the engine.
- Follow the other instructions on the previous page.

* Conservation oils are sold by oil companies.

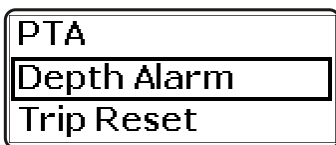
Calibration and Settings



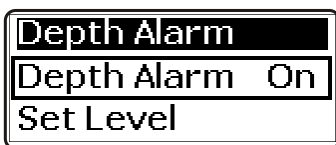
p0005184



P0001015



P0001028




P0001027

Settings menu

Settings are entered and certain calibrations are carried out in the Settings menu.

Navigate through the menus by turning and depressing the control panel wheel.

It is always possible to return to the menu above by pressing . Repeated presses or holding the button down for >3 seconds will return to the main menu.

NOTICE! Only installed functions are shown in the settings menu.

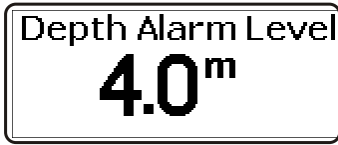
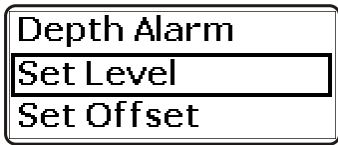
- 1 Turn clockwise until **Settings** is shown on the display.
- 2 Press the wheel to access the settings menu.
- 3 Navigate by turning the wheel.

Depth Alarm

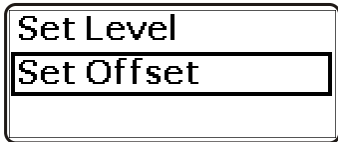
Setting the depth alarm for the Volvo Penta echo sounder.

The setting need only be entered at one display, at one station.

- 1 Activate the station.
- 2 Turn until **Depth Alarm** is shown in the settings menu. Press the wheel to reach the submenu.
- 3 **Depth Alarm**, press the wheel to switch the function on or off.



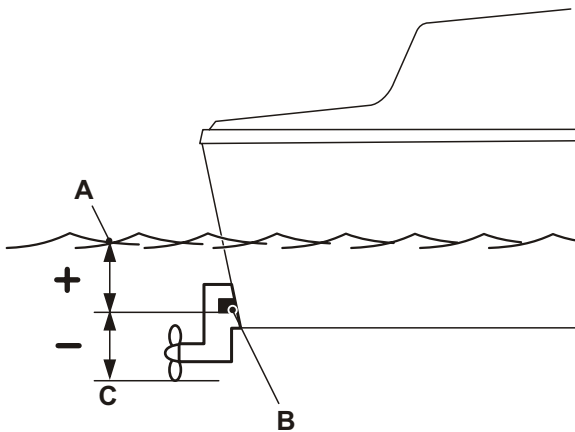
P0001033



P0001024

- 4 Turn to **Set Level**. Press the wheel to access adjustment of depth level alarm. Turn the wheel to set the alarm depth, i.e. the depth when the alarm should begin sounding. Press the wheel to confirm the set depth. The depth alarm is dependent on depth compensation (offset depth).

- 5 Turn to **Set offset**. Press the wheel to access offset depth adjustment. Adjust it to correspond to the boat's deepest point or the boat's waterline, depending on the depth to be displayed. The echo-sounder can be placed anywhere between these two points.



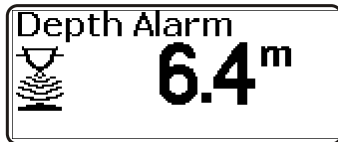
P0001201

- A Waterline
- B Echo-sounder
- C Lowest point

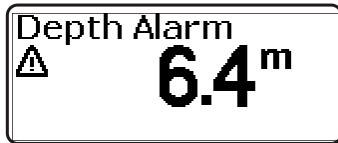


P0001023

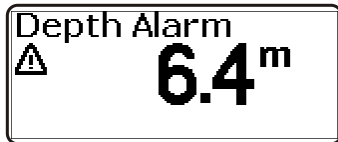
- 6 Turn the wheel to set depth compensation. If the number is positive (+) the distance between the echo-sounder and the water line is set, if the number is negative (-) it is the distance between the echo-sounder and the lowest point. Press the wheel to confirm the setting.



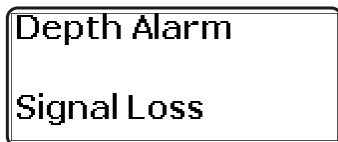
P0005853



P0005854



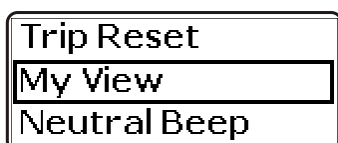
P0005855



P0001032



P0001016



Depth alarm popup window

When the depth is less than the alarm level, the popup window will display intermittently, followed by the alarm signal.

The pop-up window will be displayed every 30 seconds until the depth is greater than the alarm level.

Confirm the selection by depressing the navigation wheel.

Lost depth alarm signal

If the signal from the depth alarm disappears, e.g. if the depth alarm sensor is defective, the popup window is displayed to the left.

Trip reset

Zeroing trip information

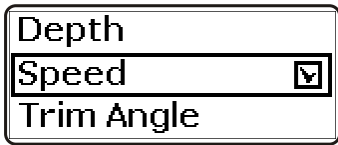
- 1 Activate the station.
- 2 Turn to **Trip reset** in the settings menu.
- 3 Press the wheel twice to zero the trip information.

My View

In My view it is possible to select the operating information to be displayed in the main menu.

The type of information that may be selected depends on the functions installed.

- 1 Turn to **My View** in the settings menu. Press to reach the submenu.



P0001014

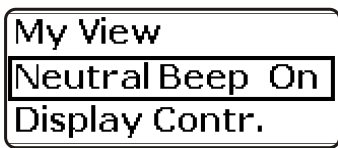
- 2 Turn to navigate through the menu with available operating information.
- 3 Press the wheel to check and uncheck the information to be displayed in the main menu.

Neutral Beep

Sound indication, controls in neutral position. The sound may be set on or off. The sound level is set under *Information beep*.

The setting must be entered at each station. If the station has several displays, the setting need only be made at one display.

- 1 Turn until **Neutral Beep** is shown in the settings menu.
- 2 Press the wheel to select **On** or **Off**.

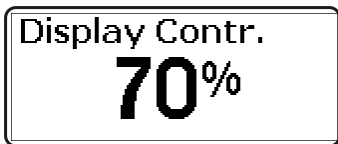


P0001031

Display Contrast

Adjusting the tachometer display contrast

- 1 Turn to **Display Contrast** in the settings menu. Press to reach the submenu.
- 2 Turn to adjust the contrast. Press the wheel to confirm the selection.



P0001030

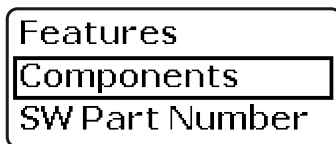
EVC Info

Information regarding accessories, components and software installed in the boat is displayed here.

- 1 Turn to **EVC About** in the settings menu and press the wheel to reach the submenu.



P0001020



P0001019

- 2 **Features** shows what accessories are installed. Press the wheel to access the submenu.
- 3 **Components** shows what hardware components are installed. Press the wheel to access the submenu.
- 4 **Software** shows what software is installed. Press the wheel to access the submenu.

Units

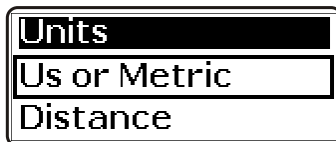
Setting operating information and trip data units.

- 1 Activate the station.
- 2 Turn until **Units** is shown in the settings menu. Press to reach the units menu.



P0001035

- 3 Turn to **US or Metric**; press the wheel and select US or Metric. Press the wheel to confirm the selection.
- 4 Turn to **Distance**; press the wheel and select km, Nm (nautical miles) or Miles. Press the wheel to confirm the selection.



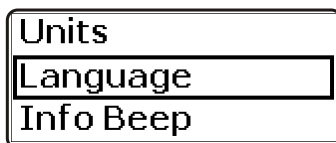
P0001036

Language

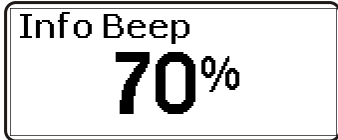
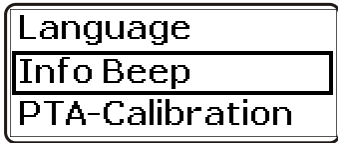
It is possible to select between 10 languages.

On boats with more than one station and with several displays language only need to be selected on one display for it to be shown at all stations and on all displays.

- 1 Activate the station.
- 2 Turn until **Language** is shown in the settings menu. Press to reach the language menu.
- 3 Turn to the desired language and press to confirm the selection. The display will return to the settings menu.



P0001037



P0001039

Information Beep

Adjusting the volume of the integral tachometer alarm.

- 1 Turn until **Info Beep** is shown in the settings menu. Press to access adjustment.
- 2 Turn to the desired volume. Press to confirm the selection; the setting will be confirmed by a beep at the set volume. The display will return to the settings menu.

Fuel Tank

There are two alternative methods for calibrating the level sensor in the fuel tank. **Full Fuel Tank Calibration** is an approximate method, while **Fuel Multipoint Calibration** provides more precise results. Multi-point calibration is a prerequisite if the trip computer is to show fully accurate information.

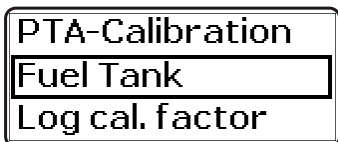
Fuel Multipoint Calibration

In order for multi-point calibration to be carried out, the fuel tank may not be filled to more than 20% of its total capacity.

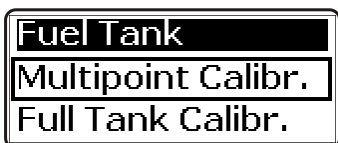
Calibration is carried out in 5 steps.

- POS 1, 20% full tank
- POS 2, 40% full tank
- POS 3, 60% full tank
- POS 4, 80% full tank
- POS 5, 100% full tank

- 1 Activate the station.
- 2 Turn to **Fuel Tank** in the settings menu and press to access the calibration menu.



P0001012



P0001011

- 3 Turn to **Multipoint Calibr.** and press the wheel.

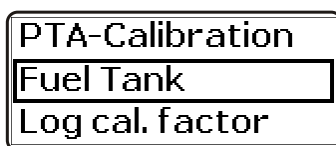


P0001010

- 4 Fill the tank with the quantity shown in the display, POS 1.
- 5 Fill the tank up to the level shown in the display, POS 2.
Press the wheel to confirm that the tank has been filled to the indicated level.
- 6 Repeat the procedure for POS 3 , POS 4 and POS 5. Confirm by pressing the wheel at each position.

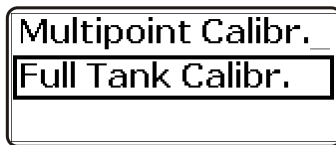
Full Fuel Tank Calibration

For this method the tank must be full and calibration of the fuel level sensor takes place in one step. This means that the fuel level value will be approximate, and therefore all trip data based on remaining fuel must be seen as approximate values.



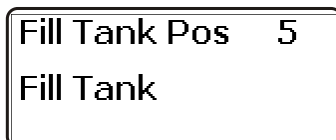
P0001012

- 1 Turn to **Fuel Tank** and press the wheel to reach the submenu.



P0001009

- 2 Turn to **Full Tank Calibr.** and press the wheel.



P0001034

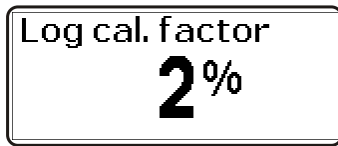
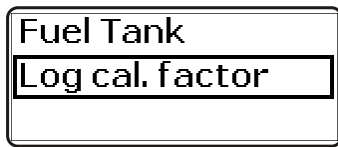
- 3 Fill the fuel tank. Confirm that the fuel tank is full by depressing the wheel.

Speed Factor

The speed factor must be set while the boat is under way. Compare the displayed boat speed value with GPS data (or another boat) and adjust the speed factor until the values agree.

On boats with more than one station and with several displays it is enough to enter the setting on one display for it to be shown at all stations and on all displays.

- 1 Activate the station.



P0001230

- 2 Turn to **Log cal. factor** in the settings menu and press to reach adjustment,
- 3 Turn the wheel to set the level. Press to confirm the selection.

Technical Data

Engines

Engine model	D12-650	D12-775
Crankshaft power* @ 2300 rpm	478 kW (641 hp)	496 kW (665 hp)
Max torque @ 1400 rpm	2600 Nm (1918 lbf.ft)	2600 Nm (1918 lbf.ft)
After market designation	D12D-E MP	D12D-E MP
No. of cylinders and configuration	in-line 6	in-line 6
Bore	131 mm (5.16")	131 mm (5.16")
Stroke	150 mm (5.91")	150 mm (5.91")
Displacement	12,13 dm ³ (740 in ³)	12,13 dm ³ (740 in ³)
Dry weight	1400 kg (3086 lbs)	1400 kg (3086 lbs)
Weight with reverse gear ZF325A-EB	1570 kg (3461 lbs)	1570 kg (3461 lbs)
Compression ratio	16,5:1	16,5:1
Low idle speed, rpm**	525 (±10)	525 (±10)

* According to ISO 8665.

** At delivery, the idle speed is adjusted to 520 rpm. If needed, the speed can be adjusted within the range 550–700 rpm.

Lubrication System

Oil capacity including oil filters, approx.:	
no engine inclination	44 liter (6.4 US gals)
engine inclination 8°	33 liter (4.8 US gals)
Oil pressure, hot engine:	
at normal running rpm	400–550 kPa (58.0–79.8 PSI)
at idling rpm	175 kPa (25.4 PSI)

Oil grade ¹⁾	Sulphur content in fuel, by weight		
	up to 0,5%	0,5–1,0%	more than 1,0% ²⁾
Oil change interval: Reached first in operation:			
VDS-3 VDS-2 and ACEA E7 ^{3), 4)} VDS-2 and Global DHD-1 ³⁾ VDS-2 and API CH-4 ³⁾ VDS-2 and API CI-4 ³⁾	400 hr. or 12 months	200 hr. or 12 months	100 hr. or 12 months
VDS and ACEA E3 ^{3), 5)} VDS and API CG-4 ^{3), 6)}	300 hr. or 12 months	150 hr. or 12 months	75 hr. or 12 months

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

- 1) Lowest recommended oil grade. Engine oil with higher oil grade is always possible to use.
- 2) If sulphur content is > 1.0% by weight, use oil with TBN > 15.
- 3) When oil quality specifications are joined by "and" the engine oil must fulfill **both** requirements.
- 4) ACEA E7 has replaced ACEA E5, but if available ACEA E5 can be used.
- 5) ACEA E3 can be replaced by ACEA E4, E5 or E7.
- 6) API CG-4 can be replaced by API CI-4.

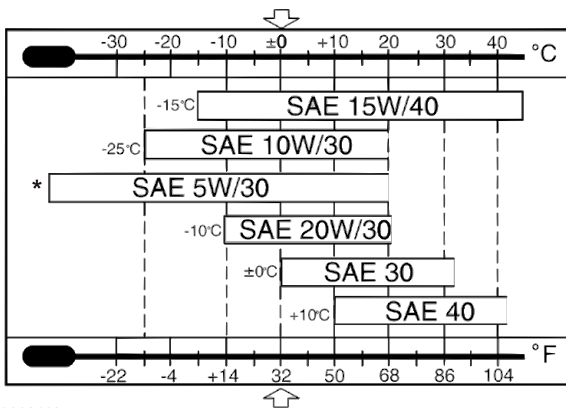
VDS = Volvo Drain Specification
ACEA = Association des Constructeurs Européenne d'Automobiles
API = American Petroleum Institute
TBN = Total Base Number
Global DHD = Globla Diesel Heavy Duty

Viscosity

Select the viscosity according to the table.

The temperature values refer to stable ambient temperatures.

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



P0002112

Fuel System

Fuel specification

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

EN 590 (with national environment 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

Freshwater system capacity including heat exchanger, approx. 60 liter (15.9 US gals).



P0002094

Water Quality

ASTM D4985:

Total solid particles	<340 ppm
Total hardness	<9,5° dH
Chloride	<40 ppm
Sulfate	<100 ppm
pH value	5,5–9
Silica (acc. ASTM D859)	<20 mg SiO ₂ /l
Iron (acc. ASTM D1068)	<0,10 ppm
Manganese (acc. ASTM D858)	<0,05 ppm
Conductivity (acc. ASTM D1125)	<500 µS/cm
Organic content, COD _{Mn} (acc. ISO8467)	<15 mg KMnO ₄ /l

Electrical System

System voltage	24V
AC generator,	
voltage/max. amperage	28V/60A
output, approx.	1700W
Alternative generator equipment (accessory):	
voltage/max. amperage	28V/100A
output, approx.	2800W
Alternative generator equipment (accessory):	
voltage/max. amperage	14V/130A
output, approx.	1820W
Battery capacity	2 connected in series 12V, max.152 Ah
Battery electrolyte density at +25°C (77°F):	
fully charged battery	1,28 g/cm ³ = 0.0462 lb/in ³ (1,24 g/cm ³ = 0.0448 lb/in ³)*
battery recharged at	1,24 g/cm ³ = 0.0448 lb/in ³ (1,20 g/cm ³ = 0.0434 lb/in ³)*

* Applies to batteries with tropical acid.

Reverse Gear

ZF

Type designation	325A-E	311A-E
Gear ratios	1,48:1; 1,73:1; 2,04:1	1,50:1; 1,76:1; 2,03:1
Angle (output shaft)	7°	7°
Oil capacity, approx.	7,5 liters (7.9 US quarts)	9 liters (9.5 US quarts)
Oil grade (in accordance with API-system)	CC, CD, CE	CC, CD, CE
Viscosity	SAE30*	SAE30*
Oil pressure during** operation	2,3–2,4 MPa (334–348 PSI)	2,3–2,4 MPa (334–348 PSI)
Weight, approx.	180 kg (397 lbs)	190 kg (419 lbs)

NOTICE! * Only **single grade** lubricating oil (only **one** viscosity number) may be used in the reverse gear.

Twin Disc

Type designation	MG5114SC
Oil capacity, approx.	13 liters (3,4 US gals)
Oil grade (in accordance with API-system)	CC, CD, CE
Viscosity at oil temperature 66–85°C (151–185°F)	SAE30*
Viscosity at oil temperature 85–100°C (185–212°F)	SAE40*
Oil pressure during** neutral	0,207–0,634 MPa (30.02–91.95 PSI)
Oil pressure during** operation	1,57–1,63 MPa (227.71–236.41 PSI)
Weight, approx.	213 kg (470 lbs)

* Only **single grade** lubricating oil (only **one** viscosity number) may be used in the reverse gear.

** At oil temperature 82°C (180°F) and 1800 rpm.

Identification Numbers

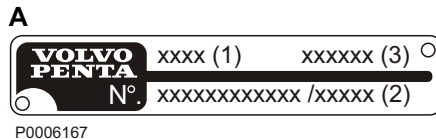
There are type plates on the engine and transmission, marked with identification numbers. This information must always be used as reference when service and spare parts are ordered. You will probably find similar plates on your boat and its equipment. Note this information below, make a copy of the page and store it in a safe place, so that you can have the information available if the boat is stolen.

The appearance and location of the type plates is shown below. The figures in brackets refer to the location of the identification number on the type plate.

Identification Numbers

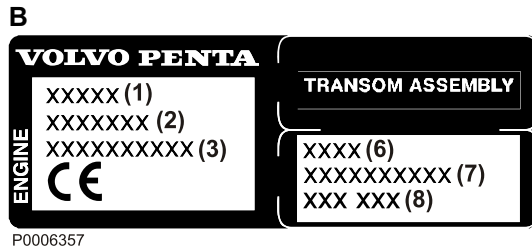
Engine: A och B

Product designation (1):
 Serial number (2):
 Product number (3):



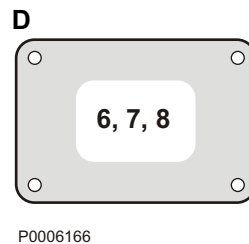
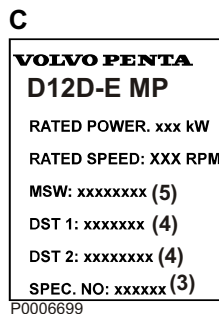
Control unit: C

Product number (3):
 Data set 1 (4):
 Data set 2 (4):
 Software (5):

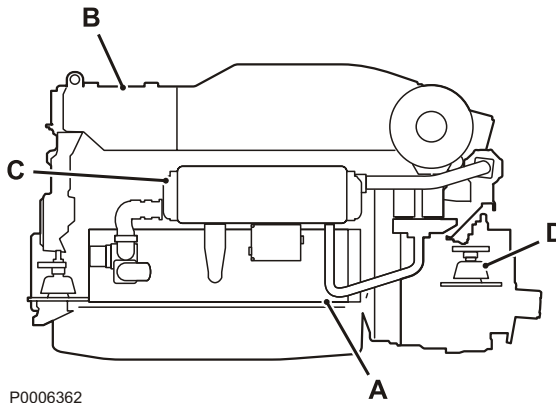


Transmission: D

Product designation (6):
 Serial number (7):
 Product number (8):



- A Identification marking
- B Engine- and transmission decall
- C Control unit decal
- D Reverse gear plate



VOLVO PENTA

Declaration of Conformity for Recreational Craft Propulsion Engines with the exhaust emission requirements of Directive 94/25/EC as amended by 2003/44/EC

D12D-E MP

Engine manufacturer:

AB Volvo Penta
Gropegårdsgatan
405 08 Göteborg
Sweden

Body for exhaust emission assessment:

Germanisher Lloyd
Vorsetzen 32/35
20459 Hamburg
Germany
ID Number:0098

Module used for exhaust emission assessment ... B +D

Other Community Directives applied EMC 89/336/EEC

Description of engine(s) and essential requirements

Engine Type 4 stroke diesel engine

Engine model(s) covered by this declaration EC Type certificate number

D12-650..... 31547-05-HH

D12-675..... 31547-05-HH

Essential requirements	Standards Used	Other normative document used
Annex I.B – Exhaust Emissions		
Engine identification	Volvo Penta std	Annex 1.B.1
Exhaust emission requirements	EN ISO 8178-1:1996	Annex 1.B.2
Durability	Volvo Penta std	Annex 1.B.3
Operator's manual	ISO 10240:2004	Annex 1.B.4
EMC Directive	EN 61000-3-2, EN 61000-3-3, CISPR 25	

This declaration of conformity is issued under the sole responsibility of the manufacturer. I declare on behalf of the engine manufacturer that the engine(s) will meet the requirements of above mentioned directives when installed in a recreational craft, in accordance with the engine manufacturer's supplied instructions and that this (these) engine(s) must not be put into service until the recreational craft into which it is (they are) to be installed has been declared in conformity with the relevant provisions of the above mentioned Directives.

Name and function: Sam Behrmann, Product Liability

(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title:

(or an equivalent marking)



Date and place of issue: (yr/month/day) 2008 /04/25 Göteborg

PL-75/08 issue 03

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