

OPERATOR'S MANUAL

D4, D6

ENG

This operator's manual is available in English.

Complete the form at the end of the operator's manual to order a copy.

GER

Diese Betriebsanleitung ist auch auf Deutsch erhältlich.

Ein Bestellcoupon ist am Ende der Betriebsanleitung zu finden.

FRE

Ce manuel d'instructions peut être commandé en français.

Vous trouverez un bon de commande à la fin du manuel d'instructions.

SPA

Este libro de instrucciones puede solicitarse en español.

El cupón de pedido se encuentra al final del libro.

SWE

Den här instruktionsboken kan beställas på svenska.

Beställningskupong finns i slutet av instruktionsboken.

ITA

Questo manuale d'istruzioni può essere ordinato in lingua italiana.

Il tagliando per l'ordinazione è riportato alla fine del manuale.

DUT

Dit instructieboek kan worden besteld in het Nederlands.

De bestelcoupon vindt u achter in het instructieboek.

DAN

Denne instruktionsbog kan bestilles på dansk.

Bestillingskupon findes i slutningen af instruktionsbogen.

FIN

Tämä ohjekirjan voi tilata myös suomenkielisenä.

Tilauskuponki on ohjekirjan lopussa.

POR

Este manual de instruções pode ser encomendado em português.

O talão de requerimento encontra-se no fim do manual.

GRE

Αυτό το εγχειρίδιο χρήσης διατίθεται στην αγγλική γλώσσα.

Για να παραγγείλετε ένα αντίτυπο, συμπληρώστε τη φόρμα που βρίσκεται στο τέλος αυτού του εγχειριδίου χρήσης.

RUS

This operator's manual is available in Turkish/Russian.

Complete the form at the end of the operator's manual to order a copy.

TUR

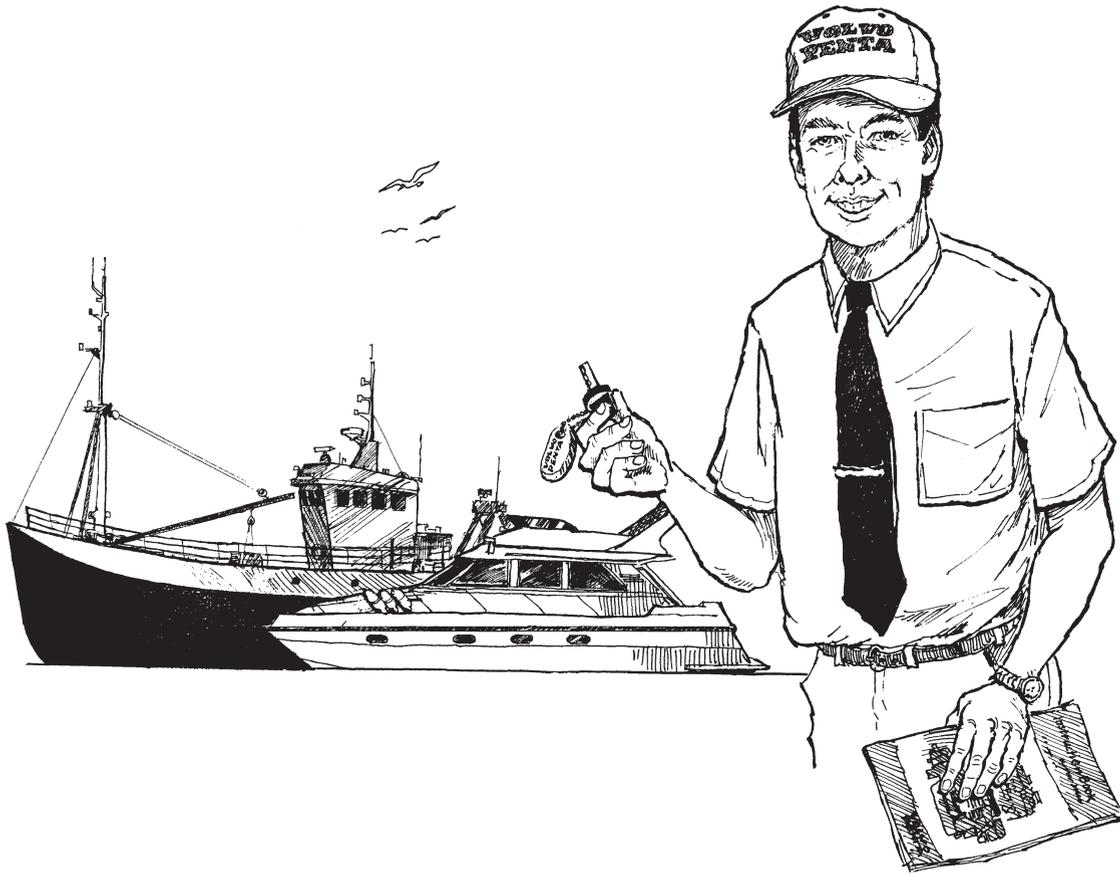
Bu kullanıçý el kitabý Türkçe dillerinde mevcuttur.

Birnişhasýný sipariş etmek için kullanıçý el kitabýnýn sonundaki formu doldurun.

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.



Welcome aboard

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. That's not surprising.

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 operation 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.

We also invite you to visit our home page on the Internet at www.volvopenta.com

With warm regards

AB VOLVO PENTA

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Safety Information

Read this chapter carefully. It concerns your safety. This section describes how safety information is presented in the operator's manual and on the engine. It also gives a general account of basic safety precautions to be taken when operating the boat and maintaining the engine.

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



If operations are performed incorrectly it could result in personal injury, or damage to property or the engine. Read the operator's manual carefully before operating or servicing the engine. If anything is unclear please contact your Volvo Penta dealer for assistance.

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

In the operator's manual warning texts have the following priority:

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

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

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

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

Safety precautions to be taken when operating the boat

Your new boat

Read operator's manuals and other information supplied with your new boat. Learn to operate the engine, controls and other equipment safely and correctly.

If this is your first boat, or is a boat type with which you are not familiar, we recommend that you practice controlling the boat in peace and quiet. Learn how the boat behaves at different speeds, weather conditions and loads before casting off for your "real" maiden voyage.

Remember that the person driving a boat is legally required to know and follow the current rules regarding traffic and safety at sea. Make sure you know the rules that apply to you and the waters you are sailing in by contacting the relevant authorities or organization.

A good piece of advice is to take a course in seamanship. We recommend that you contact your local boating organization to find a suitable course.

Accidents

Statistics show that poor maintenance of boats and engines and a lack of safety equipment are often the cause of accidents at sea.

Ensure that your boat is maintained in accordance with the relevant Instruction Manual and that the necessary safety equipment is on-board and is serviceable.

Daily checklist

Make a habit of checking the engine and engine compartment visually before operating the boat (**before the engine is started**) and after operating the boat (**after the engine has been stopped**). This will help you to quickly detect fuel, coolant or oil leaks and spot anything else unusual that has or is about to happen.

Maneuvering

Avoid violent and unexpected changes in course and gear engagement. This could cause someone on the boat to lose their balance and fall over or overboard.

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.

Avoid trimming an outboard drive too much, as steering will be severely reduced.

Refueling

When refueling there is always a danger of fire and explosion. Smoking is forbidden and the engine must be switched off.

Never overfill the tank. Close the fuel tank filler cap properly.

Only use the fuel recommended in the operator's manual. The wrong grade of fuel can cause operating problems or cause the engine to stop. On a diesel engine poor quality fuel can cause the control rod to seize and the engine to overrev with a resultant risk of damage to the engine and personal injury.

Do not start the engine

Do not start or run the engine with a suspected fuel or LPG leak in the boat, nor when you are close to or in a discharge of explosive media, etc. There is risk for fire and/or explosion in explosive surroundings.

Safety breaker

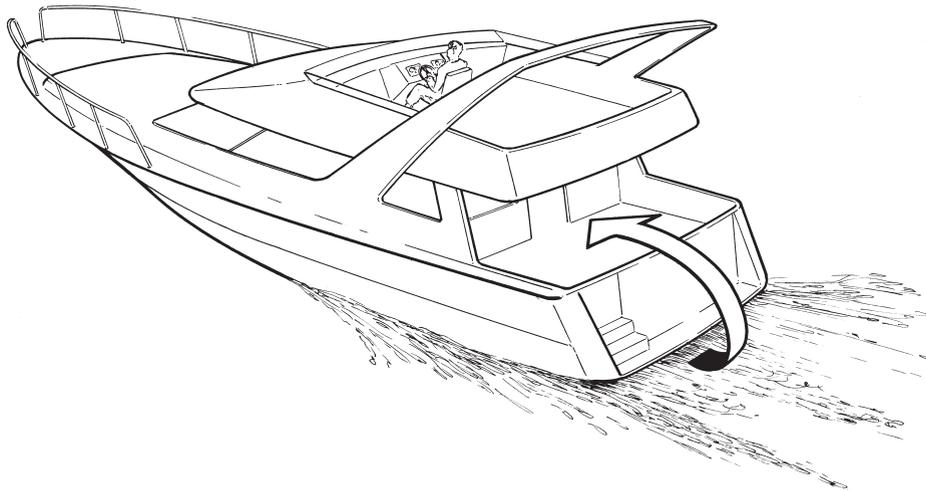
We recommend that you install and use a safety breaker (accessory), especially if you boat can travel at high speeds. The safety breaker stops the engine if the driver falls down and loses control over the boat.

⚠ Carbon monoxide poisoning

When a boat is moving forward, it will cause a certain vacuum to form behind the boat. In unfortunate circumstances, the suction from this vacuum can be so great that the exhaust gases from the boat are drawn into the cockpit or cabin and cause carbon monoxide poisoning.

This problem is most prevalent on high, wide boats with abrupt stern. In certain conditions, however, this suction can be a problem on other boats, e.g. when running with the cover up. Other factors that can increase the effect of the suction are wind conditions, load distribution, swells, trim, open hatches and portholes, etc.

Most modern boats, however, are designed in such a way that this problem is very rare. If suction should arise anyway, do not open hatches or portholes at the fore of the boat. Surprisingly, this will otherwise increase the suction. Try changing speed, trim or load distribution instead. Try taking down/opening or in any other way changing the setup of the cover as well. Get in touch with your boat dealer for help in obtaining the best solution for your boat.



⚠ Checklist

- Safety equipment Life jackets for all passengers, communication equipment, emergency rockets, approved fire extinguisher, first-aid equipment, life belt, anchor, paddle, torch etc.
- Replacement parts and tools: impeller, fuel filters, fuses, tape, hose clamps, engine oil, propeller and tools for any repairs that might have to be carried out.
- Get out your charts and go over the planned route. Calculate distance and fuel consumption. Listen to the weather reports
- Make sure that relations or contact persons are informed when planning a longer voyage. Remember to inform them if your plans have changed or been delayed.
- Tell your passengers and crew where the safety equipment is stored and how to operate it. Make sure you are not the only person on board who knows how to start the boat and operate it safely.

This list can be added to because safety equipment and other requirements vary depending on the type of boat and how it is used. We recommend that you contact your local boating organization for more detailed information on safety afloat.

Safety precautions for maintenance and service operations

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 that 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 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 ignition system (gasoline engines) and electrical systems on Volvo Penta products are designed and constructed to minimize the risk of fire and explosion.

Using non-original Volvo Penta parts can result in fire or explosion on board.

Batteries

The batteries contain and give off 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.

Incorrectly connection 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.

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 compiled to help you get the most from your Volvo Penta engine. It contains all the information you need in order to operate and maintain your engine safely and correctly. Please read the operator's manual carefully and learn how to operate the engine, controls and other equipment safely.

Always have the operator's manual available. Keep it in a safe place and do not forget to give it to the new owner if you sell your boat.

Care of the environment

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

As a manufacturer of marine engines, Volvo Penta has a special responsibility, why care of the environment is a core value in our product development. Today, Volvo Penta has a broad range of engines where progress has been made in reducing exhaust emissions, fuel consumption, engine noise, etc.

We hope you will take care in preserving these qualities. Always follow any advice given in the instruction manual concerning fuel grades, operation and maintenance and you will avoid causing unnecessary interference to the environment. Get in touch with your Volvo Penta dealer if you notice any changes such as increased fuel consumption exhaust smoke.

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

Our joint efforts will make a valuable contribution to our environment.

Running-in

The engine must be run in for its first 10 operating hours as follows: Operate the engine normally. Do not operate it at full load except for short periods. Never run the engine at a constant engine speed for long periods during the running-in period.

The engine can be expected to use more engine oil during the running-in period than would otherwise be normal. Check the oil level more often than is normally recommended.

A First Service Inspection must be carried out after 20–50 running hours. For further information: See the Warranty and Service Book.

Fuel and oils

Only use the fuel and oils recommended in the chapter Technical Data. Other grades of fuel and oil can cause operating problems, increased fuel consumption and, in the long-term, a shorter engine service life.

Always change oil, oil filters and fuel filters at the recommended intervals.

Service and replacement parts

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

The Volvo Penta worldwide network of authorized dealers are at your service. They are specialists in Volvo Penta products and have accessories and the original replacement parts, test equipment and special tools necessary for high quality service and repair work.

Always follow the maintenance intervals contained in the operator's manual. Remember to state the engine/transmission identification number when ordering service and replacement parts.

Certified engines

It is important to be aware of the following information if you own or run an engine that is exhaust emission certified:

Certification means that an engine type is inspected and approved by the authorities. The engine manufacturer guarantees that all engines manufactured of that type correspond to the certified engine.

This places special requirements for maintenance and service as follows:

- The maintenance and service intervals recommended by Volvo Penta must be observed.
- Only genuine Volvo Penta replacement parts may be used.
- The service of injection pumps and injectors or pump settings must always be carried out by an authorized Volvo Penta workshop.

- The engine must not be modified in any way except with accessories and service kits approved by Volvo Penta.
- No modifications to the exhaust pipes and air supply ducts for the engine may be undertaken.
- Seals may only be broken by authorized personnel.

Otherwise the general instructions contained in the Operator's Manual concerning operation, service and maintenance must be followed.

⚠ IMPORTANT! Late or inadequate maintenance/service or the use of spare parts other than Volvo Penta original spare parts 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.



Warranty

Your new Volvo Penta marine engine is covered by a limited warranty according to the conditions and instructions contained in the Warranty and Service book.

Note that AB Volvo Penta's liability is limited to that contained in the Warranty and Service Book. Read this book as soon as you take delivery of the engine. It contains important information about warranty cards, service and maintenance which you, the owner, must be aware of, check and carry out. Liability covered in the warranty may otherwise be refused by AB Volvo Penta.

Contact your Volvo Penta dealer if you have not received a Warranty and Service Book and a customer copy of the warranty card.

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

D4, D6

Engine manufacturer:

AB Volvo Penta
Gropegårdsgatan
405 08 Göteborg
Sweden

Body for exhaust emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number:0609

Module used for exhaust emission assessmentB+C

Other Community Directives appliedEMC 89/336/EEC

Description of engine(s) and essential requirements

Engine type.....4 stroke diesel engine with stern drive with integral exhaust

| Engine model(s) covered by this declaration | EC Type certificate number |
|---|----------------------------|
| D4-180..... | EXVOLV001 |
| D4-210..... | EXVOLV001 |
| D4-225..... | EXVOLV001 |
| D4-260..... | EXVOLV001 |
| D4-300..... | EXVOLV001 |
| D6-280..... | EXVOLV001 |
| D6-310..... | EXVOLV001 |
| D6-330..... | EXVOLV001 |
| D6-350..... | EXVOLV001 |
| D6-370..... | EXVOLV001 |
| D6-435..... | EXVOLV001 |

| 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) mentioned above comply with all applicable essential requirements in the way specified and is in conformity with the type for which above mentioned EC type examination certificate(s) has been issued.

Name and function: Sam Behrmann, Laws and Regulations
(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) 2007/04/26 Göteborg

PL-99/07

VOLVO PENTA

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

D4, D6

Engine manufacturer:

AB Volvo Penta
Gropegårdsgatan
405 08 Göteborg
Sweden

Body for sound emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number:0609

Module used for sound emission assessment Aa

Internal production control
Test according to Annex VI

Other Community Directives appliedEMC 89/336/EEC

Description of engine(s) and essential requirements

Engine type..... 4 stroke diesel engine with stern drive with integral exhaust

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

| | |
|---------------------------|-----------|
| D4-210 drive DPH | SDVOLF002 |
| D4-225 drive DPH | SDVOLF002 |
| D4-260 drive DPH | SDVOLF002 |
| D4-300 drive DPH | SDVOLF002 |
| D6-280 drive DPH | SDVOLF003 |
| D6-310 drive DPR/DPH..... | SDVOLF003 |
| D6-330 drive DPR/DPH..... | SDVOLF003 |
| D6-350 drive DPR/DPH..... | SDVOLF003 |
| D6-370 drive DPR/DPH..... | SDVOLF003 |

| Essential requirements | Standards Used | Other normative document used |
|------------------------------------|--|-------------------------------|
| Annex I.C – Noise Emissions | | |
| Sound emission levels | EN ISO 14509:2000/ prA1:2004 | Annex 1.C.1 |
| Operator's manual | ISO 10240:2004 | Annex 1.C.2 |
| 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) mentioned above comply(ies) with all applicable essential requirements in the way specified and is in conformity with the type for which above mentioned EC type examination certificate(s) has been issued.

Name and function: Sam Behrmann, Laws and Regulations
(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) 2007/04/26 Göteborg

PL-100/07

Identification numbers

Always provide the engine and transmission identification numbers when ordering service or replacement components.

The identification numbers are on an information decal located on the front edge of the engine. Note the information below. Make a copy of the page. Store the information so that it is available in event of the boat being stolen.

Engine

Product designation (1*)

Serial number (2*)

Product number (3*)



Drive/Reverse gear

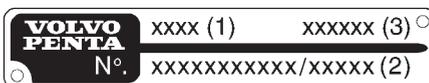
Product designation (4*)

Gear ratio (5*)

Serial number (6*)

Product number (7*)

Warranty decal
(Engine/Transom shield/Drive/Reverse gear)

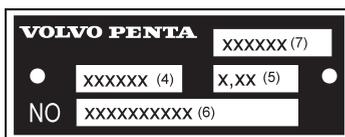


Shield (Drive)

Product designation (8*)

Serial number (9*)

Product number (10*)



Drive plate

Transom shield plate

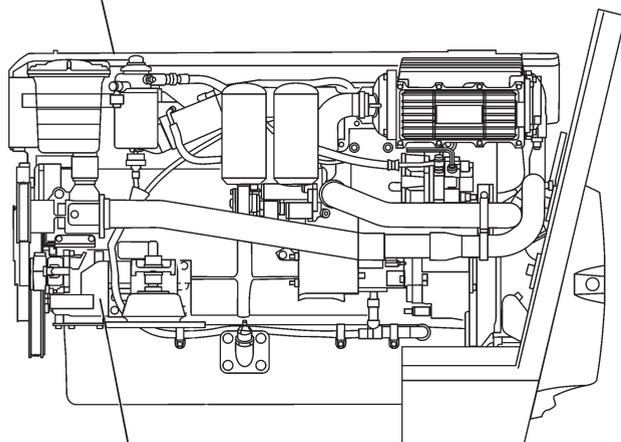
* The numbers refer to the position of the identification numbers on the information decal



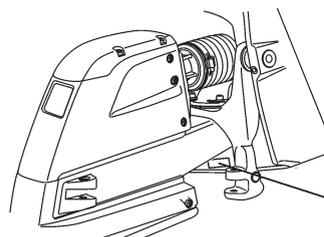
Reverse gear plate

Location of information decal and identification plates:

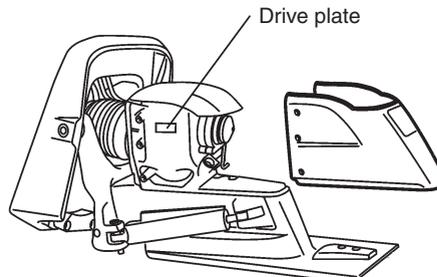
Warranty decal, IMO decal and EPA decal



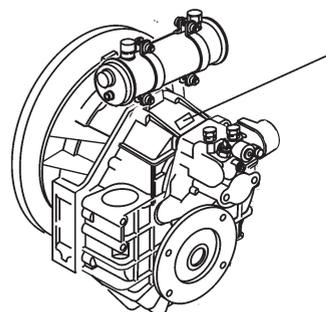
Engine plate



Transom shield plate



Drive plate



Reverse gear plate

Presentation

Volvo Penta's D4 and D6 is developed from the latest design in modern diesel technology. The engine has common rail fuel injection system, double overhead camshafts, 4 valves per cylinder, turbocharger, compressor, and aftercooler. The interaction of these, the large swept volume, and the EVC system results in exceptional diesel performance combined with low emissions.

Technical description:

Engine block and head

- Cylinder block and cylinder head made of cast-iron
- Combined ladder frame and balance shafts (D4)
- Ladder frame fitted to engine block (D6)
- Double overhead camshafts
- Oil-cooled pistons with two compression rings and one oil scraper ring
- Integrated cylinder liners
- Replaceable valve seats
- Seven-bearing crankshaft
- Rear-end transmission

Engine mounting

- Flexible engine mounting

Lubrication system

- Easily replaceable separate full-flow and by-pass oil filter
- Seawater-cooled tubular oil cooler

Fuel system

- Common rail fuel injection system
- Control unit for processing the injection
- Fine filter with water separator
- Emergency stop device

Air inlet and exhaust system

- Belt-driven compressor with silencer of absorption type on both inlet and output port
- Air filter with replaceable insert
- Crankcase gases vented into the air inlet
- Exhaust elbow or exhaust riser
- Freshwater-cooled turbocharger

Cooling system

- Thermostatically regulated freshwater cooling
- Tubular heat exchanger with separate large volume expansion tank
- Coolant system prepared for hot water outlet
- Seawater strainer and easily accessible impeller pump

Electrical system

- 12V/24V two-pole electrical system
- 115A/80A marine alternator with Zener-diodes to protect the system from peak voltage, and integrated charging regulator with battery sensor cable for maximum use of alternator
- Fuses with automatic reset

Instruments/control

- Complete instrumentation including key switch and interlocked alarm
- Digital Power trim instrument with analog or digital reading
- EVC monitoring panels for single or twin installations
- Electronic remote control for throttle and shift
- Plug-in connections

Drive

- Complete with transom shield, and installation components
- Max tilt angle 50° (adjustable)
- Protective zinc anodes to prevent corrosion
- Built-in kick-up function to reduce possible damage, in the event the drive strikes an underwater object
- Electrical shifting performed by electronic actuator
- Power trim with one-button operation in twin installation
- Fully integrated water inlet and exhaust system
- Fully hydraulic power-assisted steering system
- Isolated propellers to prevent corrosion

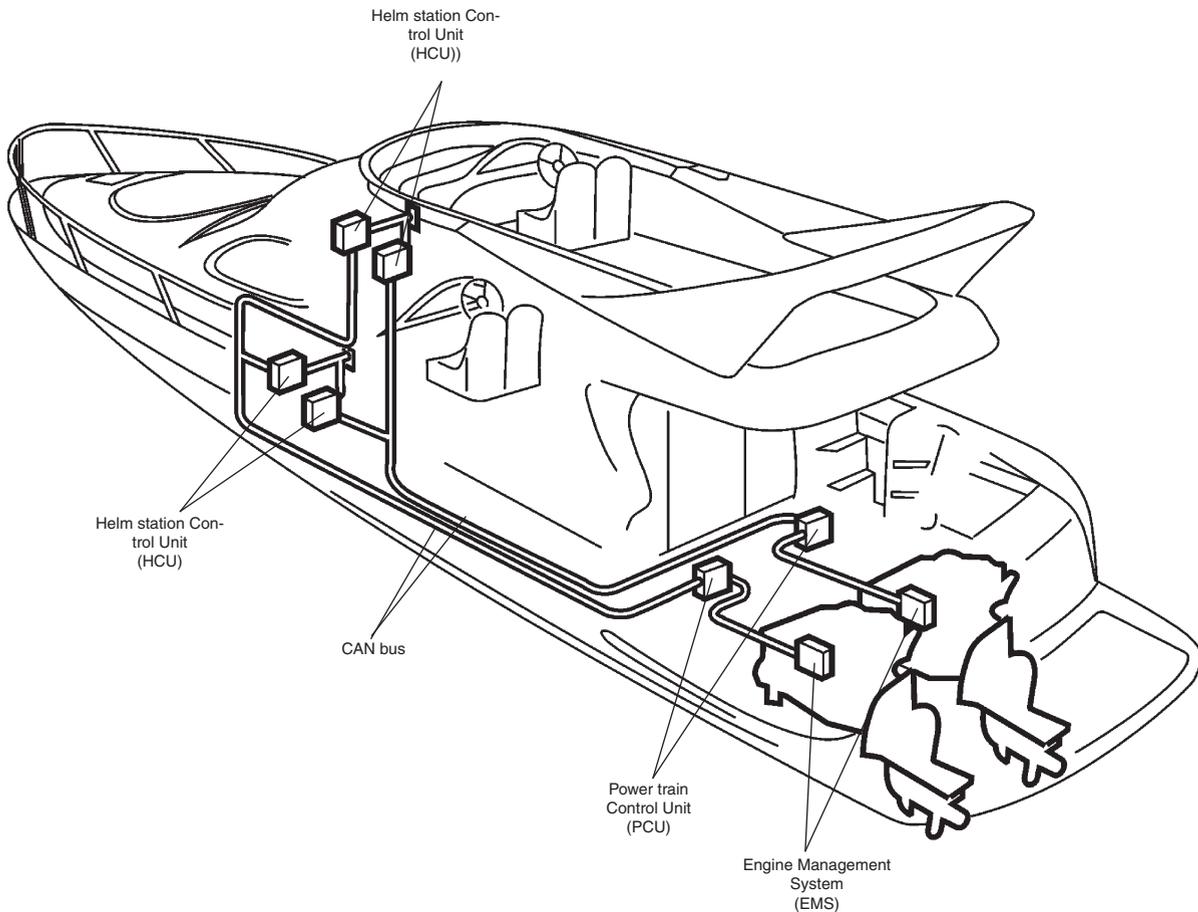
Reverse gear

- Reverse gear with matched drop center and 8° down angle for compact installation and minimum propeller shaft angle. V-drive available
- Bevel gears which results in smooth running at all speeds
- Hydraulically operated clutch for smooth shifting
- Electrical shifting performed by electromagnetic valves.
- When under sail propeller shaft can rotate 24 hours without engine start.
- Seawater-cooled oilcooler

Accessories

- An extensive range of accessories are available. For detailed information, please see Accessory catalogs.

Engine Management and EVC system



Engine Management System

The engines are equipped with common rail system and electronically controlled injectors with an electronic control module.

The injectors contain an electro-magnetic valve which sets the amount of fuel injected and the correct timing. The monitoring system measures the charge air pressure and temperature, and calculates the available air mass. This determines the maximum amount of fuel that can be injected (smoke limiter function).

The system also limits the maximum torque available at the engine speed registered to protect the engine from overload.

To protect the engine at too high coolant or charge air temperatures and boost pressure as well as oil pressure the monitoring system reduces the amount of fuel (reduced engine output) until the current values normalises.

The engine monitoring system also has a diagnostic system, which helps users and service technicians to determine the cause of malfunctions.

Users get information about faults by pop-ups that are shown on the EVC system tachometer display.

The EVC system

The Electronic Vessel Control (EVC) system is a so called distributed system. The principle of a distributed system is to have many small electronic units, called nodes, located on suitable places in the boat.

The EVC nodes are the Powertrain Control Unit (PCU) and the Helm station Control Unit (HCU). Nodes are located close to the components they control. A helm node is located close to the helm. A powertrain node is mounted in the engine room.

Each node controls a number of adjacent components, for example sensors, controls, instruments and actuators.

Each PCU and HCU is programmed for a specific engine individual. On the PCU and HCU there is a sticker with chassis no. The chassis no. shall correspond to the sticker on the engine.

A data bus, a CAN bus, connects the nodes to each other. Together they form a network and exchange information and take advantage of each others' services. The principle of forming a network of nodes to which all components are connected reduces wiring radically.

CAN stands for Controller Area Network, an industry standard for communication between nodes in distributed systems.

A distributed system supports a growing multiplicity of system configurations and optional features. New nodes can be connected to the network with minimal wiring redesign. New effective functionality can be created by letting the nodes interact and combine their capabilities, creating a more useful and safe product.

Functionalities

Engine speed and gear shift

Speed and gear shift control is handled electronically. The reverse gear or stern drive has high speed shifting protection. Dual function electronic controls works in the EVC system as well as mechanical controls with control adapters.

Engine synchronization

Engine synchronization results in better comfort, good fuel economy and minimized wear due to less vibration and reduced noise level. To enable synchronization the master (port) and slave (starboard) systems must be able to communicate. Therefore a synchronization cable has to be installed at the each helm.

Instrumentation

The instruments use a serial communication bus. The serial communication bus in combination with EVC radically reduces wiring and simplifies installation.

Gauges are available with white or black dial face and chromed or black bezel.

EVC system tachometer

The EVC system tachometer is mandatory for boats with EVC, unless the optional EVC system display is installed. The tachometer display shows operation information, information messages and alarms. The user selects what operation information to display with the control panel. **NOTE!** Only one operation information can be displayed at one and the same time.

The EVC system tachometer and control panel is also used when calibrating EVC functions.

Power Trim

The function is considerably improved compared to non EVC governed Power trim systems. EVC introduces a new trim panel with the same design as other EVC control panels. If you have a twin engine installation the stern drives can be both individually and simultaneously controlled.

Trimming in and out can be calibrated to suit the specific installation. To protect the drive it cannot be tilted when engine is running above a certain rpm.

The Power trim control panel shall be connected to the multilink bus and the gauge to the instrument cable harness from the HCU. The cable harness for stern drives has connectors for the power trim angle sensor and the power trim pump.

Extra optional equipment

EVC system display

The EVC system display is a complement or replacement for EVC system tachometer and optional instruments. The display shows operation information, information messages and alarms. The user selects what operation information to display with the buttons on the display. The EVC system display can display more than one operation information at one and the same time. The display also has access to the same display mode and calibration functions as for the EVC system tachometer display.

Trim indicator

A trim indicator sender is included in all aquamatic drives. The trim angle can be displayed on the EVC system tachometer. It is also advised to install a trim instrument. The instrument shows trim angle and trim range. If a trim instrument is used it must be connected to the instrument serial communication bus.

Fuel level

Fuel level can be displayed on the EVC system tachometer if a (3-180 ohm or 240-30 ohm) fuel level sender is installed in the fuel tank. The sender is connected to the PCU-engine cable harness. If a fuel level gauge is used it must be connected to the instrument serial communication bus.

Fresh water level

Fresh water level can be displayed on the EVC system tachometer if a (3-180 ohm) fuel level sender is installed in the water tank. The sender is connected to the PCU–engine cable harness. If a fresh water level gauge is used it must be connected to the instrument serial communication bus.

Rudder indicator

Rudder angle can be displayed on the EVC system tachometer if a (3-180 ohm) rudder indicator is installed to the drive/rudder. The sender is connected to the PCU–engine cable harness. If a rudder instrument is used it must be connected to the instrument serial communication bus.

Multisensor (Boat speed, depth and water temp)

Boat speed, depth and water temperature can be displayed on the EVC system tachometer if a multi sensor is installed on the boat. The sensor is connected to the multilink cable. If instruments (speed, depth, water temp.) are used they must be connected to the instrument serial communication bus.

Power Trim Assistant

The function power trim assistant adjust trim angle automatically according to engine speed (rpm). EVC supports power trim assistant if software for power-trim assistance is installed (order and download from VODIA website).

Boat speed

Boat speed can be shown on the EVC system tachometer, if a multisensor or NMEA 0183/NMEA 2000 compatible component (plotter, GPS, paddle wheel etc) is installed. If a speedometer is used it must be connected to the instrument serial communication bus. .

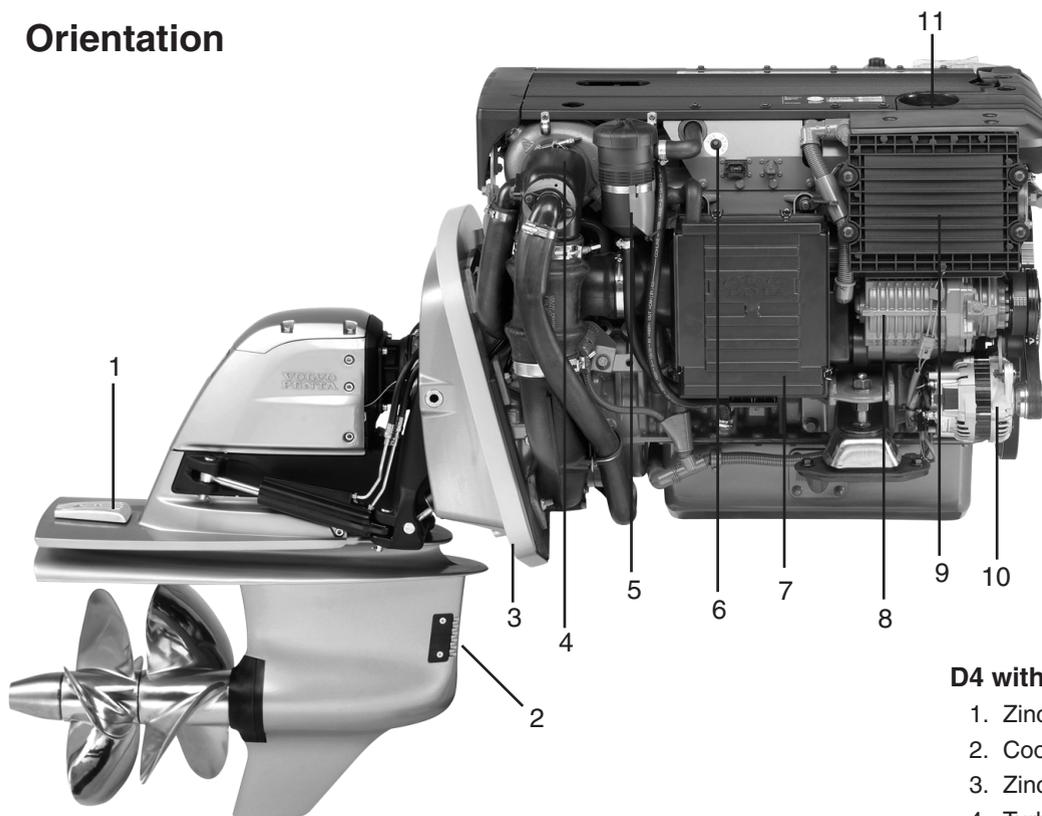
Trip computer

EVC supports trip computer functions if following are installed.

- Multisensor or NMEA 0183/NMEA 2000 compatible component (plotter, GPS, paddle wheel etc)
- Fuel level sender
- Software for trip computer (order and download from VODIA website).

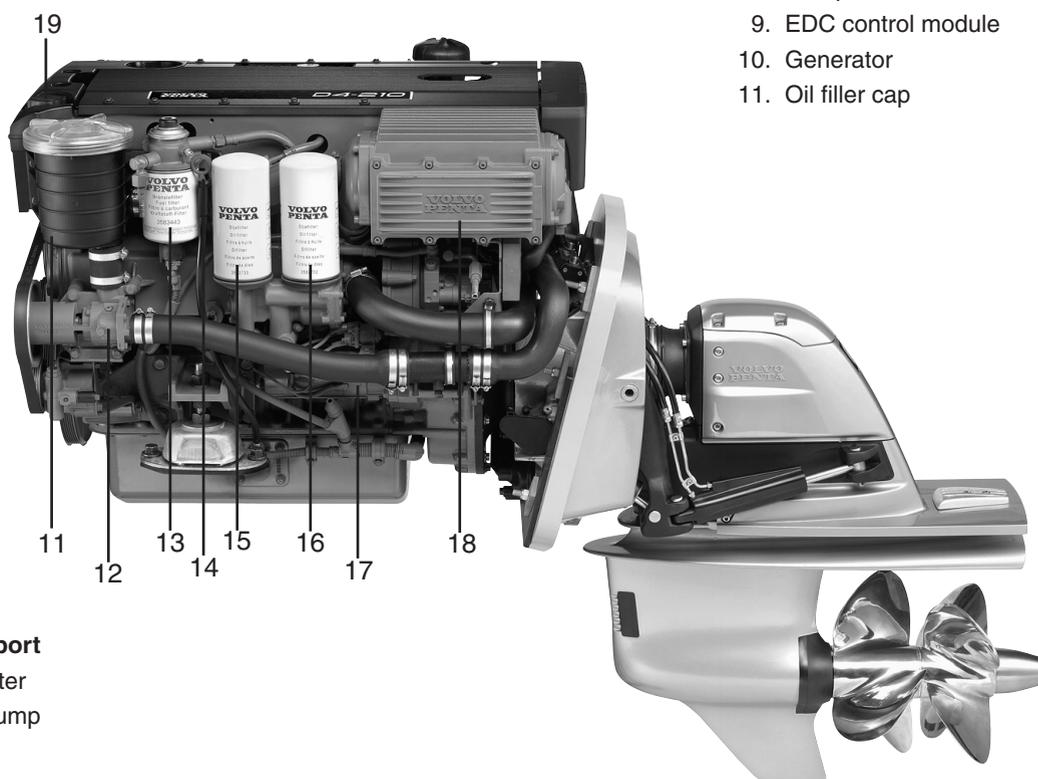
Trip computer information can be displayed on the EVC system tachometer or/and on the optional EVC system display.

Orientation



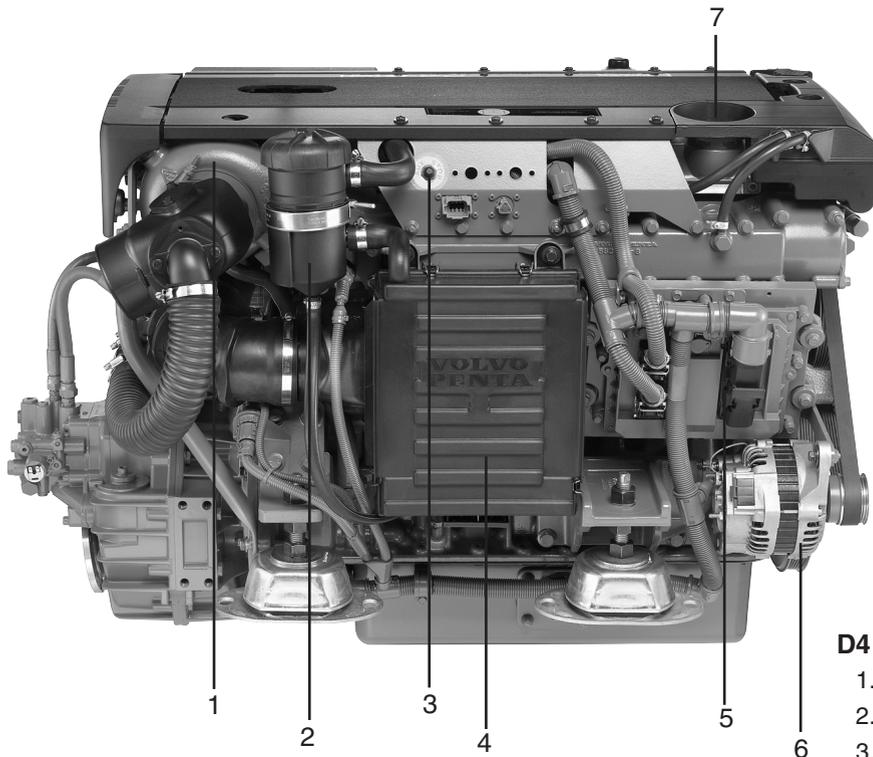
D4 with drive, starboard

1. Zinc anode
2. Cooling water intake
3. Zinc anode
4. Turbocharger
5. Crankcase ventilation filter
6. Aux Stop
7. Air filter
8. Compressor
9. EDC control module
10. Generator
11. Oil filler cap



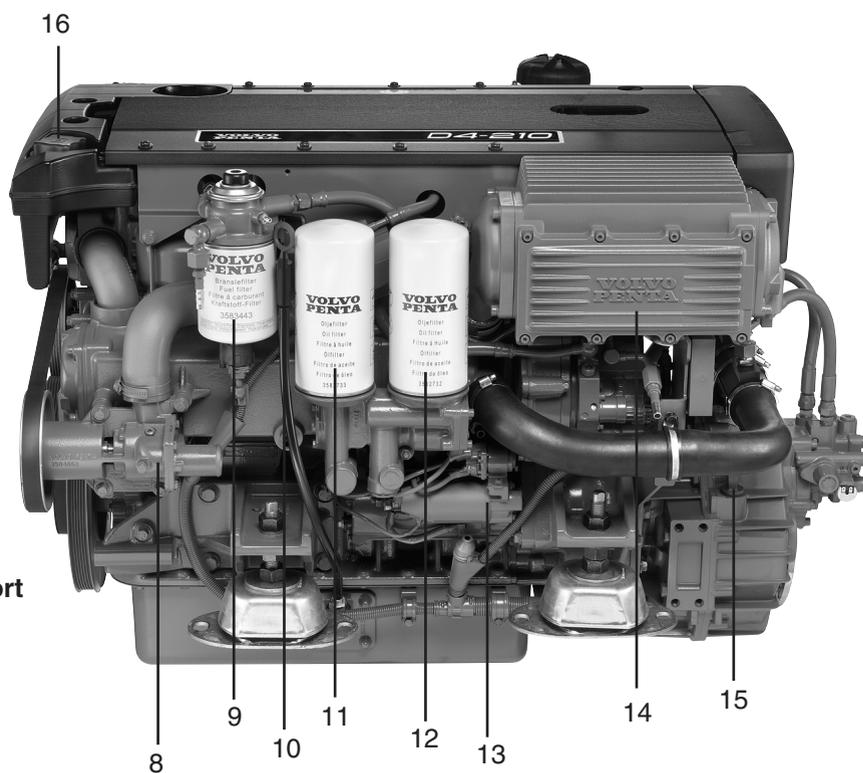
D4 with drive, port

11. Sea water filter
12. Sea water pump
13. Fuel filter
14. Oil dipstick
15. Oil bypass filter
16. Oil filter
17. Starter
18. Charge air cooler
19. Expansion tank



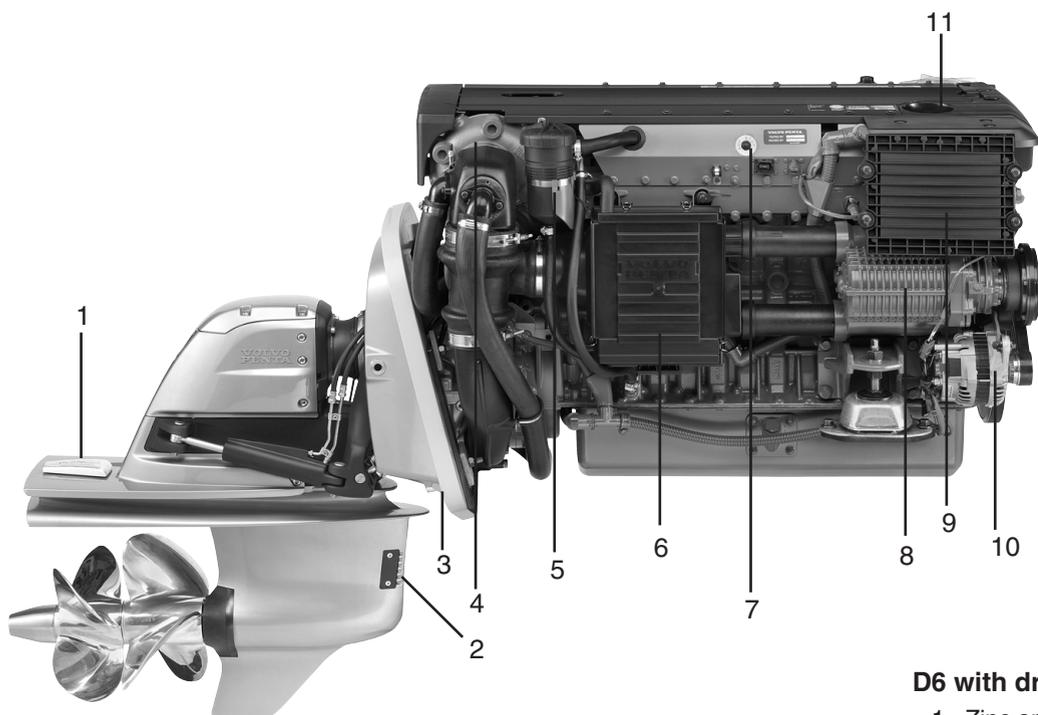
D4 with reverse gear, starboard

- 1. Turbocharger
- 2. Crankcase ventilation filter
- 3. Aux Stop
- 4. Air filter
- 5. EDC control module
- 6. Generator
- 7. Oil filler cap



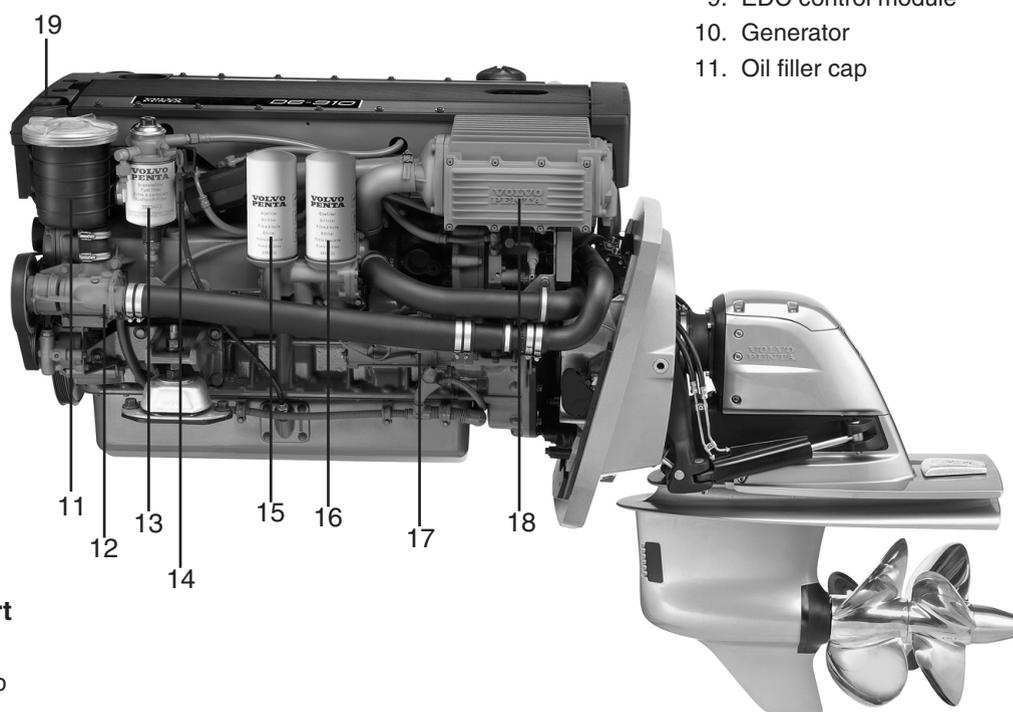
D4 with reverse gear, port

- 8. Sea water pump
- 9. Fuel filter
- 10. Oil dipstick (engine)
- 11. Oil bypass filter
- 12. Oil filter
- 13. Starter
- 14. Charge air cooler
- 15. Oil dipstick (reverse gear)
- 16. Expansion tank



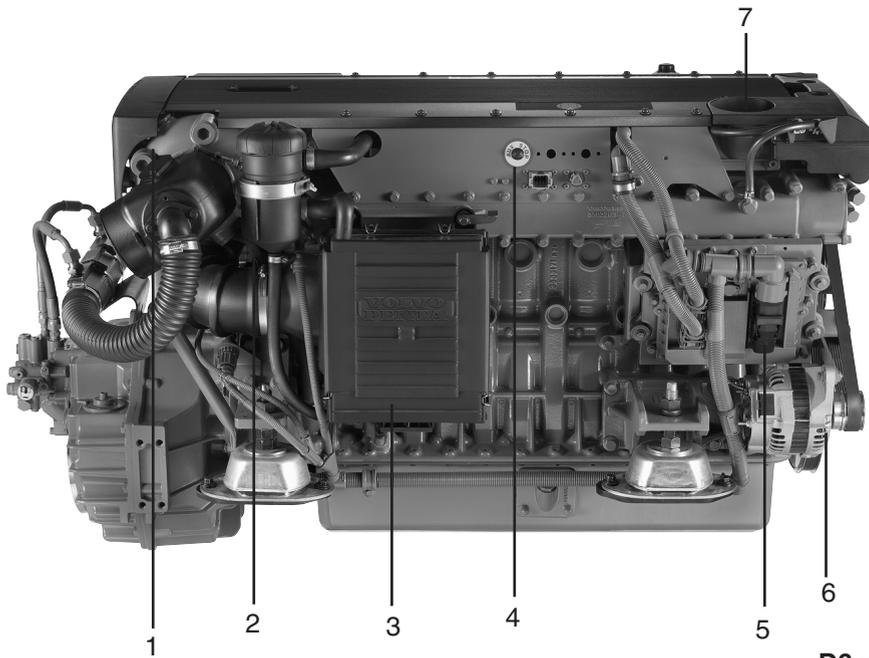
D6 with drive, starboard

- 1. Zinc anode
- 2. Cooling water intake
- 3. Zinc anode
- 4. Turbocharger
- 5. Crankcase ventilation filter
- 6. Aux Stop
- 7. Air filter
- 8. Compressor
- 9. EDC control module
- 10. Generator
- 11. Oil filler cap



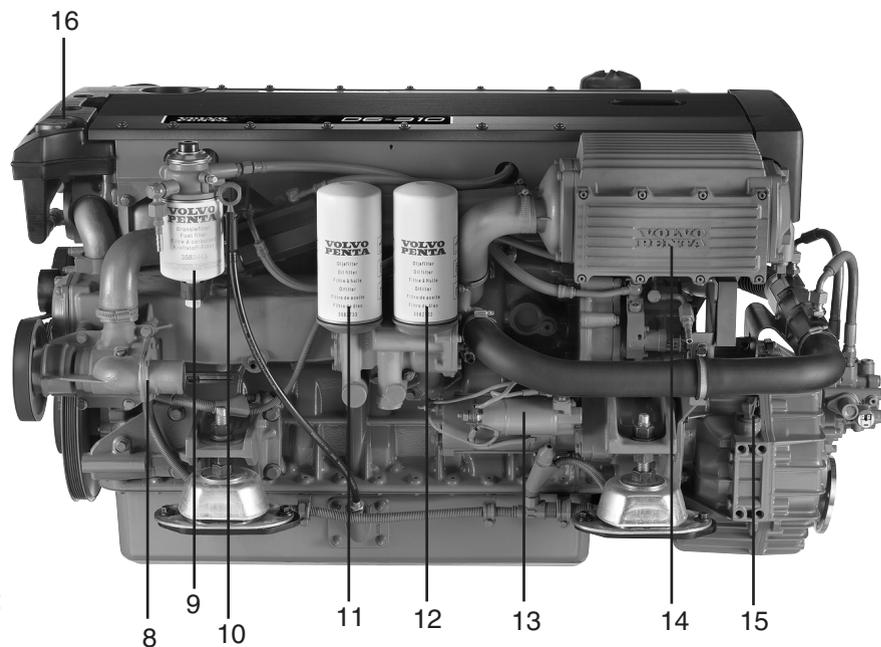
D6 with drive, port

- 11. Sea water filter
- 12. Sea water pump
- 13. Fuel filter
- 14. Oil dipstick
- 15. Oil bypass filter
- 16. Oil filter
- 17. Starter
- 18. Charge air cooler



D6 with reverse gear, starboard

- 1. Turbocharger
- 2. Crankcase ventilation filter
- 3. Air filter
- 4. Aux Stop
- 5. EDC control module
- 6. Generator
- 7. Oil filler cap



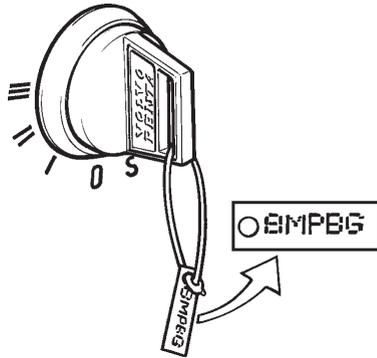
D6 with reverse gear, port

- 8. Sea water pump
- 9. Fuel filter
- 10. Oil dipstick (engine)
- 11. Oil bypass filter
- 12. Oil filter
- 13. Starter
- 14. Charge air cooler
- 15. Oil dipstick (reverse gear)
- 16. Expansion tank

Instruments

This chapter describes the instrument and control panels sold by Volvo Penta for your engine.

If you want to supplement the instrumentation, or if your boat is equipped with instruments not described here, or you are not sure about their function, please contact your Volvo Penta dealer.



Ignition lock

A tab with the key code accompanies the ignition keys, and is used to order extra ignition keys. Do **not** store the code where it is accessible to unauthorized persons.

S = Stop position.

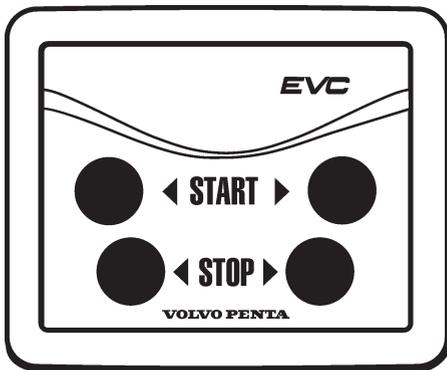
0 = Key can be inserted and removed.

I = System voltage on (drive position).

II = Not used.

III = Start position.

⚠ IMPORTANT! Read the starting instructions in the “Engine starting” chapter.



Start/stop panel

The start/stop panel is used to start or stop the engine. The starter key on the main helm station must be in position “I” (driving position) for the engine to start. The engine can only be stopped if the control panel is activated.

⚠ IMPORTANT! Read the starting instructions in the “Engine starting” chapter.

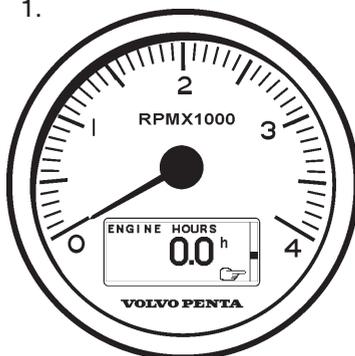
Instruments

1. EVC system tachometer (with display)

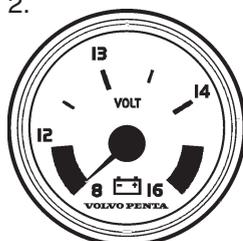
Extra optional instruments

2. Voltmeter
3. Oil pressure gauge
4. Temperature gauge
5. Rudder indicator
6. Fuel level gauge
7. Water level gauge
8. Trim instrument

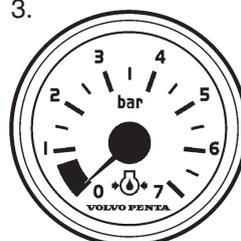
1.



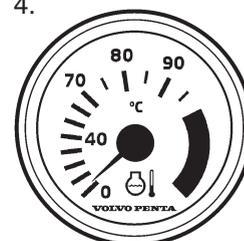
2.



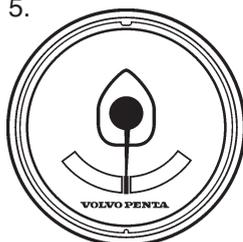
3.



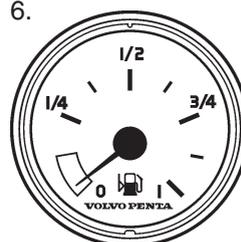
4.



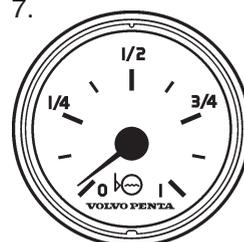
5.



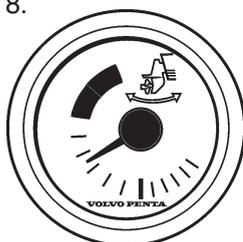
6.



7.



8.



Alarm display (extra optional)

The following warning lamps should never light up during operation. On the other hand, the warning lamps light up when the starter key is first turned to the drive position. Check that all lamps function. When the engine has started, all lamps should have gone out. The lamps flash if the diagnostic function has registered malfunction. When the fault has been acknowledged, the lamp gives continuous light.



Warning lamps (should never light up during operation).

Oil pressure (red indication)



If the oil pressure lamp lights up during operation, the oil pressure in the engine is too low. Stop the engine at once.

- Check the oil level in the engine. Please refer to “Maintenance: Lubrication” to check and top the oil up.
- Also check that the oil filters are not blocked. Please refer to “Maintenance: Lubrication system”

Please refer to the “In case of emergency” chapter, and you will find detailed information about recommended action in the “Diagnostic function” section.

⚠ WARNING! Continued operation when the oil pressure is too low can cause serious engine damage.

Water in fuel filter (orange indication)



If the lamp lights up, there is too much water in the water trap in the fuel filters.

- Empty the water trap underneath the fuel filter on the engine and pre filters. Please refer to “Maintenance: Fuel system”.



Battery (orange indication) 

The battery lamp lights up if the alternator is not charging. Stop the engine if this lamp lights up during operation. If the lamp lights up, this can be due to a fault in the electrical system or because the alternator drive belt is slack.

- Check the alternator drive belts. Please refer to “Maintenance: Engine, general”.
- Also check that there is no poor contact/broken wires.

 **WARNING!** Do not continue operation if there is any problem with the alternator drive belts. This could cause serious engine damage.

Coolant temperature (red indication) 

The coolant temperature lamp lights up when the coolant temperature is too high. Stop the engine if this lamp lights up during operation.

- Check the coolant level. Please refer to “Maintenance: Fresh water system”.
- Check that the sea water filter is not blocked. Please refer to “Maintenance: Sea water system”
- Also check the impeller in the sea water pump. Please refer to “Maintenance: Sea water system”.

Please refer to the “In case of emergency” chapter, and you will find detailed information about recommended action in the “Diagnostic function” section.

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

Coolant level (orange indication)

The coolant lamp lights up when the coolant level is too low.

- Check coolant level. Please refer to “Maintenance: Fresh water system”.

**Red warning indication, serious fault**

If the red warning indication is shown during operation, a serious fault has occurred.

Please refer to the “In case of emergency” chapter, and you will find detailed information about recommended action in the “Diagnostic function” section.

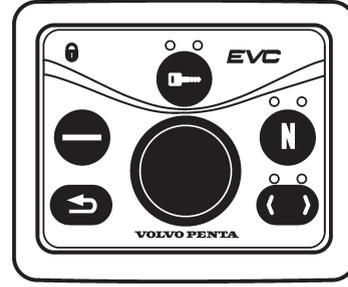
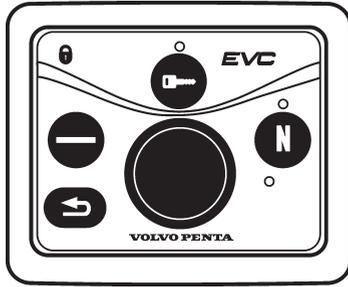
Orange alarm indication, fault

If the orange alarm indication is shown during operation, a fault has occurred.

Please refer to the “In case of emergency” chapter, and you will find detailed information about recommended action in the “Diagnostic function” section.

EVC control panel

The control panel is used in combination with the EVC system tachometer. The tachometer display shows operating information and menus that can be navigated from the control panel.



Activation button

Used to activate and lock the control panel and the helm station.

Indication (red):

Off: Control panel not activated.

Lit: Control panel activated.

Flashes: Control panel not activated due to the control lever not being in neutral or the system has been locked from another control panel.

Padlock

The padlock symbol lights if the control panel is locked manually by depressing the -button, or if exchange has been activated by routine "Change of control panel during journey".

Lit: The system is locked and the engine can only be controlled from the activated control panel.

Neutral button

Used to disengage the drive/reverse gear so that the engine speed can be increased without driving (warming up mode).

Indication (green):

Off: Drive/reverse gear engaged.

Lit: Control lever in neutral.

Flashes: Drive/reverse gear disengaged or system in calibration mode.

This button is also used for:

- Activation of the Volvo Penta Lowspeed/Trolling function (optional). For more information please refer to chapter "Operation" section "Volvo Penta Lowspeed/Trolling".

- Enabling of emergency trimming. For more information please refer to chapter "In case of emergency: Emergency trimming".

Navigation wheel

Used to navigate through the menus shown on the tachometer EVC system display. Navigate through the menus by turning the wheel. Depress the wheel to confirm a selection.

Tachometer display selection (twin installation, port or starboard tachometer)

Is used to select which of the engines menu systems should be navigable from the control panel. The menu is shown on the display of the corresponding engines tachometer. Select port or starboard.

Indication (red/green):

Off: Not possible to navigate in menu.

Lit: Possible to navigate in menu for selected engine, port (red), starboard (green).

Multifunction button

Used to increase or decrease the instrument's and panel's backlighting.

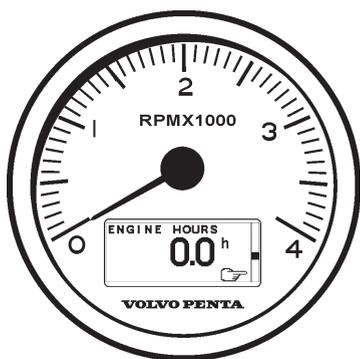
Depress the button for at least 1 second to turn the backlighting on or off. The backlighting can be adjusted in five stages by pressing the multifunction button.

If the button is pressed on an inactive control panel, operating information is shown on the display(s) and it is possible to navigate in the menus.

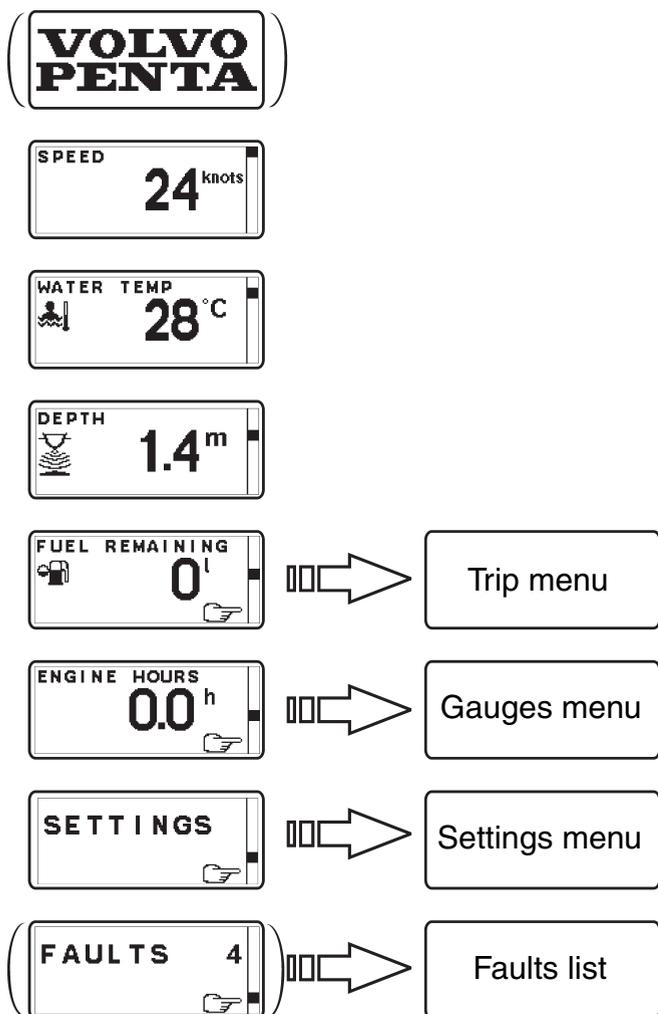
Back button

Used to back a step in the menu.

 **IMPORTANT!** Always press the buttons firmly, and for at least one second each time.



Main menu structure



EVC System Tachometer

Introduction

Volvo Penta EVC System Tachometer presents relevant boat and engine information to the helmsman. Information is presented on a display in the tachometer. Information is depending on engine model, number of sensors and type of accessories.

Using the instrument

Start-up screen

This is the start-up screen for the EVC System Tachometer. After a few seconds the first item in MAIN MENU will appear.

Main menu

Navigating the menus

Navigate the menus by turning NAVIGATION WHEEL clockwise or counter-clockwise. Views with a POINTING HAND-symbol indicates a SUB-MENU. To enter a SUB-MENU, push NAVIGATION WHEEL.

Speed (Optional)

Boat speed. Requires multisensor or GPS.

Water temp (Optional)

Water temperature. Requires multisensor.

Depth (Optional)

Water depth. Requires multisensor.

Trip menu (Optional)

Shows trip information. Requires the following:

- Multisensor or NMEA 0183/NMEA 2000 compatible component (plotter, GPS, paddle wheel etc)
- Fuel level sender
- Trip computer software

Gauges menu

Shows data parameters.

Settings menu

The SETTINGS MENU allows the user to set various options for the EVC System and to calibrate various parameters.

Faults list

Number after word FAULTS indicates number of faults stored in FAULTS LIST. List is reset when system is rebooted.

NOTE! Faults list is not shown if no faults are registered.

Trip menu (extra optional)

In the TRIP MENU the user gets trip information from the EVC System and the user is allowed to select which view that should be presented in the EVC System Tachometers MAIN MENU as trip information. To get trip information following are required:

- Multisensor or NMEA 0183/NMEA 2000 compatible component (plotter, GPS, paddle wheel etc)
- Fuel level sender
- Trip computer software

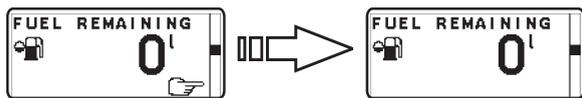
NOTE! The accuracy of trip information concerning, and based on, remaining fuel volume depends on which method the user has chosen for calibrating the fuel tank.

When in TRIP MENU, select view by turning NAVIGATION WHEEL. To select view as favorite, push NAVIGATION WHEEL. System returns to MAIN MENU.

Push BACK BUTTON to return to MAIN MENU without setting a new favorite.

Units are user selectable. See section "Units"

Trip menu structure



FUEL REMAINING: Fuel remaining (l, Gal).



FUEL ECONOMY: Instantaneous fuel rate per distance (l/nm, l/km, l/mile, Gal/nm, Gal/km, Gal/mile).



FUEL RATE: Instantaneous fuel rate per hour (l/h, Gal/h).



DISTANCE TO EMPTY: Distance to empty based on instantaneous fuel rate, remaining fuel and speed (nm, km, miles).



TIME TO EMPTY: Time to empty based on instantaneous fuel rate and remaining fuel (h).



TRIP DISTANCE: Trip distance since last reset (nm, km, miles).



TRIP FUEL: Trip fuel used since last reset (l, Gal).



TRIP FUEL ECONOMY: Average fuel rate per distance since last reset (l/nm, l/km, l/mile, Gal/nm, Gal/km, Gal/mile).



TRIP FUEL RATE: Average fuel rate per hour since last reset (l/h, Gal/h).



TRIP TIME: Trip engine hours since last reset (h).



TRIP RESET: Reset all trip data.

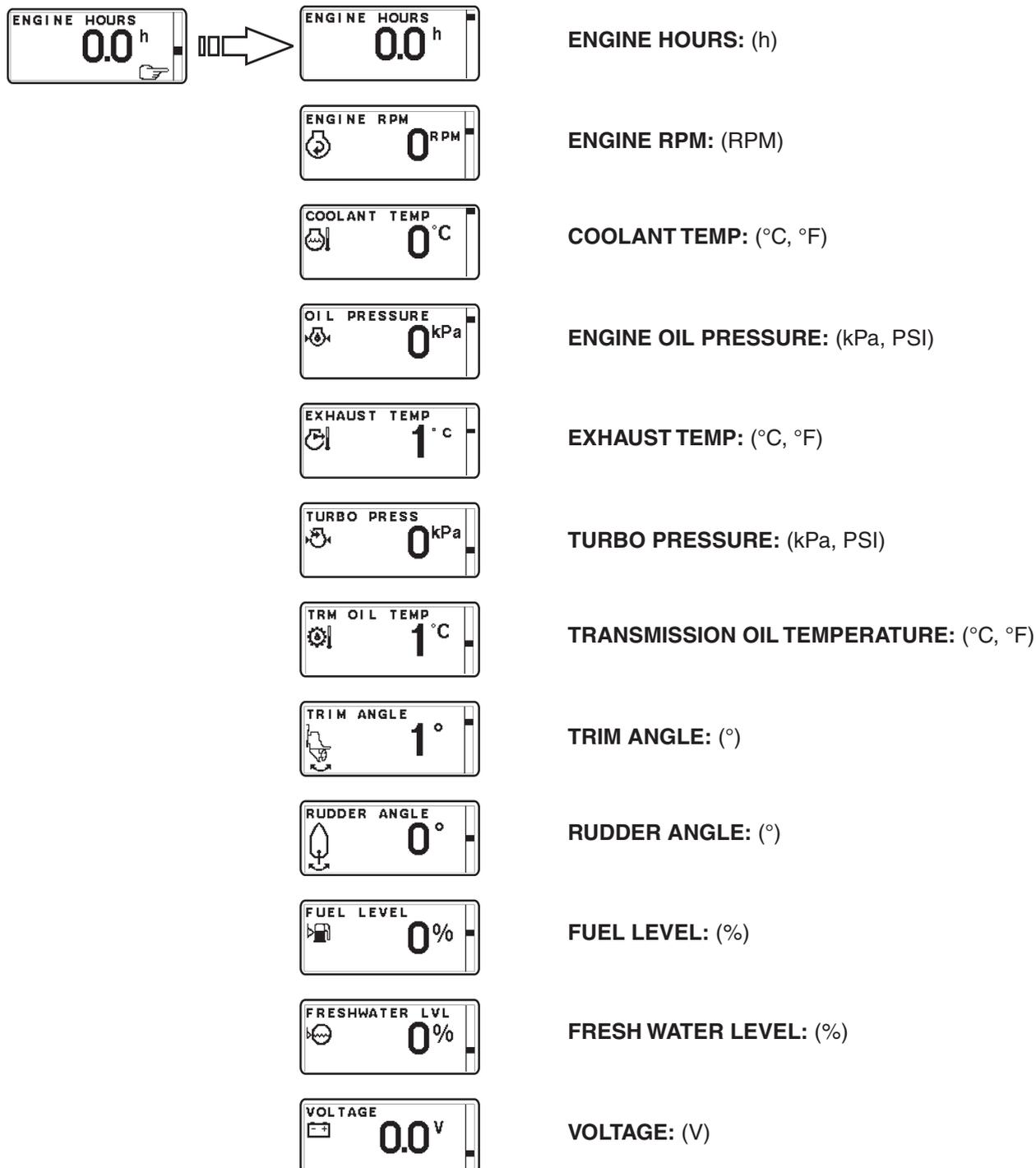
Gauges menu

In GAUGES MENU the user gets information from analogue senders, placed on the engine. If the data is not available the parameter will not be displayed.

When in GAUGES MENU, select view by turning NAVIGATION WHEEL. To select view as favorite, push NAVIGATION WHEEL. System returns to MAIN MENU.

Push BACK BUTTON to return to MAIN MENU without setting a new favorite.

Gauges menu structure



Settings menu

In the SETTINGS MENU the user is allowed to set various options for the EVC system and to calibrate various parameters.

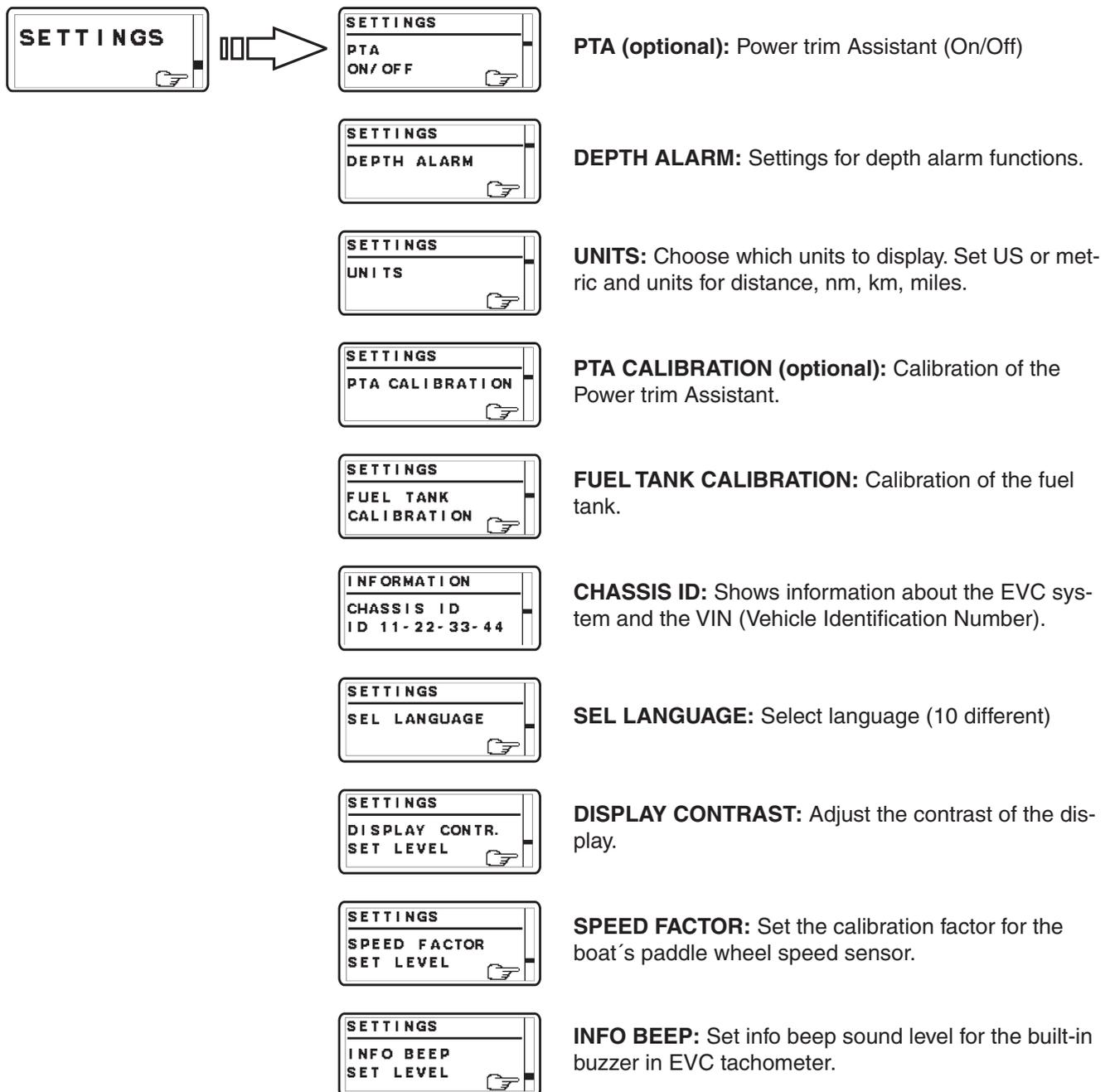
⚠ IMPORTANT! For all settings and calibration procedures: Activate helm station by pushing the ACTIVATION BUTTON.

NOTE! For twin installations always perform the settings on the port side system. Port side is the master side.

When in SETTINGS MENU, select view by turning NAVIGATION WHEEL. Views with a POINTING HAND-symbol indicates a SUB-MENU. To enter a SUB-MENU, push NAVIGATION WHEEL.

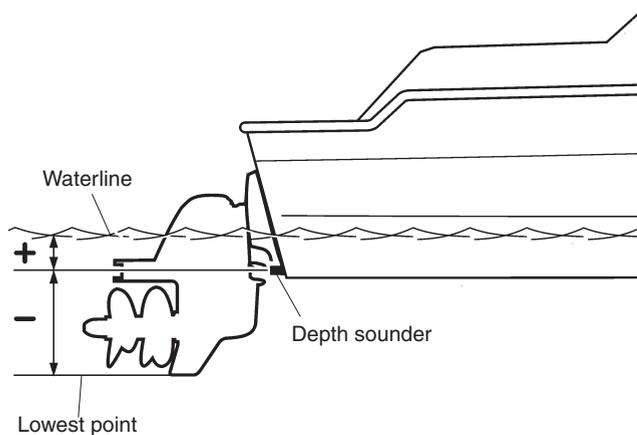
Push BACK BUTTON to return to MAIN MENU.

Settings menu structure



Depth alarm (extra optional)

All depth alarm functions are accessed through this menu. A multisensor needs to be installed.



DEPTH ALARM, ON/OFF

Depth alarm can be switched ON/OFF.

SET DEPTH

Adjust the depth alarm value by turning the NAVIGATION WHEEL. The value can be adjusted at a resolution of 0.1 m or 1 ft.

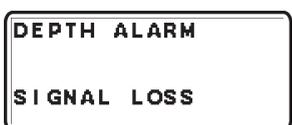
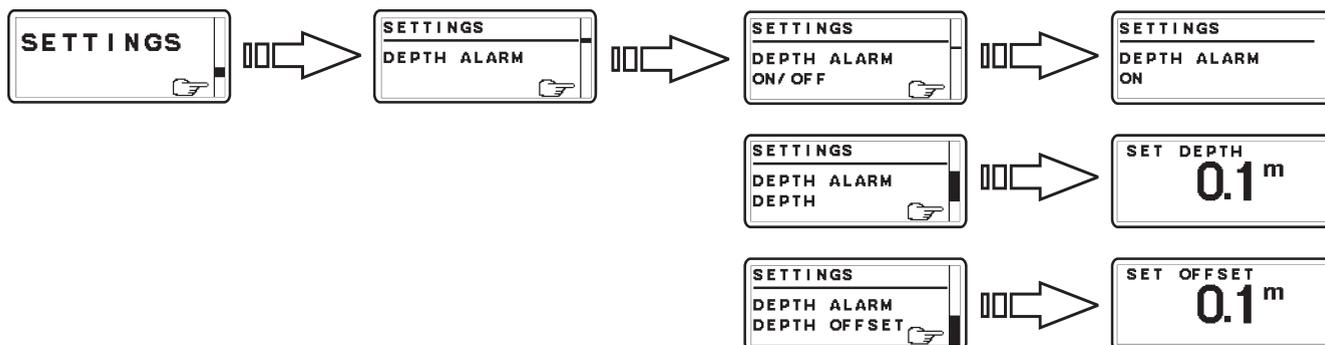
Once adjustment value is reached, the data is stored by pushing NAVIGATION WHEEL.

DEPTH OFFSET

The depth sounder can be placed somewhere on the hull that gives another depth than the desired depth. You can then add or subtract a distance so that the display shows the depth from, for example, the lowest point on the boat, or from the surface.

Adjust the depth offset value by turning the NAVIGATION WHEEL. The value can be adjusted at a resolution of 0.1 m or 1 ft.

Once adjustment value is reached, the data is stored by pushing NAVIGATION WHEEL.



Depth alarm pop-up

The depth alarm pop-up will appear when the depth is less than the depth alarm setpoint. The pop-up shows the actual depth.

Acknowledge depth alarm by pushing NAVIGATION WHEEL.

The depth alarm pop-up will re-appear every 30 seconds until the depth increases and exceeds the depth alarm setpoint.

Depth alarm signal loss

If the depth alarm is enabled and the depth signal is lost, for instance in the case of sensor malfunction, the depth alarm signal loss pop-up will appear.

Select units and language

Choose which units and languages to display.

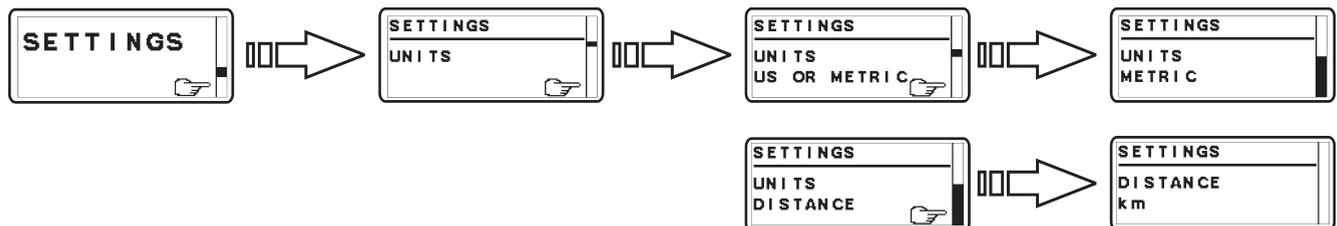
NOTE! Language and unit settings must be performed in all EVC system tachometers.

US or METRIC

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
3. Select UNITS and push NAVIGATION WHEEL.
4. Select US OR METRIC and push NAVIGATION WHEEL.
5. Set US or METRIC units by turning NAVIGATION WHEEL and confirm by pushing NAVIGATION WHEEL.

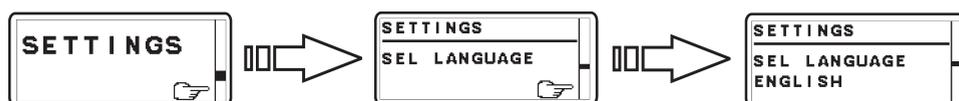
DISTANCE

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
3. Select UNITS and push NAVIGATION WHEEL.
4. Select DISTANCE and push NAVIGATION WHEEL.
5. Set distance unit: km, nm or miles and confirm by pushing NAVIGATION WHEEL.



LANGUAGE

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
3. Select SEL LANGUAGE and push NAVIGATION WHEEL.
4. Select language and confirm by pushing NAVIGATION WHEEL.



Power Trim Assistant, PTA (extra optional)

The Power trim Assistant adjust trim angle automatically according to engine speed (rpm). It is possible to set five trim angles at five different engine speeds (Idle speed included).

PTA CALIBRATION

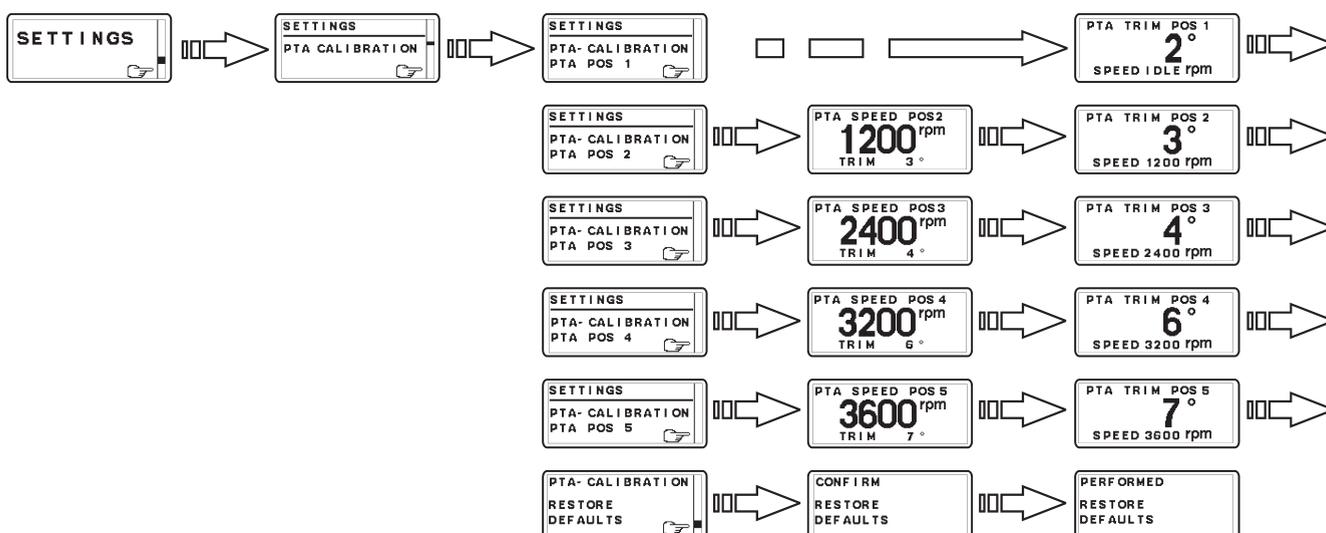
NOTE! For twin installations always perform the PTA CALIBRATION on the port side system. Port side is the master side.

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
3. Select PTA CALIBRATION and push NAVIGATION WHEEL.
4. Select PTA CALIBRATION POSITION (1-5) by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter selected PTA CALIBRATION POSITION.
5. Set RPM for PTA CALIBRATION POSITION by turning NAVIGATION WHEEL and confirm by pushing NAVIGATION WHEEL.

NOTE! RPM can not be set for PTA CALIBRATION POSITION 1, idling speed.

6. Set TRIM ANGLE for selected PTA CALIBRATION POSITION by turning NAVIGATION WHEEL and confirm by pushing NAVIGATION WHEEL.

Use the same procedure for all PTA CALIBRATION POSITIONS (1-5). Push BACK BUTTON to return to SETTINGS MENU.



Fuel tank calibration

There are two possible calibration methods for the fuel tank. One approximative, FULL TANK CALIBRATION, and one more precise, FUEL MULTIPOINT CALIBRATION. A fuel level sender need to be installed.

NOTE! If FUEL TANK CALIBRATION is not shown in SETTINGS MENU, please contact your Volvo Penta dealer.

FUEL MULTIPOINT CALIBRATION

When FUEL MULTIPOINT CALIBRATION is selected, the fuel level sender is calibrated in five equally divided steps; 20% full (pos 1), 40% full (pos 2), 60% full (pos 3), 80% full (pos 4) and 100% full (pos 5)

NOTE! To perform multipoint calibration, fuel tank must be LESS than 20% full. If calibration skips POS 1 and goes directly to POS 2, the fuel tank contains to much fuel and the calibration will not be correct.

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
3. Select FUEL TANK CALIBRATION and push NAVIGATION WHEEL.
4. Select FUEL MULTIPOINT CALIBRATION by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter FUEL MULTIPOINT CALIBRATION.



NOTE! The fuel multipoint calibration procedure differs depending on EVC software release.

5A. If the number after “POS” in the display is flashing:

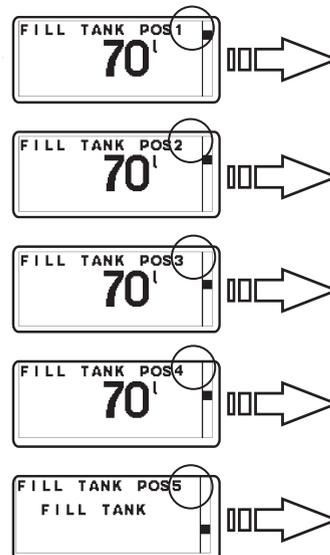
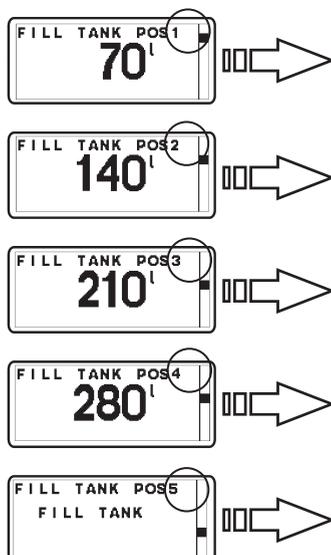
Fill fuel tank with displayed volume (POS 1) and push NAVIGATION WHEEL. Add fuel (do not reset the pump) up to displayed volume for each POS until the tank is filled.

Push BACK BUTTON to return to SETTINGS MENU.

5B. If the number after “POS” is **not** flashing:

Fill fuel tank with displayed volume (POS 1) and push NAVIGATION WHEEL. Repeat procedure for each POS until the tank is filled.

Push BACK BUTTON to return to SETTINGS MENU.



FUEL FULL TANK CALIBRATION

When FUEL FULL TANK CALIBRATION is selected, the fuel level sender is calibrated in one step. This only gives an approximated value of the fuel level. Therefore all trip data concerning and based on, remaining fuel volume should be recognized as approximated values only.

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
3. Select FUEL TANK CALIBRATION and push NAVIGATION WHEEL.
4. Select FUEL FULL TANK CALIBRATION by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter FULL TANK CALIBRATION.
4. Fill fuel tank and push NAVIGATION WHEEL. Push BACK BUTTON to return to SETTINGS MENU.



Approximated trip data

This pop-up will be shown every time after start-up if FUEL FULL TANK CALIBRATION is performed.

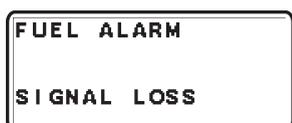


Fuel alarm pop-up

The fuel level alarm pop-up will appear when the fuel level is lower than fuel alarm setpoint. The pop-up shows the percentage of fuel remaining.

Acknowledge fuel alarm by pushing NAVIGATION WHEEL.

Fuel level alarm pop-up will re-appear every 10 minutes until the fuel level in tank is higher than fuel alarm setpoint.



Fuel level signal loss

If the fuel level has been set and the fuel level signal is lost, for instance in the case of sensor malfunction, the fuel level alarm signal loss pop-up will appear.

Speed factor

The speed factor for the boat's paddle wheel speed sensor can be adjusted at a resolution of 1% and is used by the EVC to apply a correction to the output from the speed sensor.

Set speed factor

Set speed factor while driving the boat. Compare displayed speed with speed data from GPS (or other boat) and adjust the speed factor until they correspond.

Adjust the speed factor by turning the NAVIGATION WHEEL.

Once adjustment value is reached, the data is stored by pushing NAVIGATION WHEEL.



Information message

Start attempt with gear engaged

The engine control lever must always be in neutral before starting. If not, this pop-up will be shown.

Approximated trip data

This pop-up will be shown every time after start-up if FUEL FULL TANK CALIBRATION is performed.

Retrieving faults

The EVC system is retrieving faults from its nodes.

Monitoring mode (inactive station)

An inactive station can show system information. Push MULTIFUNCTION BUTTON on the inactive station.

It is possible to navigate the menus when in monitoring mode.

EVC System Display (extra optional)

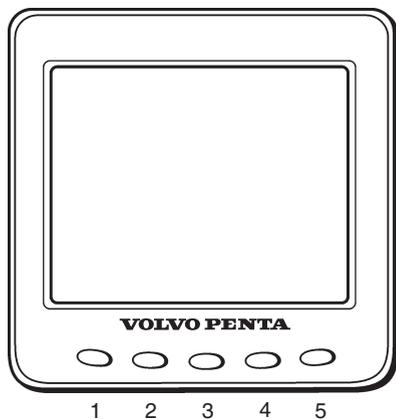
Introduction

Volvo Penta EVC system display is an instrument which displays operating information about the engine and allows you to communicate with the engine's electrical system.

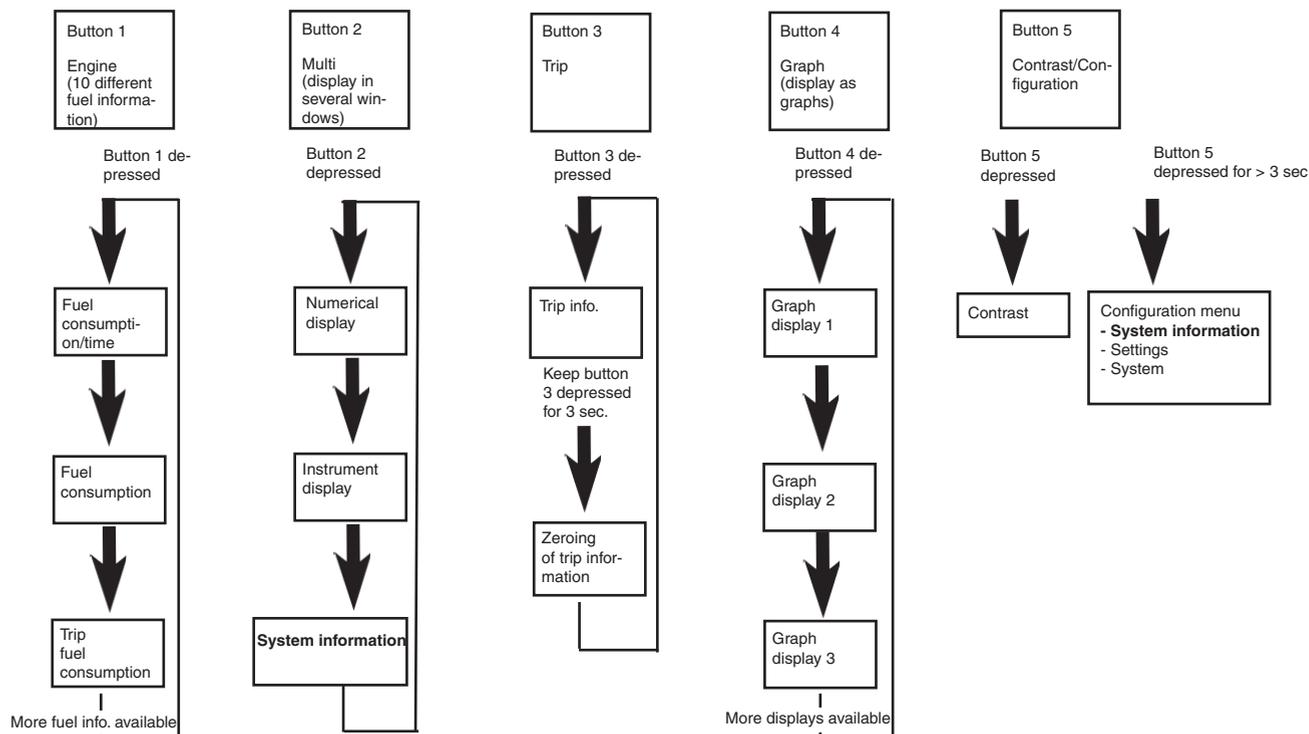
Operation information is shown on an LCD display. The driver can select the display mode operative on the display with the aid of the five buttons on the front of the instrument.

The four buttons at the furthest left are used to display operating information in different ways. The button at the furthest right is used to adjust the display contrast and to access the so-called configuration menu. Various settings etc. can be done in it. You can also use the configuration menu to reach the display mode SYSTEM INFORMATION (which can also be reached via button 2, please refer to the schedule below). This display mode functions in the same way as the display in the tachometer (EVC System Tachometer).

Before the display is used, it may be necessary to modify the way that the display shows operating information, to comply with user requirements. You can see the settings that can be changed in the section about the configuration menu.



Structure of the display functions





Start image

This is the starting image that is shown on the display for a brief period after starting.

If the unit gives a constant audible warning after starting, the self-test has failed. The unit will still work, but may behave in an unexpected manner.

Symbols for operating information

- | | | | |
|--|-----------------------|--|-----------------------------------|
| | Engine speed | | Turbocharge pressure (current) |
| | Coolant temperature | | Induction air temperature |
| | Engine temperature | | Exhaust temperature |
| | Fuel pump pressure | | Voltage |
| | Oil pressure | | Oil pressure, reverse gear |
| | Coolant temperature | | Oil temperature, reverse gear |
| | Speed | | Fuel level |
| | Fuel consumption/time | | Differential pressure, oil filter |

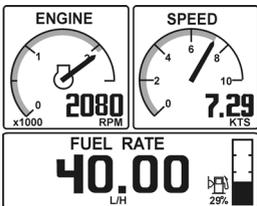


Figure for single engine installation

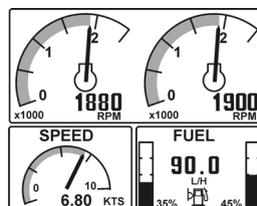
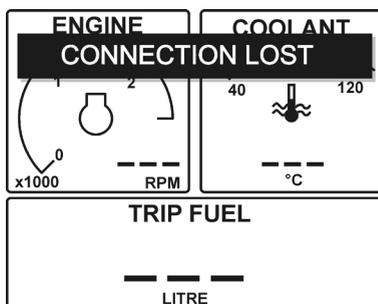


Figure for twin engine installation

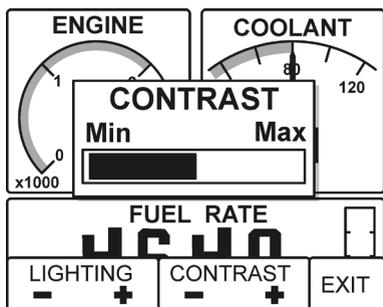
Display after starting screen

Display mode ENGINE (button 1) is always shown after the starting screen when the display is first started up (more information about this display mode can be found below in the instructions). Once the display has been used, it will always show the display mode when it starts up, that was selected when the display was last switched off.



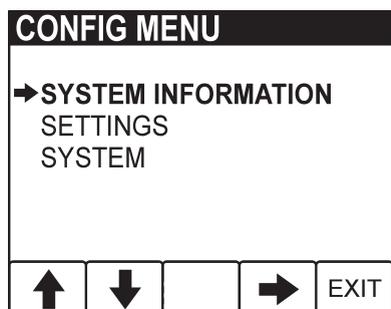
Connection fault

If the display does not register transfer of operating information from the electrical system, the pop-up window will flash CONNECTION LOST. When operating information has been registered/reset, the pop-up window disappears.



Set display contrast

Press button 5 (furthest right) to set display contrast. Then press the appropriate buttons to adapt the levels, then save the settings by pressing EXIT. The display unit has 5 contrast settings.



Configuration menu (button 5) (depressed for longer than 3 s)

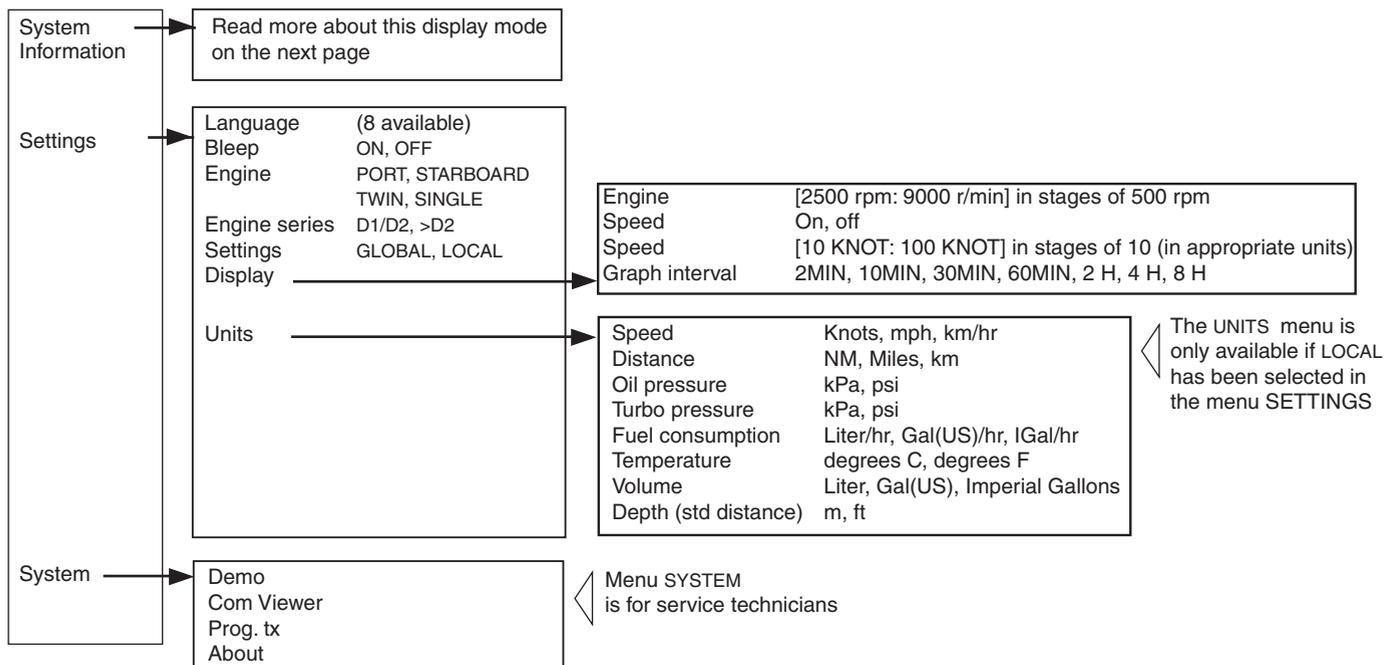
The configuration menu is used to:

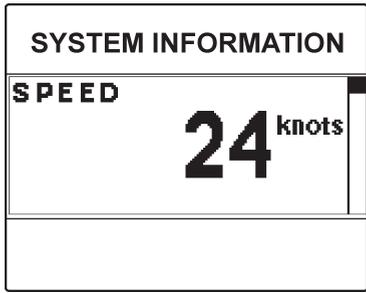
- access the display mode SYSTEM INFORMATION
- do various settings for the display.
- reach information and functions for servicing the display.

Please refer to the configuration menu structure below and read the following section, which explains each section in the menu.

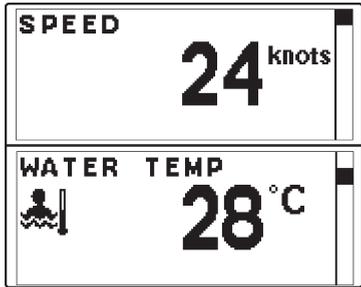
Note! The port engine or both engines must have the ignition switched on when display settings are changed.

Configuration menu structure

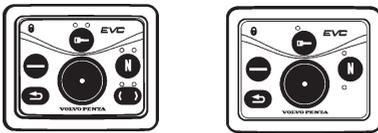




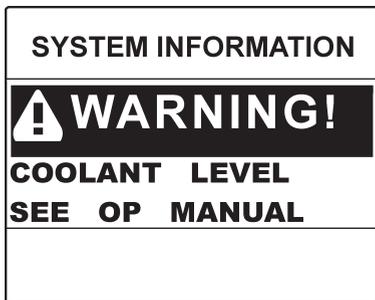
SYSTEM INFORMATION display mode for single engine installations



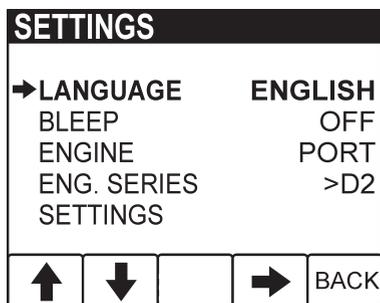
SYSTEM INFORMATION display mode for twin engine installations



Control panel



Alarm example



Display mode System Information

SYSTEM INFORMATION is a display mode that functions in the same way as the display in the tachometer (EVC System Tachometer). You navigate round these functions, using the buttons on the free-standing control panel.

In display mode SYSTEM INFORMATION there are several functions:

- Display of operating information, information messages and alarm (note! The display is adapted to suit the size of the panel in the tachometer).
- Settings for displaying operating information in this display mode.
- All calibrations.

Detailed instructions for the functions in display mode SYSTEM INFORMATION are found in the section about the tachometer in this owner's manual .

Information message and alarm

The display automatically switches to display mode SYSTEM INFORMATION when the electrical system needs to show information messages or alarms. Instructions about how information messages and alarms should be handled are found in the section about the tachometer and in the section "In case of emergency" in this owner's manual.

Settings

Menu SETTINGS is used to do various settings for the display.

- **Language:** This is where you select the language that the display should use (8 different languages are available).
- **Bleep:** This is where you select whether a beep should be heard when any button is depressed. ON/OFF.
- **Engine:** This is where you select the engine for which operating data will be displayed. SINGLE, PORT, STARBOARD or TWIN.
- **Engine series:** This is where you select the engine for which the display has been installed D1/D2, >D2. The display is pre-set for use with engines larger than D2.

| UNITS | |
|----------------|------|
| SPEED | KM/H |
| →DISTANCE | KM |
| OIL PRESSURE | kPa |
| TURBO PRESSURE | kPa |
| FUEL RATE | L/H |
| ↑ | ↓ |
| → | BACK |

- **Display:** This is where you set the measurement intervals of the speedometers and tachometers.
Rpm engine: [2500 rpm: 9000 r/min] in stages of 500 rpm
 - Speed: Change speed display (on/off)
 - Speed: [10 KNOT: 100 KNOT] in states of 10 (in the appropriate speed intervals)
 - Graph interval: 2 MIN, 10 MIN, 30 MIN, 60 MIN, 2 H, 4 H, 8 H
- **Units:** (This menu is only displayed if LOCAL has been selected in menu SETTINGS). This is where you select the measurement units to be used to display operating information. (GLOBAL is pre-set, which means that the units of measurement are pre-set, but they can be changed if LOCAL is selected in menu UNITS).
 - Speed: KNOT, MPH, KM/H
 - The distance is adjusted to suit the speed unit: NM, MILE, KM
 - Oil or Turbo pressure: kPa, PSI
 - Volume: LITER, GAL, Imperial GAL
 - Fuel consumption / time: is adjusted to suit the volume unit: L/H, GAL/H, IGAL/H
 - Temperature: °C (CELSIUS), °F (Fahrenheit)

| SYSTEM | |
|------------|------|
| DEMO | ON |
| COM VIEWER | |
| PROG. TX | |
| →ABOUT | |
| ↑ | ↓ |
| → | BACK |

System

Menu SYSTEM is intended to provide the necessary functions and information for service technicians.

- **Demo:** Switches between demo mode ON/OFF
The unit is in normal operation mode when Demo is OFF.
- **Com Viewer:** Shows the latest messages received on the communication inputs
- **Prog tx:** Transfers the contents of the application program in the flash memory to other CANtrak units on the same CANbus link
- **About :** Shows the following information:
 - ID no:** Display serial number
 - Eeprom:** No. of writes to the EEPROM
 - Vers:** Software version number
 - Chk:** Flash memory checksum
 - Part no:** Volvo's part number for the software
 - Source:** Shows the source of the received data
 - Label:** Label allocated on the bus. Each unit on the same bus must have its own unique label

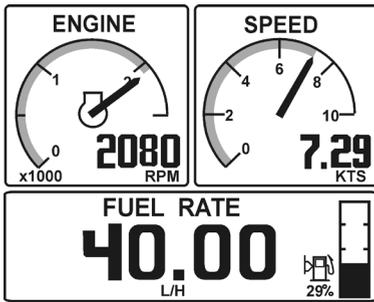


Figure for single engine installation

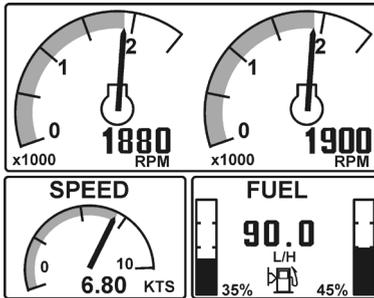


Figure for twin engine installation

Display mode Engine (Button 1)

This display mode shows the engine speed and boat speed in the form of standard instruments, together with a trip computer and fuel level gauge. The fuel level gauge is displayed if there is a tank sender installed.

Note! Trip information is only displayed if following are installed:

- Multisensor or NMEA 0183/NMEA 2000 compatible component (plotter, GPS, paddle wheel etc)
- Fuel level sender
- Software for trip computer (order and download from VODIA website)

The trip computer shows various types of information if you repeatedly press the button ENGINE (ENGINE) (button 1). Please refer to the trip computer menu below.

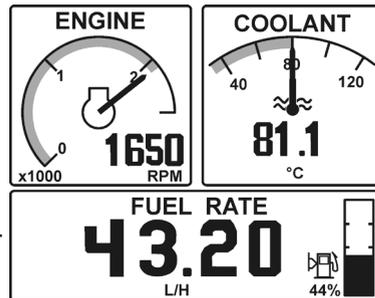
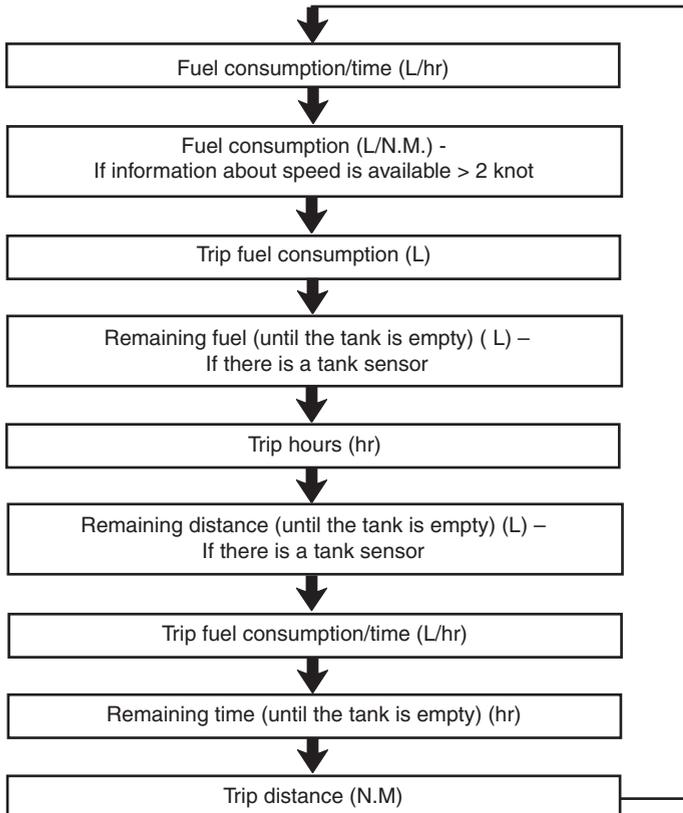
Note! Only metric values are displayed, but other units can be displayed if they have been chosen in the configuration menu.

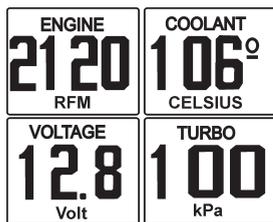
The scale values for maximum engine speed and maximum speed can be set in the configuration menu.

If information about boat speed is not available, the display shows coolant temperature instead.

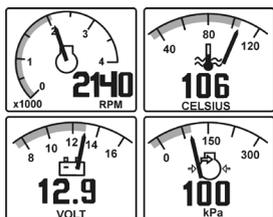
Menu, trip computer

Button 1
Changes display each time the button is pressed





Example of display in several windows for single engine installation



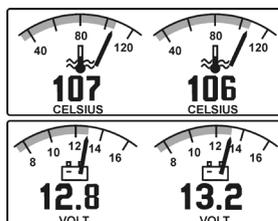
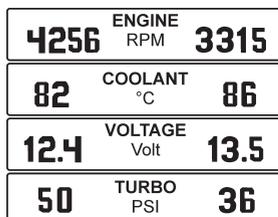
Display mode Multi (button 2)

This display mode shows operating information in four different windows (see below). The user can choose the operating information to be displayed in each window.

The information can be displayed as figures or as standard instruments. Display indication shifts between the two modes when you press button 2 repeatedly.

If an item of operating information is not available, the unit displays "—" and the analogue gauge needle is not shown.

From this display mode MULTI, you can also reach display mode that functions in the same way as the smaller display in the tachometer. Read more about this display mode SYSTEM INFORMATION in the configuration menu section.



Example of display in several windows for twin engine installation

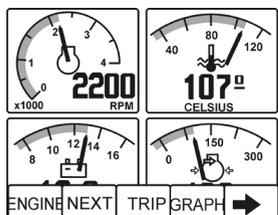


Figure for single engine installation

Press button 5 to choose setting mode

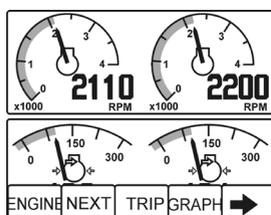


Figure for twin engine installation

Set the appearance of the display mode Multi

Display mode MULTI has a mode to set the operating information to be displayed in each window.

The setting mode is reached by pressing button 5 (furthest right), when you are in the display mode MULTI. Please refer to the illustrations below.

Note! The type of operating information available depends on the electrical system in the boat and the sensors that the boat is equipped with. Optional sensors include depth gauge, water temperature, speed, trim angle and rudder angle.

Note! This applies to the graphic display: The maximum engine speed range can be set on the configuration menu.

The voltage interval can be [8V: 16V] or [16V: 32V] and is changed automatically, depending on the latest data value.

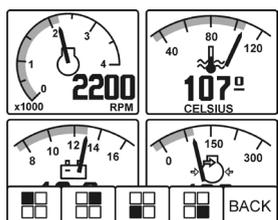


Figure for single engine installation

Buttons 1 to 4 are used to adjust the corresponding window (please refer to the black markings)

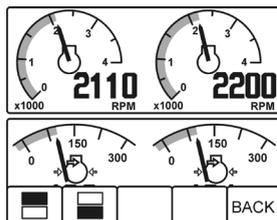


Figure for twin engine installation

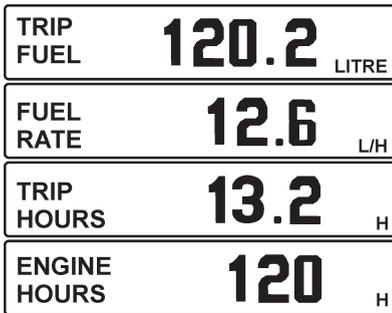


Figure for single engine installation

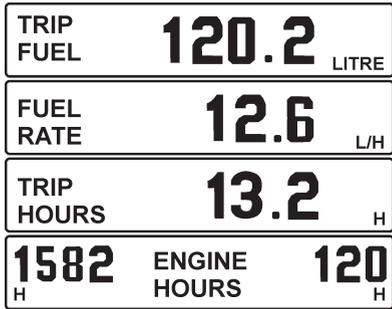


Figure for twin engine installation

Display mode Trip (button 3)

This display mode shows:

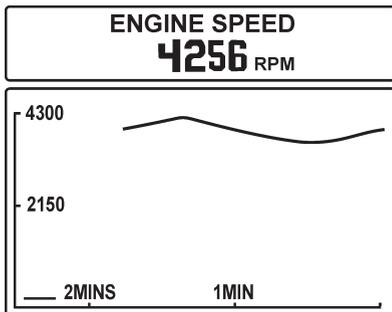
- Fuel used after last zeroing
- Instantaneous fuel consumption (amount of fuel used per hour) (If speed information is available, instantaneous fuel consumption can also be calculated in relation to distance.)
- Operation time after last zeroing
- Total operating time (can not be zeroed)

If you want to zero the trip values (trip fuel consumption and trip operating time), keep button 3 depressed for 1 second. The unit beeps and the values are zeroed.

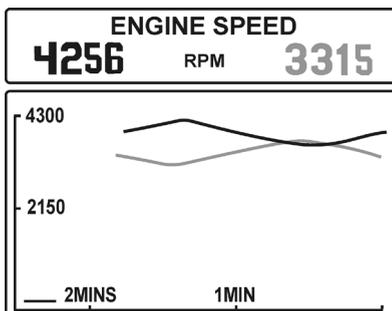
Note!

When the display is set for a twin engine installation, the information displayed for each engine will be the sum of the values from both engines, apart from operating time. Operation times for twin engines are shown separately.

The size of the operating hours figures shown on the display is reduced if the number does not fit in the window.



Window with curve for single engine installation (shows engine speed)



Window with curve for twin engine installation (shows engine speed)

Display mode Graph (button 4)

In this display mode, operating information is displayed in the form of a histogram. Press button 4 repeatedly to show different operating information.

If an item of operating information is not available, that window can not be chosen.

If contact with the relevant information is lost during display, the curve will no longer be drawn, but the line will continue to scroll across the window.

Data for the port engine or single engine information is drawn with a black line.

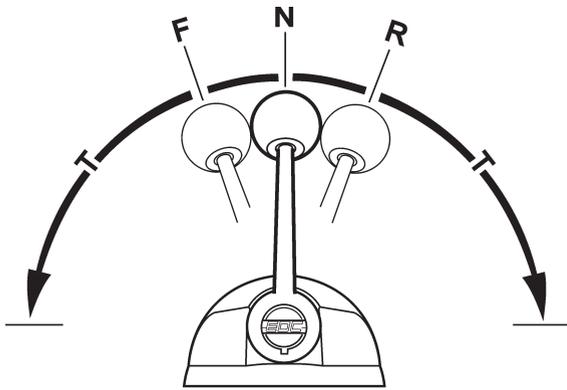
Data for the starboard engine information is drawn with a gray line.

The maximum time interval can be set to one of the following values in the configuration menu: 2 min, 10 min, 30 min, 1 h, 2 h, 4 h, 8 h.

The interval on the Y axis is automatically adjusted for best indication.

Controls

This chapter describes the instrument panels sold by Volvo Penta for your engine. If your boat is equipped with controls which are not described here and you feel uncertain about the function, please contact the dealer you purchased the boat from.



Single lever control. Electronic

Operation

Both the shift function and engine speed control are controlled using the single lever control.

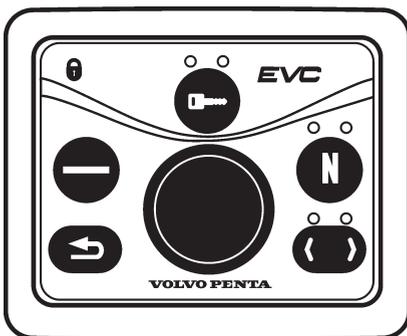
N = Neutral position (reverse gear/stern drive is disengaged and the engine runs at idle speed).

F = Reverse gear/stern drive engaged for movement ahead.

R = Reverse gear/stern drive engaged for movement astern.

T = Adjustment of engine speed.

NOTE! The engine can only be started if the Control lever is in the neutral position.



Disengaging the shift function

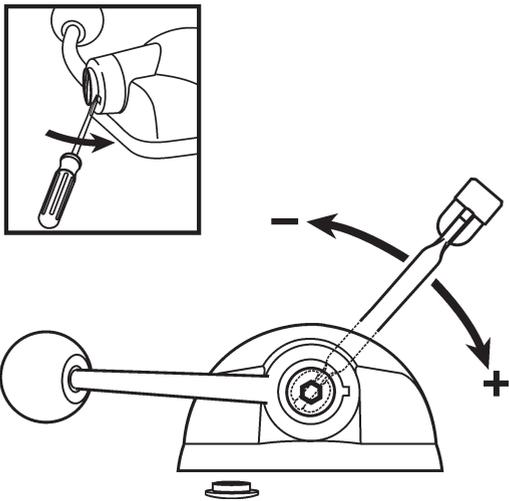
The shift function can be disengaged so that the control lever only affects the engine speed.

1. Move the lever to the neutral position (N)
2. Press the neutral button (N) in and hold it down while moving the control lever forward to the shift position (F).
3. Release the neutral button. The green indicator begins to flash to acknowledge that the shift function is disengaged.

The lever now only controls engine speed.

When the lever is moved back to the neutral position it will automatically re-engage. This is confirmed by the green indication which gives constant light.

⚠ WARNING! Take care not to engage the reverse gear/stern drive unintentionally.

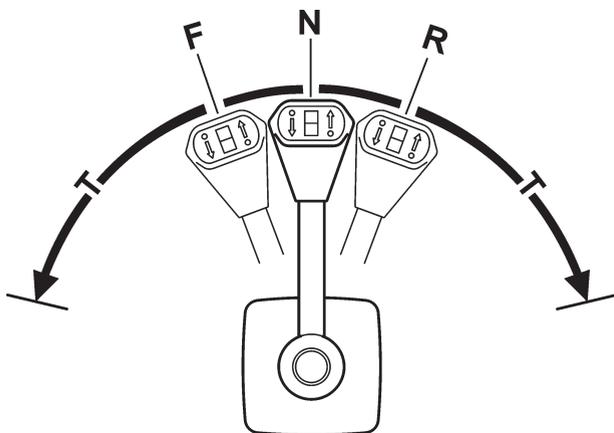


Friction brake

The control has a friction brake which can be adjusted as necessary to provide lighter or heavier lever action.

Adjusting the friction brake:

1. Stop the engine.
2. Mover the control lever forwards so that the groove in the hub of the control lever is accessible.
3. Position a screwdriver in the groove and remove the plug.
4. Adjust the friction brake (8 mm wrench):
Clockwise = heavier lever action
Counter clockwise = lighter lever action.
5. Reinstall the plug.



Side mounted control lever. Electronic

Operation

Both the shift function and engine speed control are controlled using the control lever.

N = Neutral position (stern drive is disengaged and the engine runs at idle speed).

F = Stern drive engaged for movement ahead.

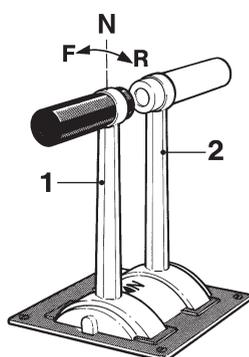
R = Stern drive engaged for movement astern.

T = Adjustment of engine speed.

NOTE! The engine can only be started if the Control lever is in the neutral position.

Two lever control. Mechanical

A



Operation

The two lever control has separate levers for shifting (1) and speed control (2).

The control has a neutral position switch that only allows the engine to be started with the reverse gear in neutral.

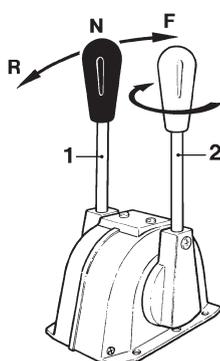
Black lever (1):

N = Neutral position. Reverse gear is disengaged.

F = Reverse gear engaged for movement ahead.

R = Reverse gear engaged for movement astern.

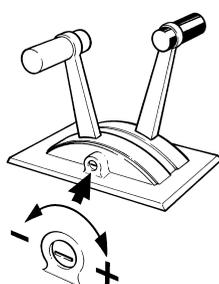
B



Red lever (2):

Engine speed control.

A



Friction brake

The control has an adjustable friction brake for speed control.

Adjust the friction brake by turning the screw (control A) or lever (control B).

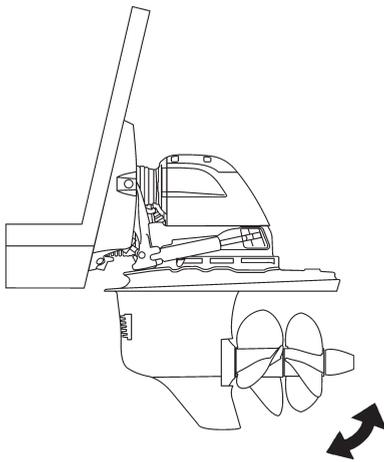
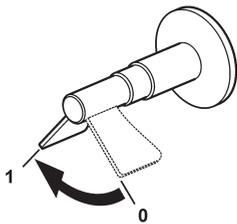
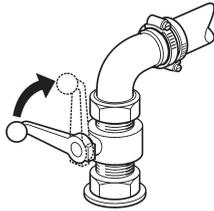
Turn clockwise (+) for **heavier** lever movement or anti-clockwise (-) for **lighter** lever movement.

Starting the engine

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

To minimize starting smoke in cold starting, we recommend that a heater should be installed to warm the engine bay at temperatures below +5°C.

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



Before starting

- Open the fuel tap
- Open the sea cock (reverse gear)
- Do the tasks under the “Daily before first start” heading in the maintenance schedule.
- Turn the main switches on.
 - ⚠ **IMPORTANT!** Never disconnect the current with the main switches when the engine is running. This can damage the alternator.
- Start the engine bay fan, if one is installed, and let it run for at least four minutes.
- Check that the amount of fuel aboard is enough for your planned voyage.
- Check the oil level.
- Lower the drive(s) if raised.

General information about starting

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

The engine is pre-heated by the engine control unit, which allows the engine to crank several revolutions with the starter motor before fuel is injected. The colder the engine is, the more revolutions the engine makes. This raises the temperature in the combustion chambers, which ensures reliable starting and reduces starting smoke.

The idling speed is also governed by engine temperature, and is somewhat raised after a cold start.

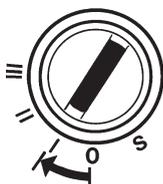


Starting method

Put the reverse gear/stern drive in neutral

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

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



Turn the ignition on

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

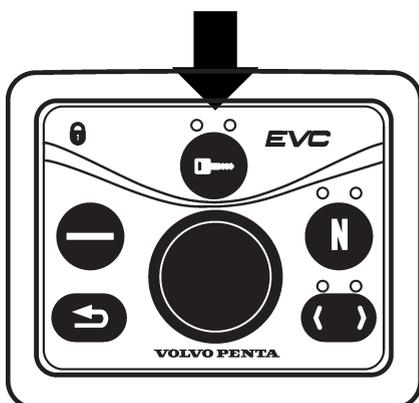
Check LEDs

Each time the ignition is turned on, all LEDs are illuminated on the main control panel. Check that all LEDs function.

If the boat has more than one control panel, the LEDs on the other panel(s) are not checked until the control panel(s) is(are) activated.

Check the tachometer display

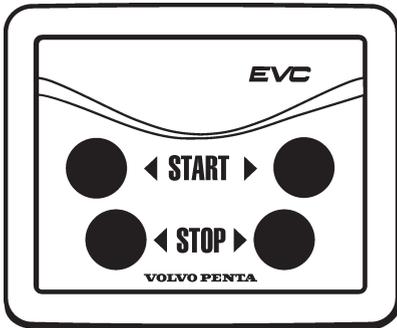
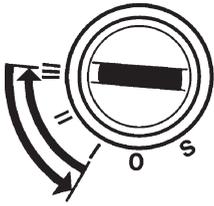
If a fault is registered it will be shown in the tachometer display.



Lock the system.

If the boat has more than one control panel, the system can be locked, so that the engine can only be controlled from the activated control board. Press the activation button for a second to lock the system. The padlock sign lights up in confirmation.

Unlock the system by pressing the activation button for one second. This can only be done from an activated control panel.



Start the engine

Start using the ignition switch

Turn the key to position III. Release the key and let it key spring back to position I as soon as the engine has started. Stop cranking if the engine does not start with in 20 sek.

Starting with the starter button

Press the starter button. Release the button as soon as the engine has started. Please note that if you start from an alternative control station, the starter key at the main control station must be in position I. Stop cranking if the engine does not start with in 20 sek.

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. Leave the starter motor to cool for at least five minutes (if possible) before making a new start attempt.

Read the instruments and warm the engine up

Allow the engine to idle for the first ten seconds, and check that instruments and displays show normal values. Check that no alarms are displayed and that no warning lamps (optional) are flashing.

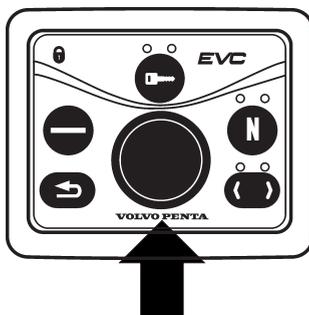
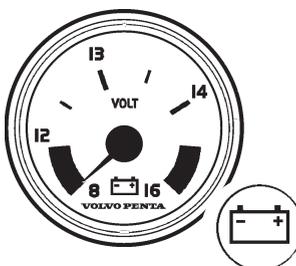
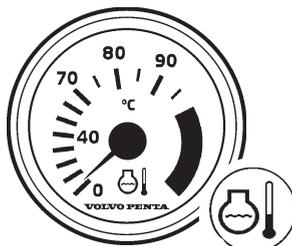
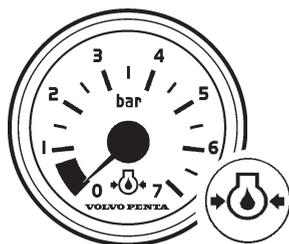
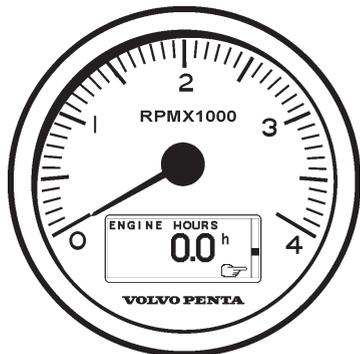
Then warm the engine up at low speed and low load, so that reaches normal operating temperature before full power is used.

 **IMPORTANT!** Never race the engine when it is cold.

Operation

Learn to handle the engine, controls and other equipment in a safe and correct manner before you cast off on your maiden voyage. Remember to avoid sudden or surprising rudder movements and gear shifting. There is a risk that passengers could fall over or overboard.

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



Reading the instruments

Read all instruments directly after starting, and then regularly during your voyage.

EVC system tachometer

Shows user selected boat and engine information.

Oil pressure

The oil pressure gauge (analogue or in tachometer) should normally indicate between 3-5 bar. It will indicate a somewhat lower value when idling.

Coolant temperature

The temperature gauge (analogue or in tachometer) should normally indicate between 75– 95°C (167-203°F) during normal operation.

Charging

The voltmeter (analogue or in tachometer) should normally indicate about 14V.

Acknowledging alarms and messages

There are several types of alarms and messages that can appear as a pop-up in the tachometer/display.

NOTE! Some alarms for fault are also accompanied by a buzzer. First silence the buzzer by pushing the  NAVIGATION WHEEL on the control panel.

1. Read the alarm/message pop-up.
2. Acknowledge the pop-up by pushing the  NAVIGATION WHEEL on the control panel (sometimes repeatedly). The pop-up will disappear.
3. Take the indicated actions.

If there is an alarm pop-up of a fault please refer to the "In case of emergency" and "Fault register" chapters.

NOTE! If there is a fuel alarm pop-up it will reappear every 10 minutes until tank is filled. If there is a depth alarm pop-up it will reappear every 30 seconds until the depth exceeds the depth alarm setpoint.



Alarm

If a fault occurs, the audible warning will sound and the relevant warning lamp on the optional alarm display will start to flash and the tachometer display will show a alarm pop-up.

1. Reduce engine speed to idling.
2. Acknowledged the larm by pressing the navigation wheel on the control panel once.

When the fault has been acknowledged, the lamp concerned gives constant light and the audible warning will become silent.

Please refer to the chapters "In case of emergency" and "Fault register" and you will find detailed information about recommended action.

The fault will also be stored in the form of a fault code for as long as the malfunction remains. It is possible to read the fault code during a subsequent service.

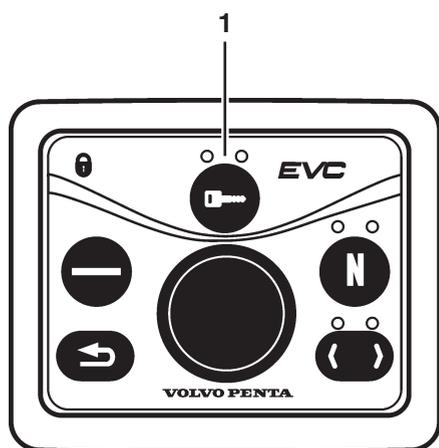
Cruising speed

Avoid operation at full throttle, for best fuel economy. We recommend a cruising speed which is at least 10% below the maximum engine speed at full speed (full throttle). The maximum engine speed will vary due to propeller choice, load and sea conditions, but it should be in the full throttle range.

Full throttle range:

| | |
|---------|---------------|
| D4..... | 3400–3600 rpm |
| D6..... | 3400–3600 rpm |

If the engine does not reach the full throttle range, this could be caused by a number of factors which are noted in the "Fault tracing" chapter. If the engine speed exceeds the full throttle range, select a coarser pitch propeller. Ask your Volvo Penta dealer for advice.



Changing the helm station

The first time you change control panel after starting the EVC system, a bulb check is done automatically. All LEDs and bulbs light up for 2 seconds.

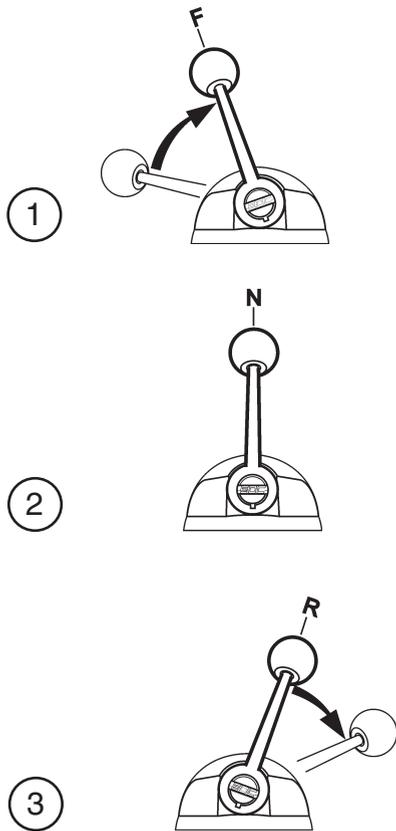
1. Check that the control lever(s) is (are) in neutral on **both** the control panel you leave and on the new control panel.
2. Check that the EVC system is not locked.
3. Press the activation button (1) for at least one second. When the button is released, the indication lights up to confirm that the control position is activated.
4. Press the activation button (1) for a further second to lock the EVC system. The padlock sign lights up in confirmation. Unlock the system by pressing the activation button for one second. This can only be done from an activated control panel.

Changing helm station while cruising (optional)

This function must be enabled to permit the control panel to be changed during operation. The function can only be enabled by authorized Volvo Penta personnel. Please contact your Volvo Penta dealer.

1. Press the activation button (1) to unlock the system. The padlock sign goes out on all control panels to indicate that it is possible to change control panel.
2. The control lever on the alternative control panel must be in neutral before it is possible to change control panel.
3. Press the activation button (1) on the alternative control panel. The activation button indication flashes on the alternative control panel, and on the main control panel it gives constant light.
4. The alternative control panel becomes active when the correct gear and approved engine speed is demanded. The activation button (1) gives constant light to confirm that the control panel is activated. The system is now locked, which is indicated by the padlock sign, which lights up.

NOTE! If the correct gear or engine speed is not demanded within 15 sec, the system ramps engine speed down to neutral and the gearbox engages neutral.



Operation

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 1500 rpm.

Always do a forwards/revers operation as follows:

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

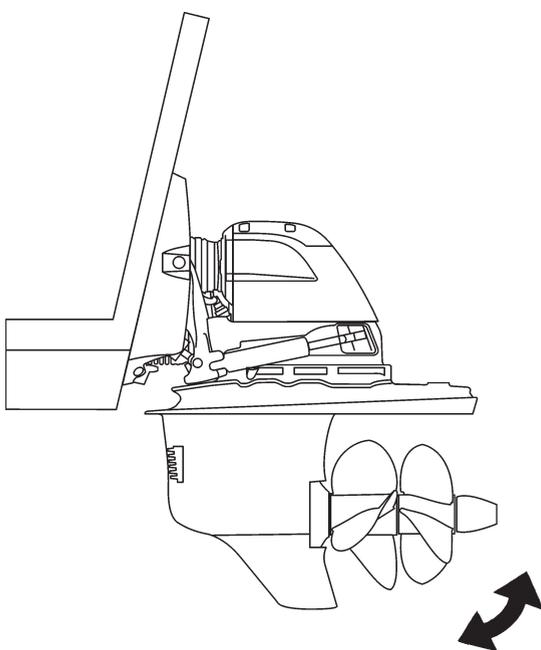
⚠ WARNING! Never shift to reverse when the boat is planing.

2. Move the control lever to neutral with a rapid, distinct movement. Make a brief pause.

NOTE! A beep will sound to indicate that the control lever is in neutral.

3. Then move the control lever to reverse with a rapid, distinct movement and increase engine speed.

⚠ IMPORTANT! If the boat has twin engines, it is important that both should be running during reverse maneuvers, to avoid the risk of water entry (via the exhaust pipe) into the stationary engine.



Power Trim

Your Volvo Penta drive is equipped with a hydraulic trim system, with which you can change the angle of the drive in relation to the transom. This will affect the running position of the boat and make it possible to optimize boat handling in various conditions.

Power trim is operated from the control position using the panels, controls and instruments.

NOTE! The engine can not be started with the drive in the "Tilt range".

⚠ WARNING! Avoid over-trimming the drive system as this can adversely effect the steering of the boat severely.

⚠ IMPORTANT! Avoid running with the drive fully trimmed for long periods (when planing). Apart from excessive fuel consumption this can cause cavity damage to the propeller(s).

Operating with the drive in the Trim range

The Trim range is used to achieve maximum comfort under normal operation at all speeds from start to maximum speed.

Since every boat has its own unique characteristics and will be effected in different ways by the factors involved, only general advice is given here on how to get the best trimming angle for your boat. It can generally be said that when the boat feels well-balanced, easy to steer and pleasant to operate, then that is the optimal trim angle for the boat.

To familiarize yourself with the Power trim, make test runs at slower speeds and at various trim positions to see the effect of trimming. Note the time it takes for the boat plane. Watch the tachometer and speedometer readings and the ride action of the boat.

When starting

Trim the drive in. The bow will be pressed down and the boat accelerates faster. This gives improved running and steering characteristics at speeds below the planing threshold.

Operating in “Bow-down” Position

The “bow-down” position is normally used for acceleration onto plane, operating at slow planing speeds, and running against a choppy wave condition. In the fully “bow-down” position the boat may tend to selfsteer. You may have to compensate with the steering wheel to keep the boat in a straight-ahead path. In this position the boat’s bow will tend to go deeper into the water. If the boat is operated at high speed and/or against high waves, the bow of the boat will plow into the water. The boat may tend to bow steer or spin about rapidly and possibly eject occupants.

 **IMPORTANT!** The boat trim should be adjusted to provide balanced steering as soon as possible each time you get underway. Some boat, engine, and propeller combinations may encounter boat instability and/or high steering torque when operated at or near the limits of the “bow-up” or “bowdown” positions. Boat stability and steering torque can also vary due to changing water conditions. If you experience boat instability and/or high steering torque, see your Volvo Penta dealer to correct these conditions.

At planing speed

Trim the drive out to the operating position which provides the most stable and comfortable running.

If the boat has twin motors the drives can be trimmed with different angles to compensate for side winds and to a certain extent compensate for uneven loading on one side of the boat or the other.

Operating in “Bow-up” Position

The “bow-up” position is normally used for cruising, running with a choppy wave condition, or running at full speed. In a full “bow-up” position the boat may tend to self-steer. You may have to compensate with the steering wheel to keep the boat in a straight-ahead path. In this position the boat’s bow will tend to raise clear of the water. Excessive “bow-up” trim will cause propeller ventilation resulting in propeller slippage. Engine RPM will also increase, but boat speed will not increase and may even drop.

 **IMPORTANT!** Use caution when operating in rough water or crossing another boat’s wake. Excessive “bow-up” trim may result in the boat’s bow rising rapidly and possibly throwing the boat’s occupants into the water.

For maximum fuel economy

Operate engine at a steady throttle opening. Trim the drive out/in slightly. The boat is most easily propelled and speed will increase in the position that gives the highest engine speed. The throttle opening can then be slightly reduced to retain the original speed.

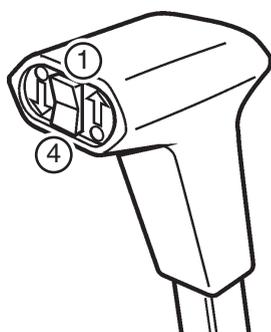
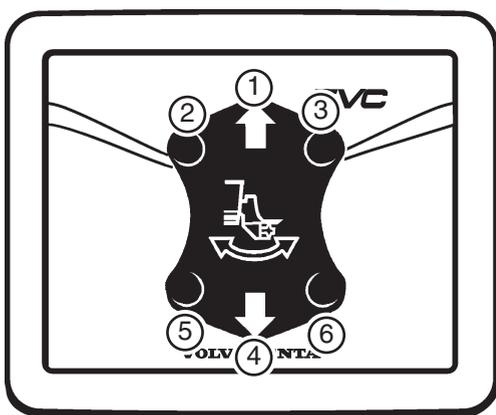
In choppy seas or running against a heavy sea

Trim drive so the bows drop. This will provide more comfortable running. See section "Operating in Bow-down Position"

Operating with the drive in the Beach range

The beach range is used for operation **at reduced speed** in shallow water or where water depth is uncertain.

 **IMPORTANT!** Max. permitted engine speed (rpm) when running in the “Beach range” is 1 500 rpm. Check that drive is never trimmed so that the cooling water intake is out of the water.



Power Trim Control Panel

This control panel is used for both single and twin engine installations. The current position of the drive is shown on the trim instrument, refer to the "Trim instrument" chapter.

For twin engine installations, the control panel can be used to make individual or simultaneous adjustments to the drives.

By trimming out the drive away from the transom, the height of the bow will be "raised" in relation to the horizontal axis and trimming in the drive will "lower" the bow of the boat.

Trimming out the drive

Press in button 1 on the control panel to raise the bow of the boat (drive trimmed out).

In twin engine installations, both drives can be operated simultaneously by pressing button 1.

The drives can be operated separately by pressing button 2 on the control panel for the port drive and button 3 for the starboard drive.

Trimming in the drive

Press in button 4 on the control panel to lower the bow of the boat (drive trimmed in).

In twin engine installations, both drives can be operated simultaneously by pressing button 4.

The drives can be operated separately by pressing button 5 on the control panel for the port drive and button 6 for the starboard drive.

Emergency trimming

If a fault occurs which prevents the drive from being trimmed, it is possible to perform an emergency trimming. Please refer to "In case of emergency: Emergency trimming".

Trim ranges

In order to utilize the information gained from the trim instrument, it is essential to know about the different trim ranges and their uses. There are three trim ranges:

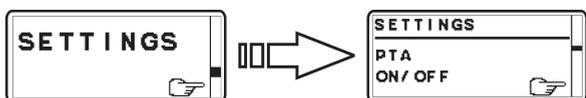
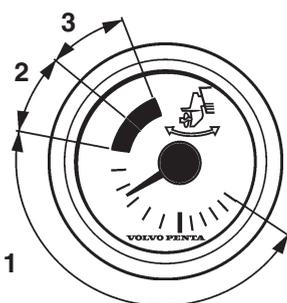
Trim range

The trim range is used to obtain the best comfort at all running speeds (from start to maximum speed).

Beach range

The beach range is used for running **at reduced speed** in shallow water or where water depth is uncertain.

⚠ WARNING! Max. permitted engine speed when running in beach range is 1500 rpm. Make sure the drive's coolant inlet is never trimmed out of the water.



Tilt range

Tilt range is used to lift the drive to maximum height **but not when the engine is running**. The range is used e.g. for trailing. Power trim has an automatic stop that cuts the power when its end limit has been reached. The stop is reset automatically when activating down trimming.

NOTE! The engine can not be started with the drive in the "Tilt range".

Digital trim instrument

The display window will show TRIM while the drive angle* is between -5° and +6° (Trim range).

The display window will show BEACH while the drive angle* is between +6° and +30° (Beach range). LED (1) lights orange.

While the drive angle* is over +30° (Tilt range), the LED (2) will light red. No text in display window.

*The number corresponds to the drive angle in relation to the horizontal (stationary boat). The lowest value shows that the drive is at max trim in and the highest value that the drive is raised to max. Observe that the lowest value can vary from boat to boat depending on the angle of the transom.

Analogue trim instrument

This instrument shows the current position of the drive. Beach range is marked with an orange zone and lift range with a red zone.

1. Trim range.
2. Beach range (orange).
3. Tilt range (red).

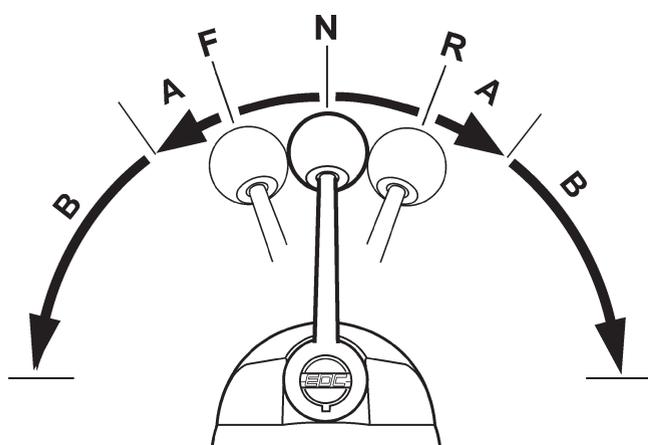
Power trim Assistant (extra optional)

The power trim assistant adjust trim angel automatically according to engine speed (rpm). It is possible to set five trim angles at five different engine speeds (idle speed included). Please refer to the section about "EVC system tachometer".

The power trim assistant is turned on and off in the EVC system tachometer menu SETTINGS/sub-menu PTA.

⚠ IMPORTANT! For twin installations all Power Trim Assistant settings should be made in the port side system. Port side is the master side.

⚠ WARNING! If the boat is equipped with Power Trim Assistant the function must be turned off before taking the boat out of the water. This prevents automatic trimming of the drive/drives if any test runs are performed while the boat is on land.



(A)



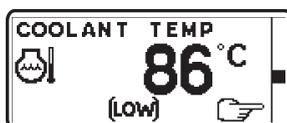
Pop-up when Lowspeed is engaged. It is possible to acknowledge pop-up by pushing NAVIGATION WHEEL.

(B)



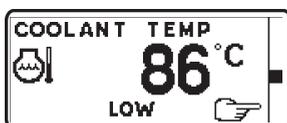
Pop-up when initializing Lowspeed - Lowspeed is not ready to use.(Twin disc)

(C)



Lowspeed initializing - Lowspeed is not ready to use. (Twin disc)

(D)



Lowspeed activated - Function active.

(E)



Pop-up when Lowspeed is disengaged. It is possible to acknowledge pop-up by pushing NAVIGATION WHEEL.

Volvo Penta Lowspeed (extra optional)

The Volvo Penta Lowspeed function is only available for engines with hydraulic reverse gear.

For boats with powerful engines, where the boat speed at idle is too high, Volvo Penta Lowspeed is used to reduce boat speed by reducing propeller rpm - compared to normal at engine idle speed.

N = Neutral idling (reverse gear disengaged, engine runs at idle speed)

F = Forward idling (reverse gear engaged for movement ahead, engine runs at idle speed), maximum slip in reverse gear.

R = Reverse idling (reverse gear engaged for movement astern, 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.

Engaging Lowspeed

1. Move the lever to neutral position.
2. Press the neutral button (N) to activate Lowspeed. When Lowspeed is engaged a pop-up (A) is shown on the tachometer display. It is possible to acknowledge pop-up by pushing NAVIGATION WHEEL.
3. Active Lowspeed is indicated by an icon, **LOW**, on the tachometer display (D).

⚠ IMPORTANT! If Lowspeed initializing pop-up (B) and then icon, **(LOW)**, are shown on the tachometer display (C), Lowspeed is not ready to use. Normal gear shifting until Lowspeed is activated (D).

⚠ IMPORTANT! 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 deactivate Lowspeed. A pop-up (E) is shown on the tachometer display. It is possible to acknowledge pop-up by pushing NAVIGATION WHEEL.
3. The indication in tachometer display goes out.

Running aground

The automatic Kick-up function releases the drive if it grounds or hits an object in the water. If the function has been tripped and the drive released it must be trimmed back to the original position using the control buttons.

 **IMPORTANT!** The Kick-up function only protects the drive when running ahead (forwards). There is no protection for the drive while running astern (backward).

Check after running aground that the drive or propeller are not damaged or if there are vibrations from the drive. If this is the case then the boat (if possible) should be run to harbor at reduced speed and taken out of the water.

Take the boat out of the water. Check the oil level in the drive. If it is colored gray then water has entered the drive. If this is the case or if other damage has occurred to the drive it must be inspected at an authorized Volvo Penta workshop. If only the propeller has been damaged it must be replaced. Launch the boat and test drive. If there are still vibrations it must be inspected by an authorized Volvo Penta workshop.

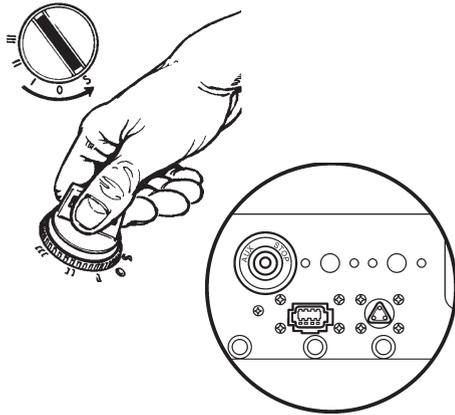
 **IMPORTANT!** To prevent galvanic corrosion any damage to the paintwork on the drive and propeller must be repaired before launching the boat: See section "Laying up/Launching".

Control of parallel strut

 **WARNING!** If the parallel strut shows signs of damage, run at reduced speed to harbor. The parallel strut is a vital safety component, damage may affect steering characteristics. In the worst case steering could be lost altogether. Never align or weld a damaged parallel strut. Please contact your nearest authorized Volvo Penta workshop for assistance.

Stopping the engine

The engine should be run for a few minutes at idle (in neutral) before turning it off. This will avoid boiling and even out the temperature. This is especially important if the engine has been operated at high engine speeds and loads.



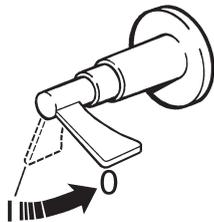
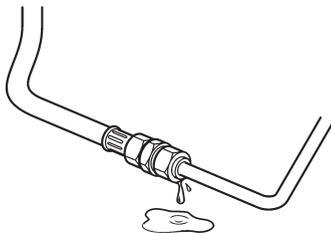
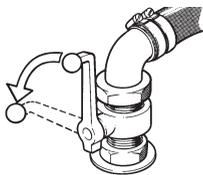
Stopping

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.

- ⚠ **IMPORTANT!** Never switch off the main switches while the engine is running. This could damage the alternator.
- ⚠ **IMPORTANT!** Never switch off the main switches before the starter key is turned off (is in “0” position or removed). This could damage the electrical system.

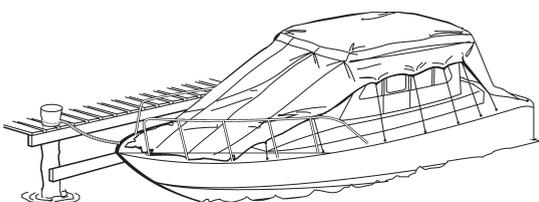
Auxiliary stop

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.



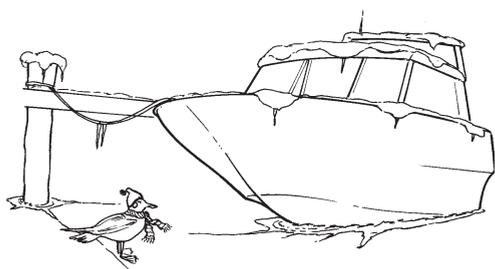
After stopping the engine

- Close the fuel cock and sea cock (reverse gear) for the cooling water intake.
 - ⚠ **IMPORTANT!** Do not forget to open the cocks before the engine is started again.
- Inspect the engine and engine compartment for any leaks.
- Boats with drives: The drive must be trimmed in to its maximum to protect the trim cylinders untreated surfaces from fouling.
 - ⚠ **IMPORTANT!** If there is a risk that the drive can run aground, it must instead be trimmed out to its maximum lift position.
 - ⚠ **IMPORTANT!** Make sure that the starter key is turned off (is in “0” position or removed) before main switches are switched off. Otherwise the electrical system could be damaged.
- Switch off the main switches if the boat is not to be used for some time.



Laying up

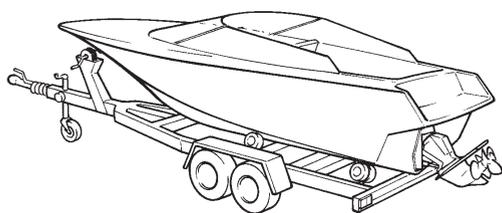
If the boat is not going to be used for some time but is being left in the water, the engine must be run to operating temperature at least once every 14 days. This prevents the corrosion in the engine. If the boat will not be used for more than two months then inhibiting should be carried out: Refer to section “Laying up/Launching”.



Cold weather precautions

To prevent freezing damage, the seawater system must be drained and the freshwater system coolant must have sufficient antifreeze protection. Refer to the cooling system section in chapter “Maintenance”.

⚠ IMPORTANT! A poorly charged battery may burst as a result of freezing.

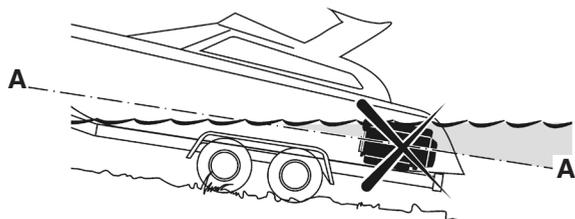


Transporting on a trailer

Before pulling boats with a drive on to a trailer, trim the drive out to “Lift range” (maximum lift). An automatic stop will cut off the current to the hydraulic pump when the drive has reached its max. lift point. The stop is automatically reset when trimming down. **NOTE!** Check local legislation for transporting boats on trailers, there are differences between different countries’ trailer laws. It is possible to trim the drive without starting the engine.

⚠ IMPORTANT! The engine must not be run with the drive in the “Lift” range. Before transporting the boat by trailer always secure the drive in the lift position with a Trailer Kit (accessory) or similar, so that it cannot drop down.

⚠ IMPORTANT! Boats with reverse gear: Drain water out the exhaust system to prevent water entering the engine when transporting the boat by trailer.



Laying up on land/Launching

⚠ IMPORTANT! If the boat (engine) submerges significantly below the static waterline (A) when it is laid up or launched there is a risk of water entering the engine through the exhaust system.

Where boats are kept laid up on land when not in use, there is a lower level of galvanic corrosion protection due to oxidation on the sacrificial anodes. Before launching the boat the sacrificial anodes on the drive and shield must be cleaned with emery paper to remove any oxidation.

⚠ IMPORTANT! Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.

Maintenance schedule

General information

Your Volvo Penta engine and its equipment 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. If given preventive maintenance, according to the maintenance schedule, and if Volvo Penta original spares are used, these qualities are retained and unnecessary malfunctions can be avoided.

Warranty inspection

During the first period of operation, the specified warranty inspection "First service inspection" must be done by an authorised Volvo Penta workshop. Instructions about when and where this should be done are found in the **Warranty and service book**.

Extended Protection

Volvo Penta offers an Extended Protection for your marine diesel engine, including transmission, if used for pleasure use only. To be valid a Extended Protection service has to be performed at the owners cost and expense by an authorized Volvo Penta distributor, dealer or workshop before the expiry of the 12 months Warranty Period. Further directions can be found in the **Warranty and Service Book**.

MAINTENANCE SCHEDULE

 **WARNING!** Before you do any maintenance work, read the "Maintenance" chapter carefully. This contains advice on doing the work in a safe and correct manner.

 **IMPORTANT!** Maintenance points marked must be done by an authorised Volvo Penta workshop.

Daily, before first start:

- Engine and engine room. General inspection..... page 66
- Engine oil. Check level..... page 70
- Coolant. Check level..... page 75
- General inspection of drive, propeller, shield, steering.
- Leakage and function check.....not shown

Every 14 days:

- Drive belts. Check for wear. Change as required..... page 68
- Sea water filter. Clean..... page 77
- Battery. Check electrolyte level..... page 84
- Reverse gear. Check oil level..... page 88
- Outboard drive. Check corrosion protection page 90
- Outboard drive. Check oil level..... page 91
- Outboard drive. Power trim pump. Check oil level page 92
- Outboard drive. Servo pump. Check oil level page 94
- Do a visual check of the alignment between the stern drives.....not shown

Every 50-200 hours / at least once a year, included in extended protection:

- Engine oil. Change¹⁾ page 71
- Oil filter. Change ²⁾ page 72
- Outboard drive. Check/Adjust drive alignment page 95

Every 200 hours / at least once a year, included in extended protection:

- Crankcase ventilation filter. Change page 67
- Air filter. Change page 67
- Exhaust pipe. Check page 68
- Drive belts. Check belt tension page 68
- Compressor. Check oil level page 69
- Sea water pump. Check impeller page 76
- Sacrificial anodes. Charge air cooler, heat exchanger. Check page 78
- Fuel filter/ fuel pre-filter. Change page 80
- Reverse gear. Change oil and filter page 88
- Outboard drive. Change oil ³⁾ page 91
- Outboard drive. Check exhaust bellows page 92
- Clean and touch up the paintwork as required not shown
- Inspection of exhaust hose and cooling water hoses. not shown
 - Check hoses/pipes, unions and hose clamps
- Check the condition of all rubber hoses, and re-tighten hose clamps not shown
- Outboard drive. Change universal joint bellows not shown
- Thoroughly inspect all hydraulic hoses and fittings for signs of leaks, wear, cracks or ageing not shown
- EVC system. Inspection with diagnostic tool not shown

Every second year:

- Coolant. Change page 73

Every 600 hours / at least every 5 years:

- Reverse gear. Change propeller seal not shown
- Turbo. Inspect/clean as required not shown
- Trim/steering cylinders, hoses, hydraulic hoses. Check for leakage not shown
- Outboard drive. Check for function and wear not shown
 - Bushes/shaft stubs in shield and suspension fork
 - Propellershaft seal
 - Propellershaft (check straightness)
 - Gear change mechanism and control cable
 - Steering

¹⁾ Oil change intervals vary, depending on engine type oil grade and sulfur content of the fuel. Please refer to page 70.

²⁾ Change the filters during each oil change.

³⁾  **IMPORTANT!** In operation situations where the number of forward-reverse operations averages more than 20 per hour, the oil should be changed every 100 hours.

Every 1200 hours / at least every 5 years:

- Drive belts. Change page 68
- Drive belt, compressor. Change not shown
- Compressor. Change oil page 69
- Heat exchanger. Inspect/Clean..... not shown
- Intercooler. Inspect/Clean not shown
- Control cables and seals. Change not shown
- Inspect exhaust hose and cooling water hoses. not shown
 - Check hoses/pipes, unions and hose clamps
- Safety and function check not shown
 - In a safety and function check, the outboard drive is disassembled to check for wear and damage. Any faults are rectified. If necessary, the complete drive is changed.

Every 1500 hours (commercial use):

- Outboard drive. Change gears, bearings, all bushings and sealing rings not shown
- Outboard drive. Rebuild or change U-joint not shown
- Outboard drive. Check propellershaft wear and strightness. Change as required not shown
- Outboard drive. Perform pressure check not shown

¹⁾ Oil change intervals vary, depending on engine type oil grade and sulfur content of the fuel. Please refer to page 70.

²⁾ Change the filters during each oil change.

³⁾  **IMPORTANT!** In operation situations where the number of forward-reverse operations averages more than 20 per hour, the oil should be changed every 100 hours.

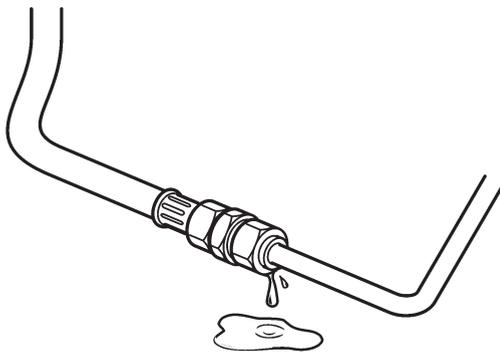
Maintenance

This chapter describes how to carry out the above maintenance. Read the instructions carefully before starting work. Maintenance intervals are contained in the chapter above: Maintenance schedule

⚠ WARNING! Read the safety precautions for maintenance and service in the chapter: Safety Information, before starting work.

⚠ WARNING! Unless otherwise specified all maintenance and service must be carried out with the engine stopped. Stop the engine before opening or removing engine hatches. Immobilize the engine by removing the ignition key, turning off the power supply with the main switch.

Engine, general



General inspection

Make a habit of “visually” inspecting the engine and engine room before starting the engine and after stopping when the engine has been turned off. This will help you to quickly detect abnormalities that have occurred or are about to occur.

Look especially carefully for oil, fuel and coolant leaks, loose bolts, worn or slack drive belts, loose connections, damaged hoses and electric cables. This inspection takes only a few minutes but can prevent serious operating disturbances and costly repairs.

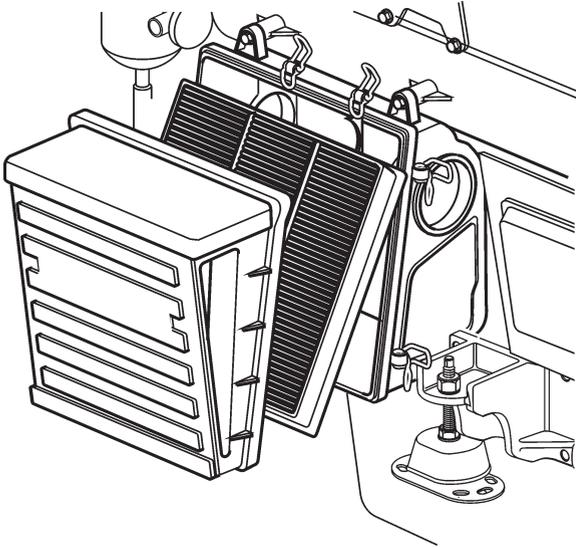
⚠ WARNING! Accumulations of fuel, oil and grease on the engine or in the engine room is a fire hazard and must be removed immediately they are detected.

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

⚠ IMPORTANT! Never point high-pressure water jets directly at seals, rubber hoses or electrical components. Never use the high-pressure function when washing the engine.

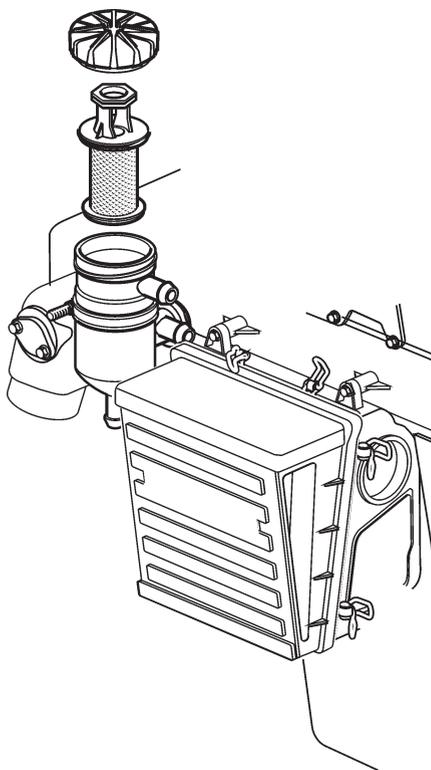
Changing air filter

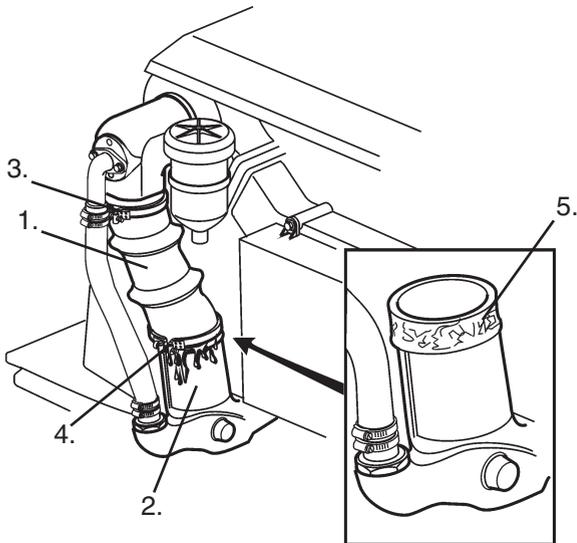
Remove the air filter cover. Remove the old air filter. Clean the air filter cover/housing if necessary. Take care not to allow impurities to enter the engine. Fit the new air filter and the air filter cover.



Changing crankcase ventilation filter

Unscrew the lid and remove the old filter. Clean the filter cover/housing if necessary. Take care not to allow impurities to enter the engine. Fit the new filter.





Checking exhaust line

The exhaust line of drive installations must be inspected every year with respect to corrosion between the hose (1) and the pipe (2).

⚠ WARNING! Risk of water entering. The exhaust line must be inspected while the boat is on land.

In case of serious corrosion damage, the pipe must be repaired or replaced with a new one.

To check: Undo the clamps (3) and (4) holding the hose (1). Detach the hose. Check the contact surface (5). In case of serious corrosion damage, the pipe must be repaired or replaced with a new one.

Checking drive belts

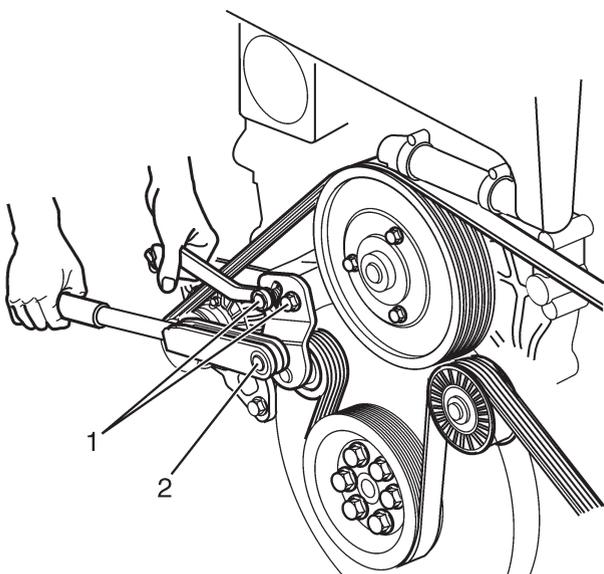
⚠ WARNING! Stop the engine before commencing maintenance work.

General

Check belt tension and condition regularly. If the belt is too taut it can damage bearings and if it is too loose it may slip.

Therefore, check the belt tension regularly. **Check and adjust after operation when the belt is warm.**

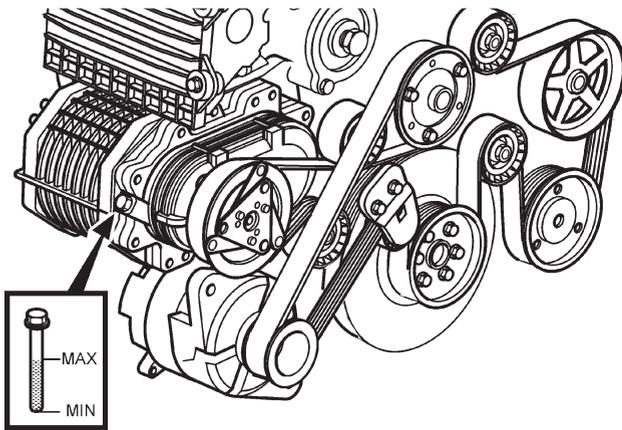
⚠ IMPORTANT ! Always change a belt that appears worn or is cracked (belts working in pairs must be replaced together).



Adjusting/changing drive belts.

The standard generator and water pump are driven by a poly-V belt for optimum function and service life. Change/tension the belt as follows:

1. Undo the bolts (1) on the tensioning roller bracket. Remove and change the belt if necessary.
2. Tension the belt to apply a torque of 70 Nm on the tensioning roller square fitting (2). Secure the tensioning roller with the bolts (1). The bolts must be torque tightened to 50 Nm.
3. Undo the bolts (1) when warm and repeat the belt tensioning procedure.



Compressor. Checking oil

Checking and topping up

Unscrew and remove the dipstick. Wipe off oil. Screw the dipstick down fully and then remove it again. Check that the level oil is between the markings. If the dipstick is not screwed down fully the oil level will be slightly above the MIN marking if the oil level is correct. Ensure therefore that the dipstick is fully screwed in to read off the oil level correctly. Top up the oil as required (use the dip stick tube to fill). For oil quality and capacity: See the "Technical Data" chapter.

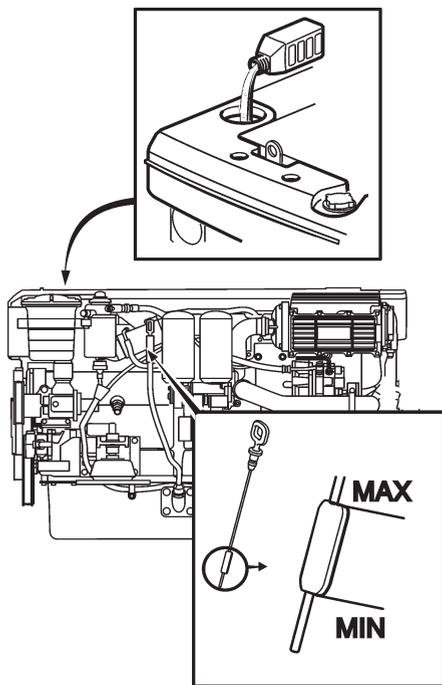
⚠ IMPORTANT! The oil level should always be within the MAX and MIN range marked on the dipstick.

Oil change

Run engine to normal operating temperature. Remove the oil dipstick. Remove the plug (1) and let the oil run out. Reinstall the plug and fill with oil to correct level as above.

Lubrication system

- ⚠ IMPORTANT!** With a new or reconditioned engine, the oil and oil filters must be changed after 20–50 hours of operation. Use only the recommended grades of oil. Please refer to the “Technical Data” chapter.
- ⚠** Oil change intervals can vary from 100 to 200 hours, depending on oil grade and sulphur content of the fuel. Please refer to the “Technical Data” chapter. **Note that oil change intervals must never exceed a period of 12 months.** If you want longer oil change intervals, the condition of the oil must be checked by the oil manufacturers through regular oil testing.



Oil change volume

Please refer to the “Technical Data” chapter.

Checking and topping up the oil level

NOTE! Check the oil level every day **before** the engine is started for the first time.

- ⚠ IMPORTANT!** Do not check the oil level directly after the engine is shut down. The oil in the engine needs time to run down to the oil pan before a correct oil level check can be performed. Wait 15 minutes if the engine has been run up to normal operating temperatures. Wait one hour if the engine only has been run at idle.

- ⚠ IMPORTANT!** The oil level should always be between the MAX and MIN marks on the dipstick. Higher or lower oil level than permitted could lead to engine damage.

Topping up is done via the filling hole on the top of the engine. Top up oil slowly. Wait 5 minutes before checking the oil level again since the oil needs time to run down to the oil pan. Then check the level again. Use only recommended grades of oil: Please refer to the “Technical Data” chapter.

NOTE! The volume between MAX and MIN is approx. 1.5 liter (0.4 US gals) for D4 and 3.5 liter (0.9 US gals) for D6.

Changing engine oil

Always observe the recommended oil change interval.

⚠ IMPORTANT! Only use a recommended grade of oil. Please refer to the “Technical Data” chapter.

⚠ IMPORTANT! The oil level should always be between the MAX and MIN marks on the dipstick. Higher or lower oil level than permitted could lead to engine damage.

1. Start the engine (this makes it easier to suck the oil up from the sump). Let the engine run till operation temperature is reached (temperature gauge indicate a value between 75– 95°C (167-203°F)). Then stop the engine.

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

2. Connect the oil bilge pump to the drain pipe. Pump up the oil.
3. Change the oil filter and bypass filter at each oil change (please refer to chapter “Changing oil filter and bypass filter”).
4. Fill up with new oil through the filling hole on the top of the engine.

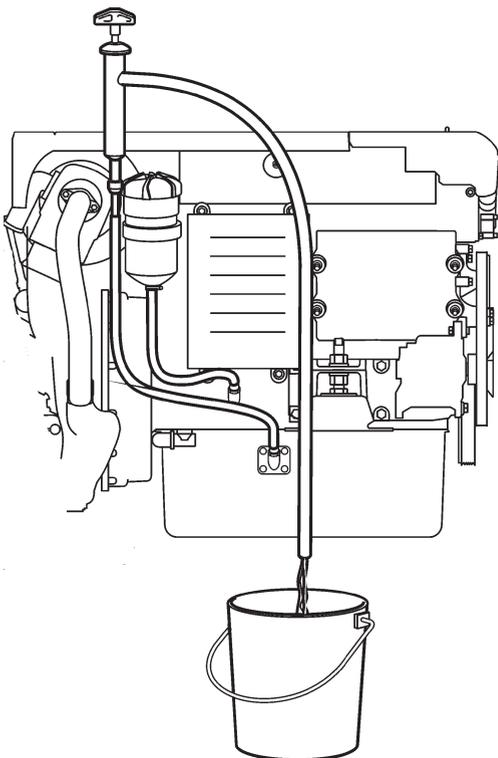
NOTE! Fill 1.5 liters (0.4 US gals) less than the total oil volume since there always is a small amount of oil left in the oil pan. Please refer to the “Technical Data” chapter for oil volume.

5. Start the engine. Check that the oil pressure warning lamp goes out and that no leakage occurs by the filters.

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

6. Stop the engine. Wait one hour before checking the oil level again since the oil needs time to run down to the oil pan. Top up if necessary.

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

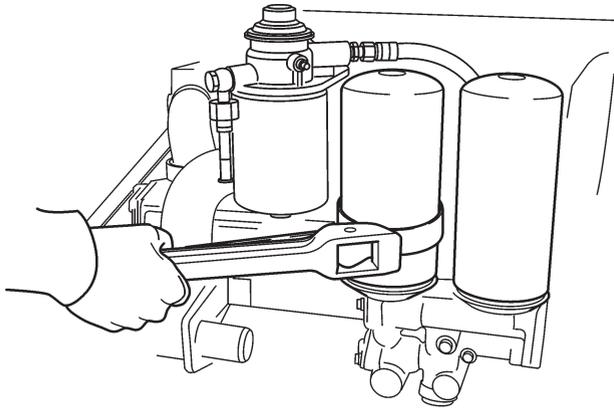


Changing oil filter and bypass filter.

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.



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.

Freshwater system

The fresh water system is the engines' internal cooling system, which ensures that the engine operates at the correct temperature. It is a closed circuit system and must always be filled with a mixture of at least 40 % concentrated coolant and 60 % water to protect against internal corrosion, cavitation and damage caused by freezing.

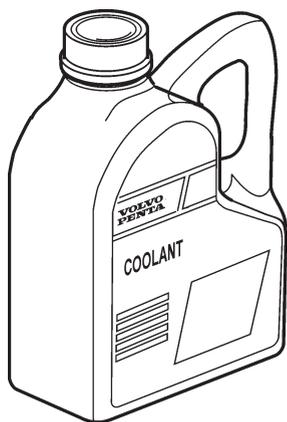
We recommend that you use **“Volvo Penta Coolant, Ready Mixed”**, alternatively **“Volvo Penta Coolant”** (concentrated) mixed with **pure** water according to spec, see “Coolant. Mixture”. Only coolant of this quality is suited too and approved by Volvo Penta.

The coolant should contain ethylene glycol of a good quality with a suitable chemical consistency for an adequate protection of the engine. Using anti-corrosion additive exclusively is not permitted in Volvo Penta's engines. Never use water by itself as coolant.

⚠ IMPORTANT! Coolant must be used all year round. This applies even if there is never any risk for frost, to ensure that the engine has an adequate protection against corrosion.

Future warranty claims on the engine and additional equipment may be rejected if an unsuitable coolant has been used or if the instructions concerning coolant mixing have not been followed.

NOTE: The anti-corrosive agents become less effective after a time, which means that the coolant must be replaced, see “Service schematic”. The cooling system should be flushed out at the same time as the coolant is replaced, see “Cooling system. Flushing”.



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

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



Coolant. Mixture

⚠ WARNING! All glycol is hazardous and harmful to the environment. Do not consume! Glycol is flammable.

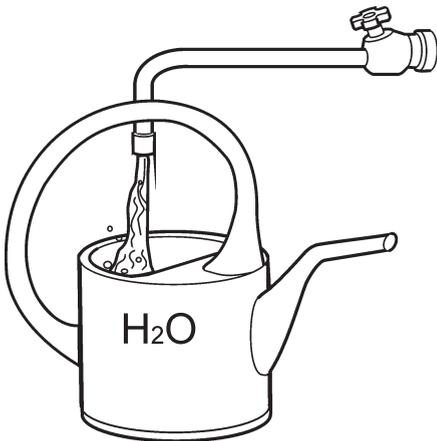
⚠ IMPORTANT! Ethylene glycol must not be mixed with other types of glycol.

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

This mixture protects the engine against internal corrosion, cavitation and frost damage down to -28 °C (-18°F). (Using 60 % glycol lowers the freezing point to -54 °C (65°F)). Never mix more than 60 % concentrate (Volvo Penta Coolant) in the cooling liquid, this will give reduced cooling effect and increase the risk of overheating, and will give reduced freezing protection.

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

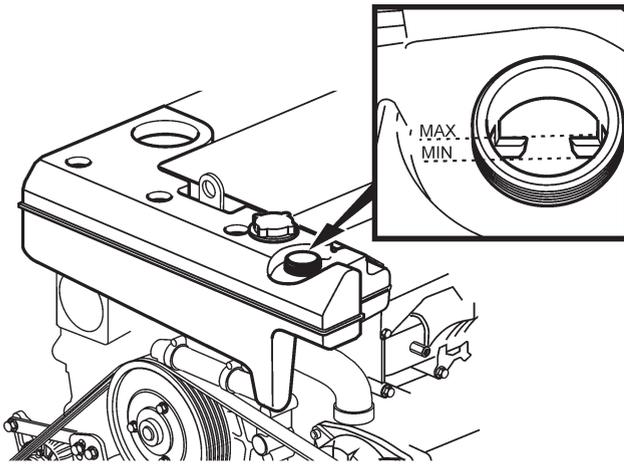
⚠ IMPORTANT! It is extremely important that the correct concentration of coolant is added to the system. Mix in a separate, clean vessel before adding into the cooling system. Ensure that the liquids mix properly.



Water quality

ASTM D4985:

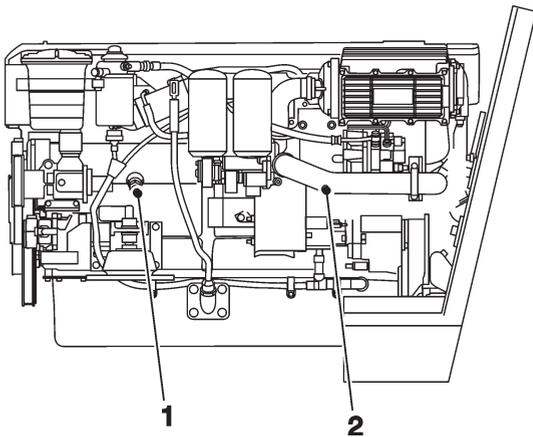
| | |
|---|------------------------------|
| Total solid particles | < 340 ppm |
| Total hardness:..... | < 9.5° dH |
| Chloride | < 40 ppm |
| Sulfate..... | < 100 ppm |
| pH value..... | 5,5–9 |
| Silica (acc. ASTM D859)..... | < 20 mg SiO ₂ /l |
| Iron (acc. ASTM D1068) | < 0.10 ppm |
| Manganese (acc. ASTM D858)..... | < 0.05 ppm |
| Conductivity (acc. ASTM D1125)..... | < 500 µS/cm |
| Organic content, COD _{Mn} (acc. ISO8467) | < 15 mg KMnO ₄ /l |



Checking coolant level

⚠ WARNING! Do not open the engine coolant system filler cap when the engine is still hot except in an emergency. Steam or hot coolant may spray out.

Turn the filler cap slowly counter clockwise and let any pressure escape from the system before removing the cap. Top up coolant if necessary. The coolant level should be between the MAX and MIN marking on the expansion tank. Reinstall the filler cap.



Draining fresh water system

Remove the filler cap on the expansion tank (to allow the coolant to run out faster). Use a suitable receptacle while draining.

There is a hose mounted on the intercooler. Move the hose and connect it to the drain nipple (1). Open the drain nipple by carefully screwing the nipple. Use a no. 17 block spanner if the nipple sticks. Drain all coolant and screw in the nipple by hand.

Move the hose and then continue to drain the coolant from the drain nipple (2) on the engine block.

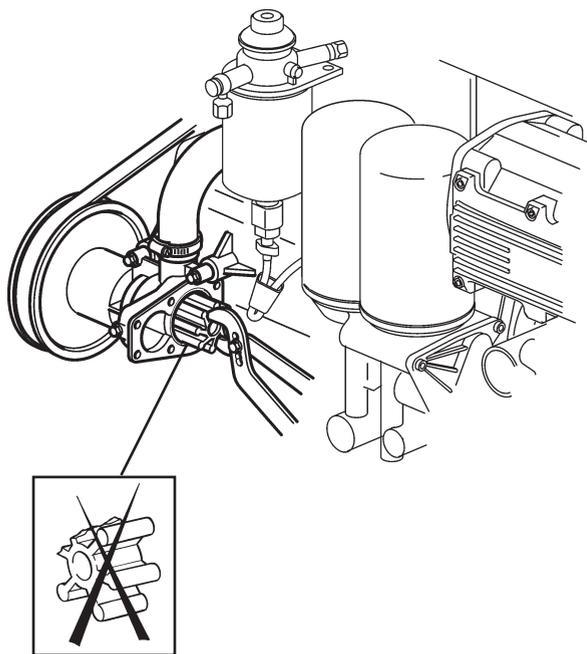
NOTE! Leave the old coolant to a facility for destruction

Seawater system

The seawater system is the boat's external cooling system. On engines with drives, the seawater pump draws in water via the drive, through the control system oil cooler to the seawater pump, after which the water passes the seawater filter before being pumped through the fuel cooler, intercooler, engine oil cooler and heat exchanger. Finally, the water is pumped into the exhaust pipe elbow, where it is mixed with the exhaust gases.

On engines with reverse gear, the seawater pump draws in water via the seawater inlet, after which it passes the seawater filter (extra equipment) before being pumped through the intercooler, heat exchanger, engine oil cooler and reverse gear oil cooler. Finally, the water is pumped into the exhaust pipe elbow, where it is mixed with the exhaust gases.

⚠ WARNING! There is a risk that water will enter while working on the seawater system (if the boat is in the water). Water may flow into the boat if a hose, plug or similar object located below the waterline is removed. So always close the seawater cock. If the boat does not have a seawater cock, the flow of water must be stopped in a safe manner. The boat must be brought up on land if this is not possible.



Checking/Changing impeller.

⚠ WARNING! Risk for water penetration.

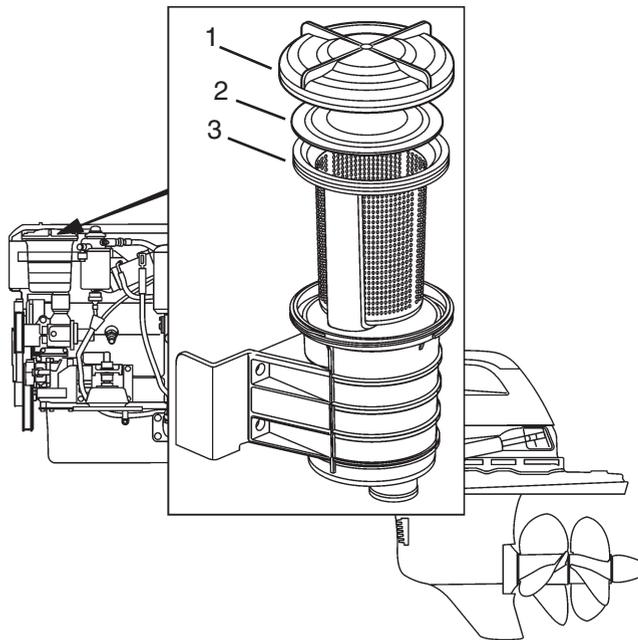
Remove the cover from the seawater pump and remove the impeller (1).

If there are cracks or other defects the impeller must be replaced. (If the pump shaft can be turned by hand the flange must be replaced). Lubricate the pump housing and the inside of the cover with a little **glycerin**.

⚠ IMPORTANT! The impeller will be damaged if other types of lubricant than glycerin are used.

⚠ WARNING! If the impeller is damaged, the pump will not work, which can lead to engine damage or fire.

Reinstall the impeller using a rotating movement. Install the seal washers on the shaft center. Install the cover together with a new o-ring. Reverse gear: Open the sea cock.

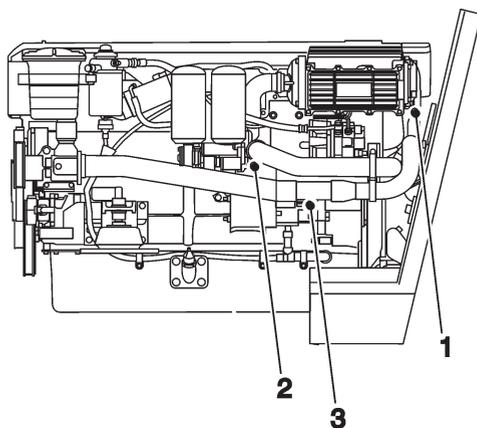


Cleaning seawater filter.

⚠ WARNING! Risk for water penetration.

Screw off cover (1) and remove seal plate (2). Lift out and clean the insert (3).

⚠ IMPORTANT! If the boat is used in water that has a lot of contaminants, seaweed etc. the filter must be checked more frequently than indicated in the maintenance schedule. Otherwise there is a risk the filter will clog and the engine will overheat.

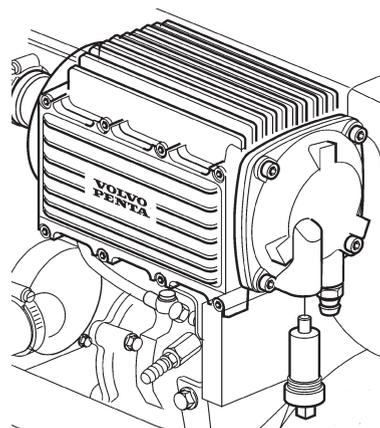
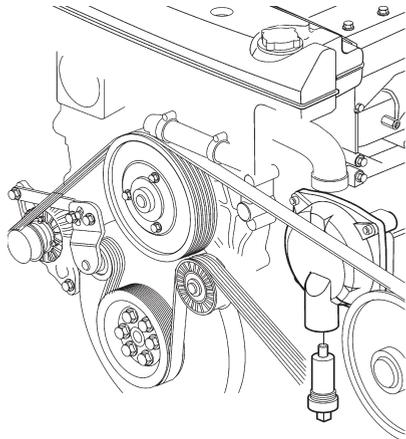


Draining seawater system

Use a suitable receptacle while draining.

Open the drain nipple (1) by carefully screwing the nipple. Use a no. 17 block spanner if the nipple sticks. Drain all coolant and screw in the nipple by hand.

Move the hose and then continue to drain the coolant from the drain nipple (2) and (3).



Checking/Changing sacrificial anodes

⚠ WARNING! Risk of water entering. Close the seawater cock before starting work on the seawater system.

1. Close the seawater cock.
2. Drain the seawater as described in "Draining the seawater system".
3. Remove the sacrificial anodes in the heat exchanger and the intercooler.
4. Check the sacrificial anodes and change them if they are less than 50% of their original size. Otherwise, clean the sacrificial anodes with sandpaper to remove the layer of oxide before refitting them.

⚠ IMPORTANT ! Clean with sandpaper. Use no steel tools as this will impair electrical protection.

5. Fit the sacrificial anodes. Make sure there is good contact between the anode and the metal goods.
6. Close the drain nipples.
7. Open the seawater cock before starting the engine.
8. Make sure there are no leaks.



Seawater system. Cleaning and inhibiting

To prevent the build up of deposits and salt crystals in the seawater system it must be flushed with freshwater. When the boat is laid up it must also be inhibited.

⚠ WARNING! Risk of water penetration. Cleaning and inhibiting the seawater system should be carried out with the boat on land.

1. Open the seawater cock (reverse gear).
2. Detach hose from the seawater pump and connect a hose (1) which reaches to a bucket filled with fresh water. Take care of filling.
3. Check that there is nothing that will get splashed behind the exhaust outlet.

⚠ WARNING! Approaching a running engine is dangerous. Watch out for rotating components and hot surfaces.

⚠ IMPORTANT! The impeller will be damaged if it runs dry.

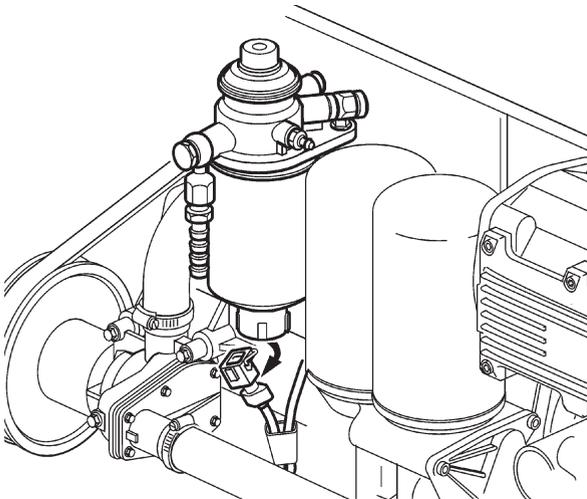
4. Set the gear control lever in the neutral position. Check that nobody is near the propellers. Start the engine. Let it run at fast idle a few minutes. Stop the engine.
5. For inhibiting fill a bucket with antifreeze mixture (50/50 freshwater and antifreeze). Secure a container by the exhaust outlet. Repeat step 4.
6. Connect seawater hose.
7. The system is now inhibited. The antifreeze mixture should be left in the system while the boat is laid up. Drain the mixture just before the boat is launched. Reuse the antifreeze mixture next season or deposit it at a properly designated disposal site.

Fuel system

The engine fuel system is a so-called common rail-system. The advantage of the common rail-system is that the engine control unit controls the timing and fuel amount, this mean better emission control and a smooth running engine.

All work on the engine common rail-system must be carried out at an authorized workshop. Use only the recommended grade of fuel: See the chapter "Technical Data".

⚠ WARNING! Fire risk. When carrying out work on the fuel system makes sure the engine is cold. A fuel spill onto a hot surface or an electrical component can cause a fire. Store fuel soaked rags so that they cannot cause a fire.

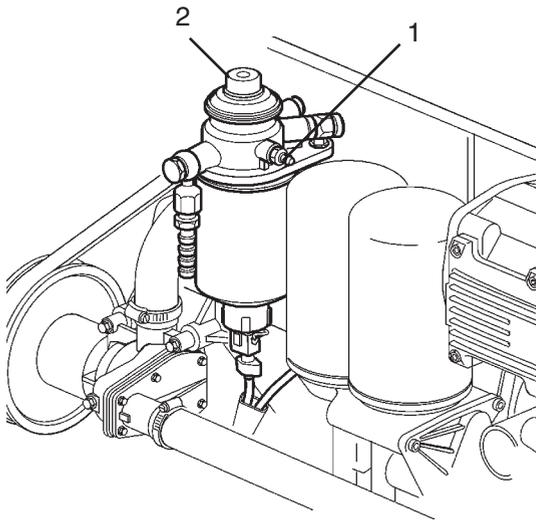


Changing fuel filter

1. Close the fuel valve/valves.
2. Clean the filter bracket and put a suitable vessel under the filter.
3. Remove the cables from the water trap (1).
4. Unscrew the 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.

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

6. Screw the new filter on by hand until the seal just touches the mating surface. Then tighten a further 1/2 turn. Reinstall the water trap cables.
7. Open the fuel valve.
8. Bleed the fuel system. See Chapter "Bleeding the fuel system".
9. Start the engine and check for leakages.



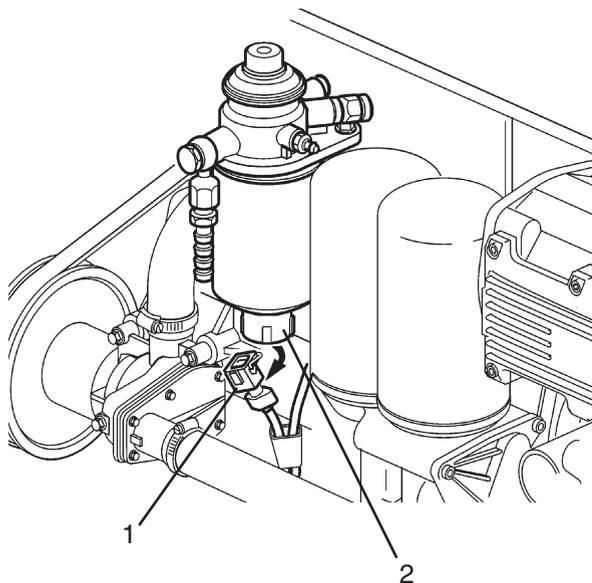
Bleeding the fuel system

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

⚠ WARNING! Never detach the pressure pipes.

1. Attach a transparent hose to the air vent valve (1). Lead the hose to a suitable receptacle to avoid spillage.
2. Open the air vent valve and pump fuel using the hand pump (2) until the fuel running out is free from air bubbles. Close and tighten the air vent valve.
3. Pump another 10 strokes with the hand pump. The resistance in the hand pump may seem quite high and is normal and necessary for bleeding the system.
4. Remove the hose and refit the protective cap on the air vent valve.

⚠ WARNING! Working on or approaching a running engine is a safety hazard. Beware of rotating parts and hot surfaces.



Water in fuel

Draining the fuel filter

If the pop-up "water in fuel" on the tachometer display or the lamp  on the optional alarm display comes on, there is too much water in the water separator on the fuel filter. Proceed as follows to rectify this:

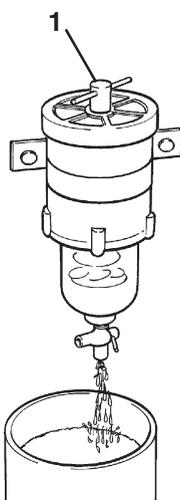
1. Stop the engine and take the starter key out of the starter switch.
2. Remove the cable from the water separator (1).
3. Place a suitable receptacle under the fuel filter and carefully unscrew the water separator (2) enough to allow the water to run out. Screw in the water separator until it bottoms against the filter. Then, screw a further 1/4 to 1/2 of a turn.
4. Fasten the cable from the water separator (1).

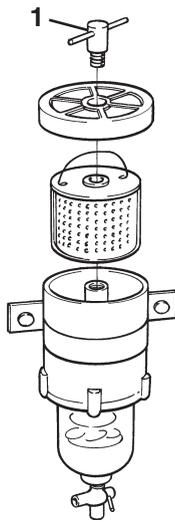
Draining of fuel pre-filter.

The fuel pre-filter is an accessory.

Position a container under the fuel filter. On the fuel filter first open the venting screw (1) approximately 4 turns. Drain off water and contaminants using the cock/plug at the bottom of the filter. Vent fuel system.

⚠ IMPORTANT! Wait a few hours after the engine has been turned off before draining the filter.





Fuel pre-filter. Changing filter insert

Close fuel cock at the fuel tank. Position a container under the fuel filter.

Remove the cover by slackening off screw (1). Replace insert and reinstall cover. Open fuel cock. Vent fuel system. **Deposit the old filter insert at a properly designated disposal site.**

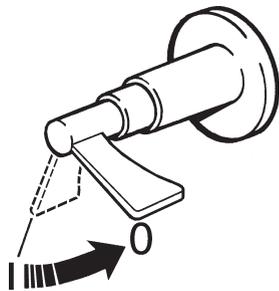
Start the engine and check for leaks.

⚠ WARNING! Approaching a running engine is dangerous. Watch out for rotating components and hot surfaces.

Electrical system

The engine is equipped with a two-pole system electrical system which means that the voltage (minus) is returned directly from the starter motor minus terminal with the battery negative lead. Individual components on the system return voltage to the starter motor minus terminal via separate cables.

⚠ 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

The main switch must never be turned off before the engine has stopped. If the circuit between the generator and the battery is cut off when the engine is running the generator can be seriously damaged. For the same reason charging circuits must never be switched over while the engine is running.

⚠ IMPORTANT! Never break the circuit with the main switches while the engine is running.

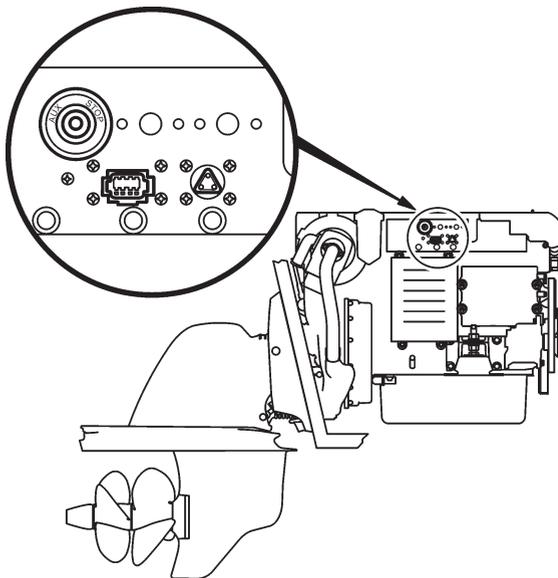
Fuses

12-volt system

The engine is fitted with fully automatic circuit breakers. The circuit breakers cut the power if the electrical system is overloaded.

If it is not possible to start the engine or if the instrument stops working while running, the circuit breaker may have been activated. If the fault is intermittent, resetting will take place automatically. If the fault persists, read out the flash codes and take the necessary measures.

⚠ IMPORTANT ! Always investigate the cause of the overload!



24-volt system

The engine is fitted with two automatic circuit breakers (1). The circuit breakers cut the power if the system is overloaded.

If it is not possible to start the engine or if the instrument stops working while running, the circuit breaker may have been activated. Reset by pressing in the circuit breaker.

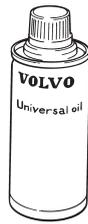
If the fault persists, read out the flash codes and take the necessary measures.

⚠ IMPORTANT ! Always investigate the cause of the overload!

EVC system

The EVC system is protected through the engine circuit breakers.

⚠ IMPORTANT ! Always investigate the cause of the overload!



Electrical connections

Also check that all electrical connections are dry and free of oxidation and that there are no loose connections. If necessary, spray these connections with a water-repellent spray (Volvo Penta Universal oil).

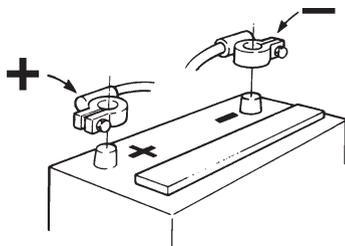


Battery Maintenance

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

⚠ WARNING! Never mix up battery positive and negative terminals. This may cause sparks and an explosion.

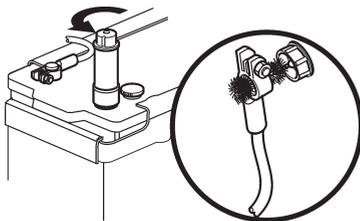
⚠ WARNING! The battery electrolyte contains extremely corrosive sulfuric acid. Protect your skin and clothes when charging or handling batteries. Always use protective goggles and gloves. If battery electrolyte comes into contact with unprotected skin wash off immediately using plenty of water and soap. If battery acid comes into contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.



Connecting and disconnecting

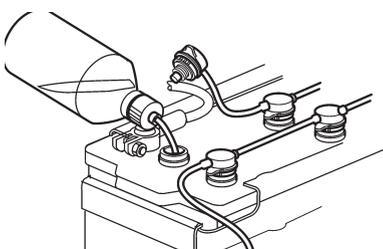
First connect the red battery lead + to the battery + terminal. Then connect the black battery lead – to the battery – terminal.

When disconnecting the battery, disconnect the – lead (black) first and then the + lead (red).



Cleaning

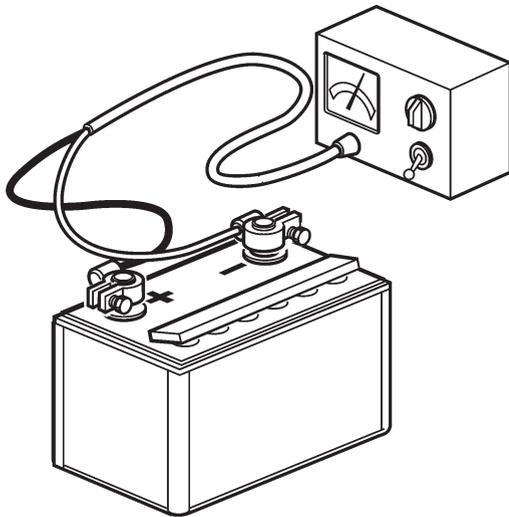
Keep batteries dry and clean. Oxidation or dirt on the battery and battery terminals can cause short-circuits, voltage drop and discharge especially in damp weather. Clean the battery terminals and leads to remove oxidation using a brass brush. Tighten the cable terminals well and grease them with terminal grease or petroleum jelly.



Topping up

The electrolyte should be 5–10 mm over the plates in the battery. Top up using **distilled water** if necessary. Charge the battery after topping up for at least 30 minutes by running the engine at fast idle.

NOTE! Certain maintenance-free batteries have special instructions which must be followed.



Battery. Charging

⚠ WARNING! Danger of explosion! The batteries give off hydrogen gas during charging which when mixed with air can form an explosive gas – oxyhydrogen. A short-circuit, naked flame or spark can cause a large explosion. Ensure that the ventilation is good.

⚠ 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 into contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.

If the battery has discharged it must be charged. If the boat has not been used for some time charge the battery and then trickle charge it (see manufacturer's recommendations). A poorly charged battery will be damaged and may burst in cold weather.

⚠ IMPORTANT! Follow the instructions supplied with the battery charger carefully. To avoid electrolytic corrosion when an external charger is connected, always disconnect the battery leads before connecting the charger.

When charging, unscrew filler plugs but leave them in their holes. Ventilation should be good, particularly if the batteries are being charged in an enclosed area.

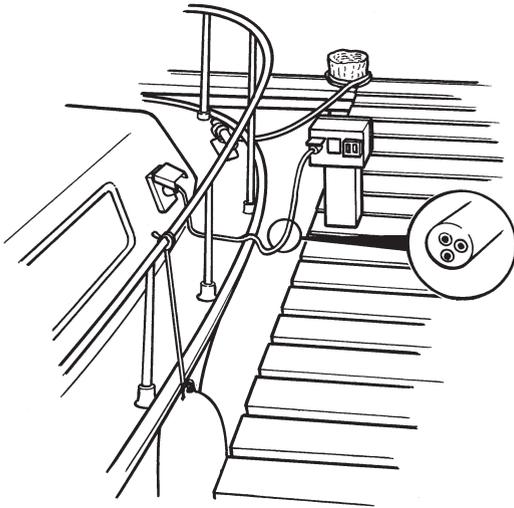
⚠ WARNING! Always switch off the charging circuit **before** removing the battery charger connectors. Never mix up battery positive and negative terminals. This may cause sparks and an explosion.

Special instructions apply when **boost charging** the batteries. Avoid boost charging the batteries as it will shorten their service life.

Electrical installations

Leakage current from the electrical system can be caused by incorrect installation of electrical equipment. Leakage current can knock out the galvanic protection of components such as the drive, propeller, propeller shaft, rudder stock and keel and cause damage by electrolytic corrosion.

⚠ IMPORTANT! Work on the boat's low tension circuit should only be carried out by qualified or experienced persons. Installation or work on the shore power equipment **must only** be carried out by electricians authorized to work with high-voltage installations.



The following should always be observed:

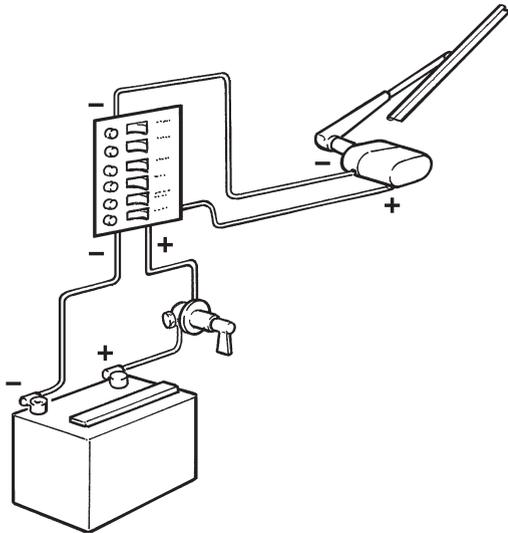
1. When shore power is connected (120V–230V), the shore safety ground (earth) must not be connected to the engine or any other ground point on the boat. The safety ground must always be connected to the connection cabinet's ground (earth) terminal ashore. The safety ground should not be connected to the negative connection on the output side (12/24V), i.e. it must be galvanically separated.

Shore power units (transformer, rectifier, battery chargers etc.) must be intended for marine usage **and the high tension circuit must be galvanically separated from the low tension circuit.**

2. Route and clamp electric cables so that they will not be exposed to rubbing, damp or bilge water in the keelson.
3. Engine or drive/reverse gear must never be used as a ground point.

⚠ IMPORTANT! The engine or drive/reverse gear must never be used as a ground or be electrically connected to other equipment such as the radio, navigational equipment, the rudder, bathing steps etc.

Protective grounds for the radio, navigational equipment, rudder, bathing steps or other equipment with separate ground leads must be connected to a common ground terminal.



4. There must be a main switch connected to the starter battery positive (+) terminal. The main switch should cut off power to all power consuming equipment and should be switched off when the boat is not in use.
5. If an auxiliary battery is in use, a main switch should be connected between its + terminal and the fuse block, and the (-) terminal and the terminal block for the boat's electrical equipment. The main switch for the auxiliary battery must cut off all power consuming equipment connected to that battery and be turned off when power is no longer needed.

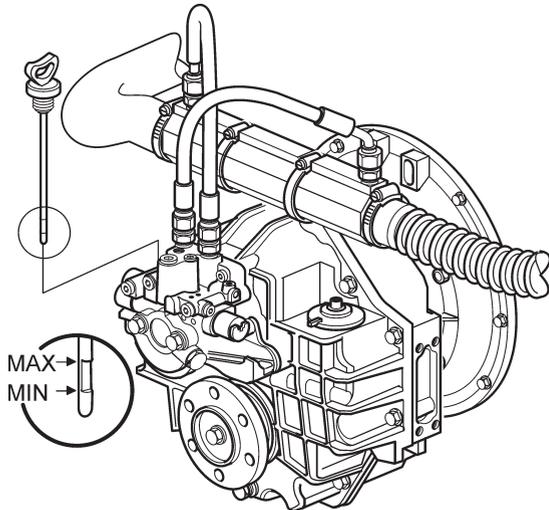
All equipment connected to the auxiliary battery should have separate switches.

To simultaneously charge two independent battery circuits, fit a Volvo Penta charge distributor (accessory) to the regular generator.

Reverse gear

The HS45AE/HS63AE/HS63VE/HS80/85AE/HS80/85VE reverse gear is hydraulic, which means that ahead/astern engagement and disengagement is hydraulically activated. The reverse gear lubrication system has an oil filter and oil cooler. The reverse gear is equipped with solenoid valves for electronically controlled shifting.

⚠ IMPORTANT! Volvo Penta recommends the installation of a seawater filter to guarantee the proper coolant water flow to the engine and reverse gear. Contaminants in the seawater will otherwise foul the reverse gear radiator and other cooling system components.

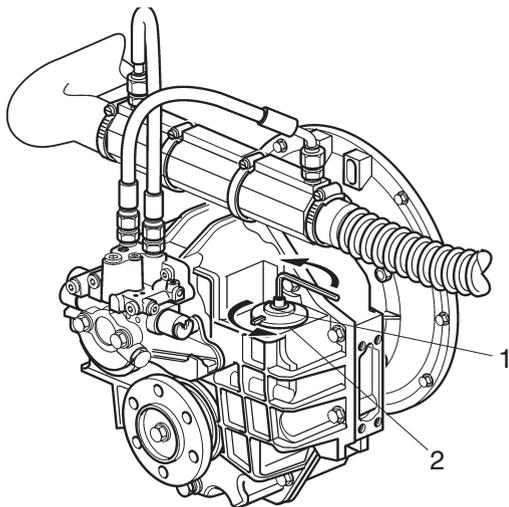


Checking oil level

Start the engine and let it run a couple of minutes. Stop the engine and remove the dipstick by turning it anti clockwise. Dry off the dipstick and reinstall it in the reverse gear, **without screwing it into place**. Remove the oil dipstick again and check the oil level. The correct oil level is inside the marked area.

If necessary, top the oil up through the dipstick hole. Please refer to the "Technical Data" chapter for oil grades and volume.

⚠ IMPORTANT! Never over-fill the reverse gear. The oil level must always be inside or at the recommended levels.



Changing oil and filter

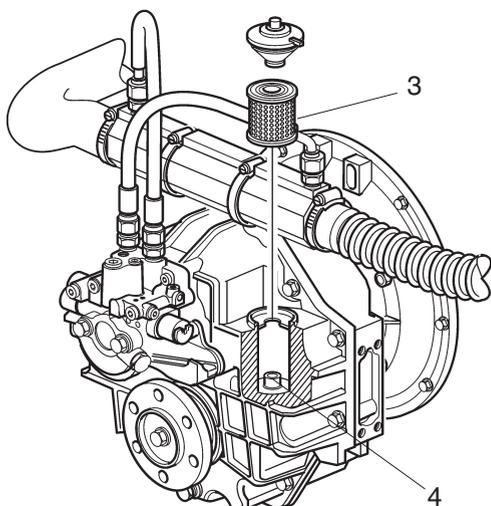
1. Clean around the lid (2), so that there is no risk that dirt could fall down into the filter housing.
2. Undo screw (1) with a 6 mm Allen key. Remove lid (2). Replace and oil in the new O-rings in the lid.
3. Remove the filter (3).
4. Suck up the oil with an oil drain pump, via the oil filter housing. Connect hose to the suction pipe (4) at the bottom of the housing.

⚠ NOTE! Maximum outside diameter of suction hose is 5/8 inch (16 mm).

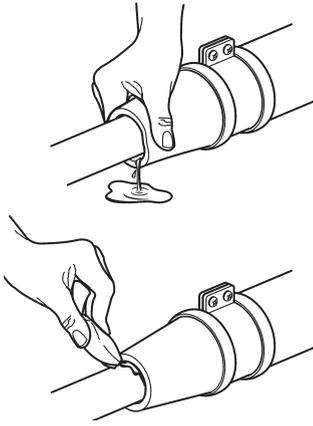
5. Measure up the correct quantity of oil and fill the reverse gear with the oil via the oil filter housing. Please refer to the "Technical Data" chapter for oil grades and volume.

NOTE! Fill with less oil than total volume since there could be a small amount of oil left in the reverse gear after draining it.

⚠ IMPORTANT! Never over-fill the reverse gear.



6. Install the new filter (3) in the filter housing.
7. Install the lid. Tightening torque 5–8 Nm.
8. Put the control lever in neutral. Start and run the engine at 1500 rpm for a few minutes to ensure that the reverse gear oil cooler is filled with oil.
9. Stop the engine and check the oil level. Top up as necessary.



Propeller shaft seal. Checking

If the boat has a Volvo Penta shaft the shaft seal must be vented and lubricated directly after launching.

Vent the bushing by pressing it together while pressing down on the shaft until water appears. Then press in approx. 1 cc **water repellent grease** into the seal.

⚠ IMPORTANT! The seal must be checked every 600 hours and changed as required. The seal must be changed every five years, however.

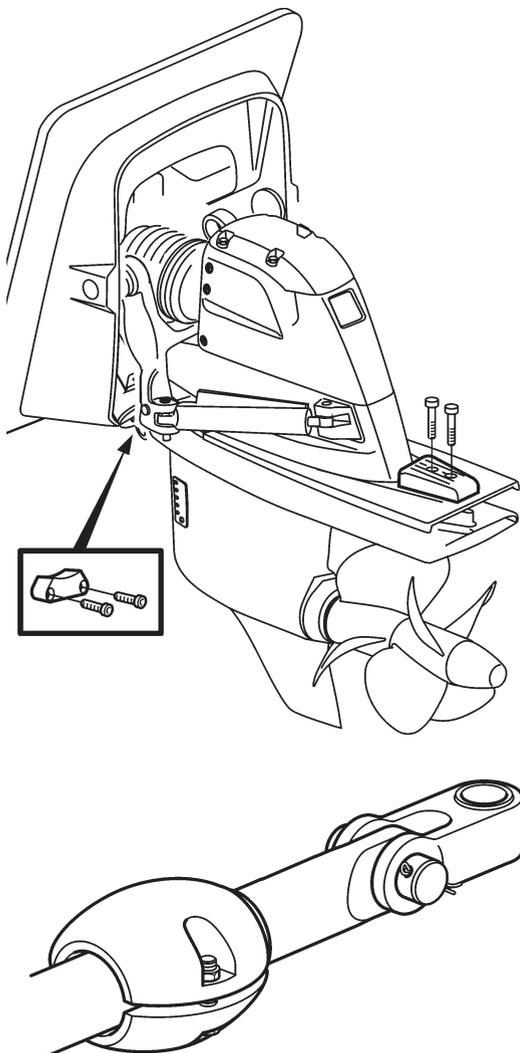
Drive

⚠ WARNING! If the boat is equipped with Power Trim Assistant the function must be turned off before taking the boat out of the water. This prevents automatic trimming of the drive/drives if any test runs are performed while the boat is on land. For instructions on how to turn off the function please refer to the section “Power Trim Assistant” in the chapter “Operating”.

Your drive is protected against galvanic corrosion. This protection consists of two-three layers of paint, sacrificial anodes and ground braids. The ground braids maintain a connection between the different components of the drive. A broken connection can result in the rapid corrosion of an individual component even though the protection is otherwise effective. Check ground braids every year. Faulty electrical installation can also cause the break down of the galvanic protection. Damage due to electrolytic corrosion occurs rapidly and is often extensive. For further information see the chapter: “Electrical system”.

⚠ IMPORTANT! Always repair damage to paintwork immediately. Improperly applied paint or the wrong type of paint on the keel can put the corrosion protection system out of action. For further information on painting see the chapter: Laying up and launching

The drive is equipped with a cone clutch for shifting using a control cable with either mechanical operation or an electric actuator and electronic operation.



Corrosion protection. Checking/Changing

Check the sacrificial anodes regularly. Change with new anodes when approximately 1/3 of the anode has been eroded. Tighten the new anode so that there is a good electrical contact.

Where boats are kept laid up on land when not in use there is a lower level of galvanic corrosion protection due to the oxidation on the sacrificial anodes. Even a new anode can be oxidized on the surface. Before launching the sacrificial anodes must be cleaned/ground using an emery cloth.

⚠ IMPORTANT ! Clean with sandpaper. Use no steel tools (e.g. wire brush) as this will impair electrical protection.

Your drive is equipped with sacrificial anodes of zinc as standard, intended for use with salt water. On drives used mainly in freshwater the sacrificial anodes should be of magnesium.

⚠ IMPORTANT ! Use protective anodes as follows:

- Zinc for use in salt water
- Magnesium for use in fresh water
- Aluminium if the boat is used primarily in salt water and occasionally in fresh water.

Changing corrosion protection

All anodes are secured with screws. Undo the screws holding the anode. Clean the contact surface and fit the new anode.

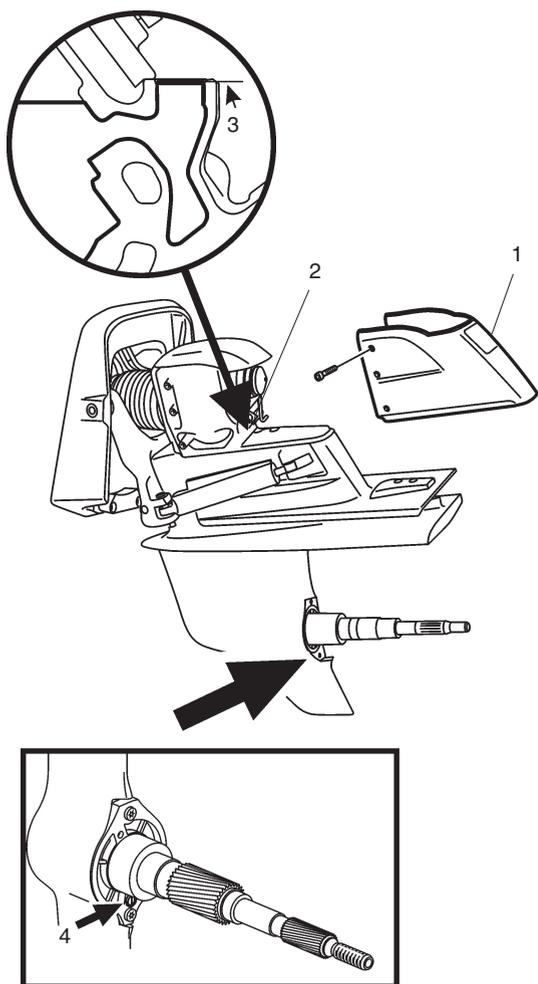
Checking oil level

Trim up the drive to 35°. Remove the cover (1) and the plug (2).

⚠ IMPORTANT! Always trim up the drive to 35° when checking the oil level.

The oil level must always be at the top of the oil filler cap (3). If not, top up with oil until the oil filler cap is completely filled. Refer to "Technical Data" concerning grade and capacity.

Check that the plug is tight and fit the cover.



Changing oil

Trim up the drive to 35°. Remove the cover (1) and the plug (2).

⚠ IMPORTANT! Always trim up the drive to 35° when changing the oil.

Dismantle the propeller and remove the oil drain plug (4) together with its gasket from the gear housing and allow the oil to run out.

If the oil is discolored, contact an authorised Volvo Penta service centre.

Refit the plug with gasket. A damaged gasket must always be replaced with a new one. Check the tightness of the plug before fitting the propeller.

Fill with new oil. Refer to "Technical Data" concerning grade and capacity.

Top up with oil until the oil filler cap is completely filled. The oil level must always be at the top of the oil filler cap (3). Refer to "Technical Data" concerning grade and capacity.

Lower the sterndrive and tilt the sterndrive to 35° position again to eliminate possible air pockets.

Remove the oil fill plug and check oil level. Top up with oil if the oil filler cap is not completely filled.

Check that the plug is tight and fit the cover.

NB! Leave the old oil to a destruction plant.



Checking oil level, power trim

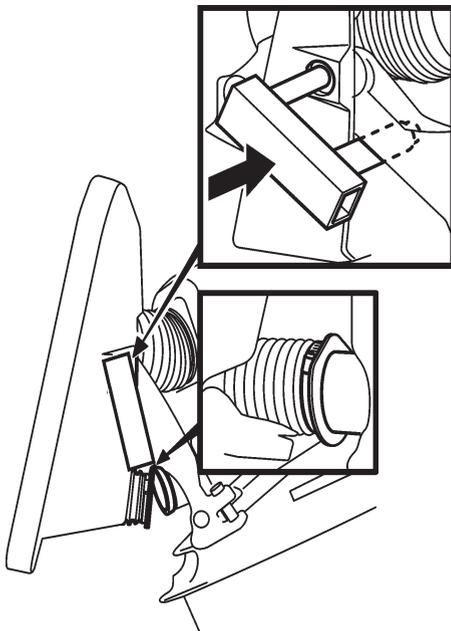
Trim the drive in as far as possible. Check the oil level is between the MAX and MIN markings on the oil container. Top up if necessary using ATF oil. Cleanliness is extremely important, no dirt must get into the drive when topping up with oil.

If the system has been drained, fill with new oil and trim the drive in and out 6–10 times to vent the system. Check the oil level and top up if necessary.

Changing universal joint bellows

Check the condition of the joint bellows once a year. It must be changed if there are any visible cracks or other defects.

The joint bellows should be renewed every 200 operating hours. The drive must be dismantled from the suspension fork in order to change the joint bellows. Dismantling the drive requires knowledge and special tools. Contact your Volvo Penta service centre.



Checking exhaust bellows

Check the condition of the exhaust bellows once a year. It must be changed if there are any visible cracks or other defects.

⚠ WARNING! Never work on the drive bellows or hydraulics without first securing the drive in raised position in such a way that it cannot fall down. The drive can cause severe personal injury if it falls down.

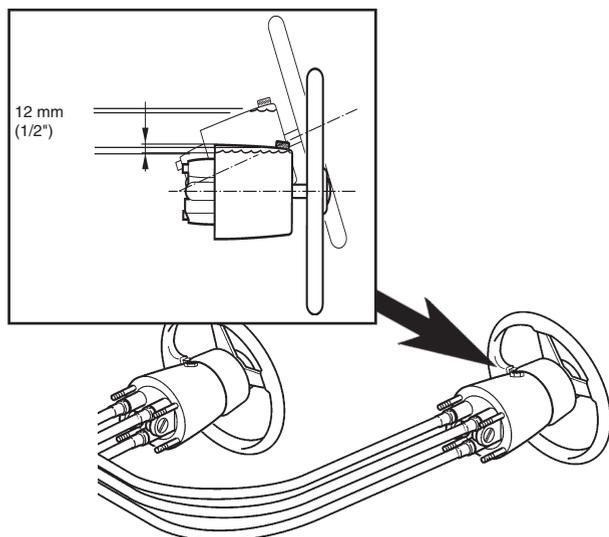
Special tool no.885800, applied correctly, will prevent the drive from falling down. Fit the tool as follows: Trim out the drive to max and apply the special tool.

Then inspect the bellows thoroughly for damage and change if necessary.

⚠ WARNING! Do not overload the tool by standing on the raised drive.

Steering

The DPH/R drive is equipped with a fully hydraulic steering system with additional power assistance to allow steering without the engine running.



Checking oil level, steering system

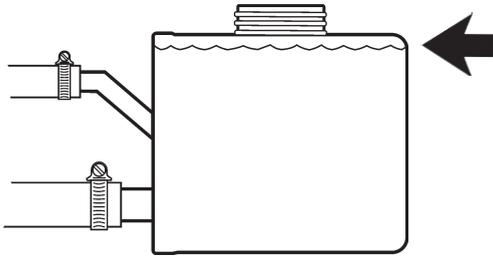
⚠ IMPORTANT! Follow the directions below to ensure problem free and safe steering:

Check the steering system oil level every two weeks so that any changes in level are discovered. Check oil level at the helm pump. Min level is 12 mm below lower edge of the fill hole. If the boat has a flybridge, do NOT open lower helm pump. Only check the oil level at the upper helm station. Normally, the oil level will not change, "oil consumption" in one year is negligible.

A drop in level is a probable indication that there is a leak or that there are air in the system. The leak must be located and rectified immediately. **Contact your Volvo Penta service centre for repair.**

The steering system is filled with ATF and does not normally require changing. As long as the fluid is red in colour and does not contain any visible contaminants, it need not be changed. If the fluid has started to turn black or if there are any visible contaminants, it must be changed. The fluid must also be purged from air if the steering system has been opened for service.

⚠ WARNING! Use only Volvo Penta recommended fluid and grade. Never top up the steering system with fluid of unknown grade. Never use brake fluid or hydraulic oil. **Any non-approved fluid may cause irreparable damage, loss of steering and cancellation of warranty.** The incorrect fluid can also result in damage to the components used in the steering system.



Checking oil level, servo pump

The oil recovery tank is a see-through reservoir, check oil level without opening the reservoir. Oil should be right below the neck of the recovery tank.

If oil needs to be added, first disconnect quick connect coupling, before opening the cap.

Hydraulic hoses. Checking

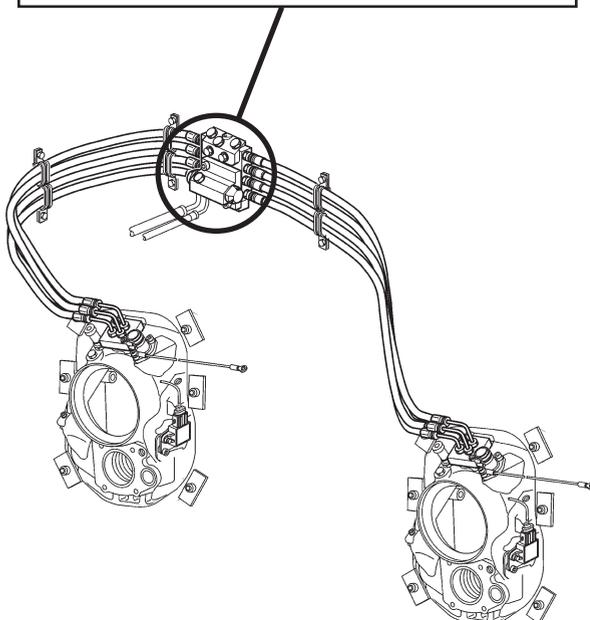
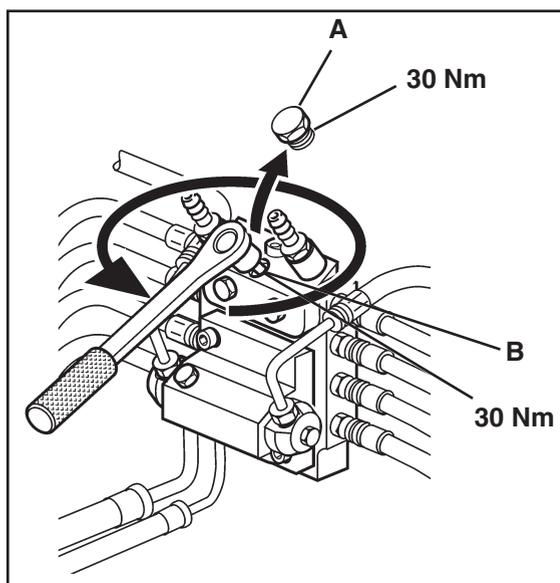
Carefully check the steering system's hydraulic hoses for wear and cracks. Check external hoses especially carefully, as these have been exposed to water fatigue. Hoses must be replaced if at all damaged.

⚠ WARNING! A leaking hydraulic hose can negatively affect steering, and at worst steering can be lost altogether. Cleanliness is extremely important, no dirt must get into the hydraulic system. Before removing, clean and check carefully how hoses are routed and connected. **Faulty routing or dirt in the hydraulic system can negatively affect steering, and at worst steering can be lost altogether.** Please contact your nearest authorized Volvo Penta workshop for assistance.

Parallel strut. Checking

The parallel strut (twin and triple installation) is a vital safety component. Inspect it carefully if the drive kick-up function has been triggered by the boat going aground or hitting an object in the water.

⚠ WARNING! If the parallel strut shows signs of damage, run at reduced speed to harbor. The parallel strut is a vital safety component, damage may affect steering characteristics. In the worst case steering could be lost altogether. Never align or weld a damaged parallel strut. Please contact your nearest authorized Volvo Penta workshop for assistance.



Hydraulic tie-bar. Adjusting

The tie-bar can be adjusted both with the boat in the water and with the boat on land.

With the boat in the water:

1. Remove protective cap screw (A). Loosen adjustment screw (B) 1-2 turns.
2. With the engines running, turn the steering wheel hard over to one side until the helm pump goes against a "lock". Both stern drives will then steer out fully to one side.
3. Tighten adjustment screw (B), **torque 30 Nm** securely. Install protective cap screw (A).

This procedure will line up the stern drives parallel to each other (straight ahead).

With the boat on land:

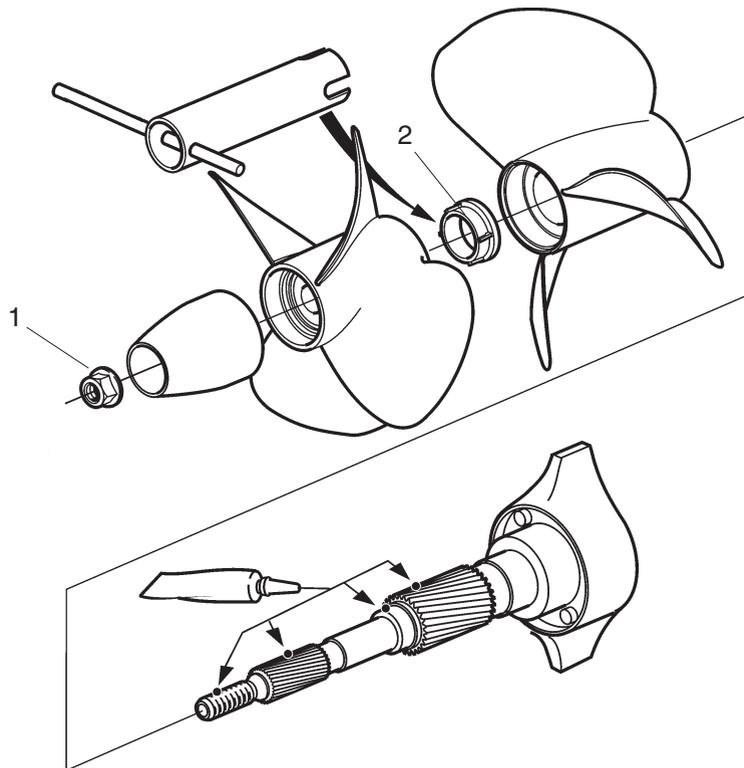
1. Remove protective cap screw (A). Loosen adjustment screw (B) 1-2 turns.
2. Set stern drives to desired alignment (straight ahead recommended).
3. Tighten adjustment screw (B), **torque 30 Nm** securely. Install protective cap screw (A).

Propellers

For best performance and fuel economy the engine speed should be within the maximum RPM range: See chapter "Operation". If the engine speed at maximum RPM falls outside the max. RPM range then the propeller should be changed.

⚠ WARNING! Make it impossible to start the engine when working on the propellers. Take the starter key out of the starter switch.

⚠ IMPORTANT! Damaged propellers should be replaced immediately. Operating the boat with a damaged propeller should be undertaken with extreme care and only at reduced engine speeds.



Propellers. DPR/DPH drive

NB! A tool for removing and fitting the propellers is supplied together with the Transom shield kit (see figure).

Dismantling

1. Turn on the power and move the control lever to reverse. Take the starter key out of the starter switch.
2. Undo the lock nut (1) and remove the rear propeller.
3. Turn on the power and move the control lever to forward. Take the starter key out of the starter switch.
4. Undo the large lock nut (2) using the special tool supplied. Remove the front propeller.
5. Wipe the propeller shafts clean.

Assembly

1. Lubricate both propeller hubs. Use Volvo Penta grease 828250.
2. Turn on the power and move the control lever to forward. Take the starter key out of the starter switch.
3. Push the front propeller onto the shaft.
4. Screw on the large lock nut (2) and torque tighten to 50-70 Nm.
5. Turn on the power and move the control lever to reverse. Take the starter key out of the starter switch.
6. Push the rear propeller onto the shaft and secure it with the lock nut (1). Torque tighten to 70-80 Nm..

Laying up/Launching

Before taking the boat out of the water for winter/out-of-season storage have an authorized Volvo Penta workshop inspect the engine and other equipment. Have any necessary repairs or service work carried out so that your boat is in top condition for the new season.

⚠ WARNING! If the boat is equipped with Power Trim Assistant the function must be turned off before taking the boat out of the water. This prevents automatic trimming of the drive/drives if any test runs are performed while the boat is on land. For instructions on how to turn off the function please refer to the section "Power Trim Assistant" in the chapter "Operating".

Inhibition should be carried out to ensure that the engine and transmission are not damaged while out of commission during the winter/off-season. It is important this is done properly and than nothing is forgotten. We have therefore provided a checklist covering the most important points.

⚠ WARNING! Read the chapter on Maintenance carefully before starting work. It contains instructions on how to carry out the most common maintenance and service operations safely and correctly.

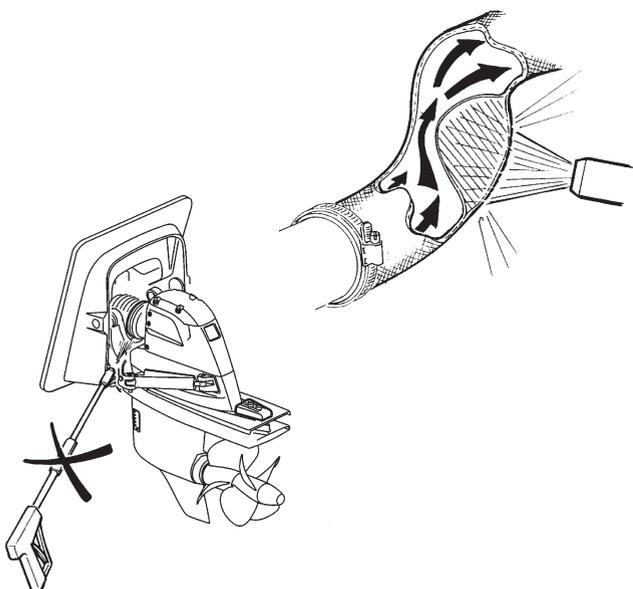
Inhibiting

The following are best carried out with the boat in the water:

- Change engine oil and replace oil filter.
- Change oil in the reverse gear.
- Replace fuel filter. Replace fuel pre-filter if installed.
- Run engine to normal operating temperature.
- Take the boat out of the water:

The following should be carried out with the boat out of the water:

- Clean the hull and drive directly after taking up the boat (before it dries).



⚠ IMPORTANT! Be careful when cleaning with a high pressure water spray. The spray must not be pointed toward the exhaust and drive union bellows, the trim/steering cylinder seals, the propeller shaft seal, hoses etc.

- Change oil in the drive.
- Clean the seawater filter.
- Clean and inhibit the seawater system.
- Remove the impeller from the seawater pump. Store the impeller in a sealed plastic bag in a cool place.
- Check the condition of the engine coolant anti-freeze. Top up if required.

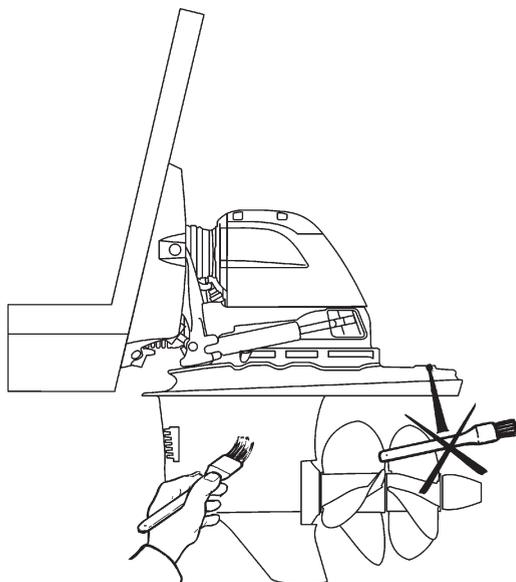
⚠ IMPORTANT! An anti-corrosion mixture in the engine coolant system provides no protection against freezing. If there is any possibility the engine will be subjected to freezing temperatures then the system must be drained.

- Drain any water and contaminants from the fuel tank. Fill the tank completely with fuel to avoid condensation.
- Clean the outside of the engine. Do not use a high pressure spray to clean the engine. Touch up any damaged areas of paintwork with Volvo Penta original paint.
- Check all control cables and treat with rust inhibitor.
- Repair any damaged areas of paintwork with Volvo Penta original paint. NOTE! Read the special instructions on painting the drive under the heading: "Painting the drive and underwater hull".
- Disconnect battery leads. Clean and charge the batteries. NOTE! A poorly charged battery may burst as a result of freezing.
- Spray electrical system components with moisture repellent spray.
- Remove propeller for winter storage. Grease the propeller shaft using water repellent grease VPnr. 828250.

Bringing out of storage

- Check oil level in the engine and drive/reverse gear. Top up if necessary. If there is inhibiting oil in the system drain and fill with new oil, change oil filter. For correct oil grade: See the chapter "Technical Data".
 - Drain the antifreeze from the seawater system.
 - Install the impeller in the seawater pump. Replace if the old one looks worn. Please refer to the Sea Water System chapter.
 - Close/tighten drain cocks/plugs.
 - Check the tension and condition of the drive belts.
 - Check the condition of rubber hoses and tighten hose clamps.
 - Check engine coolant level and antifreeze protection. Top up if necessary.
 - Connect the fully charged batteries.
 - Paint the drive and hull: See next page.
 - Check the sacrificial anode on the drive. If there is less than 2/3 of the anode left it must be replaced. Clean with emery cloth just before the boat is launched.
- ⚠ IMPORTANT!** Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.
- Install propellers.
 - Launch the boat. Check for leaks.
 - Vent and lubricate the propeller shaft seal (reverse gear).
 - Start the engine. Check that there are no fuel, engine coolant or exhaust gas leaks and that all control functions are operating.





Painting the drive and underwater hull

Drive

Before treating the drive with anti-fouling agent any damaged paintwork must be repaired. Sand down metal surfaces lightly using a 120 grade paper and a finer grade for painted surfaces. Wash off using thinners or similar. Any pores in the surface should be filled and sanded down. Paint using Volvo Penta original primer and topcoat. Let the paint dry. A further two coats of Volvo Penta anti-fouling **primer** should then be applied. Let them dry. A further two coats of Volvo Penta anti-fouling should then be applied.

⚠ IMPORTANT! The sacrificial anodes on the drive must not be painted or treated with Teflon. This also applies to stainless or bronze propellers.

Use of anti-fouling agents is not permitted in all countries. Please make sure that it is permitted where your boat is to be used. If anti-fouling agents are not permitted we recommend that a pure Teflon®* agent be applied onto the original paintwork on the drive without sanding it down first.

*Teflon is the registered trademark of the Du Pont Corp.

Underwater hull

All types of paints with anti-fouling properties are poisonous and cause damage to the marine environment. Avoid the use of such agents. Most countries have introduced legislation controlling the use of anti-fouling agents. **Always abide by these regulations.** In many cases it is completely forbidden to use them on pleasure boats, for example in freshwater. For boats that are relatively easy to get out of the water we recommend only Teflon treatment combined with mechanical cleaning several times per season. For larger craft this is not practicable. If the boat is in an area where the water quickly produces fouling then anti-fouling paints must probably be used. If this is the case use a copper-based paint containing copper cyanide and **not copper oxide.**

⚠ IMPORTANT! Leave an area of 10 mm around the drive unpainted.

Tin-based agents (TBT) must not be used. **Check the legislation that applies where the boat is to be used.** Wait for the paint to dry before launching the boat.

In case of emergency

Despite regular maintenance according to the maintenance schedule and perfect operation, faults may occur which must be attended to before the boat can travel further. This chapter contains tips for rectifying some of the possible faults.

There are safety functions which are activated when certain faults occur, to protect the engine. The following can occur:

- Engine can not be started
- Gear in neutral and engine speed is limited to 1500 rpm, no steering.
- The engine stops

If fault occurs, acknowledge any alarm and take the recommended measures. Please refer to this chapter and the "Fault register" chapter.



Starting with auxiliary batteries

⚠ WARNING! Ventilate well. 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.

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

1. Check that the rated voltage of the help start battery is the same as the system voltage of the engine.
2. Connect the red jumper cable to the positive pole (+) of the flat battery, and then to the positive pole of the help start battery.
3. Connect the black jumper cable to the **negative pole (-)** of the help start battery, and then to a place some distance from the flat batteries, such as the negative connection on the starter motor.

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

4. Start the engine and run at a fast idle for about ten minutes to charge the batteries. Make sure that there are no extra accessories 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.

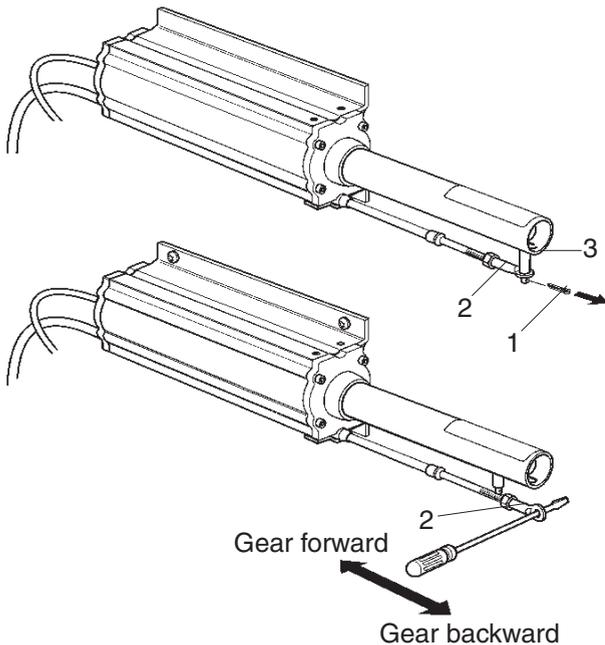
⚠ WARNING! Do not touch the connections during the start attempt: Risk of arcing. Do not stand bending over any of the batteries either.

5. Stop the engine. Remove the jumper cables in the exact reverse order from installation.

Emergency shifting

If a fault occurs which prevents the drive or 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 drive 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.

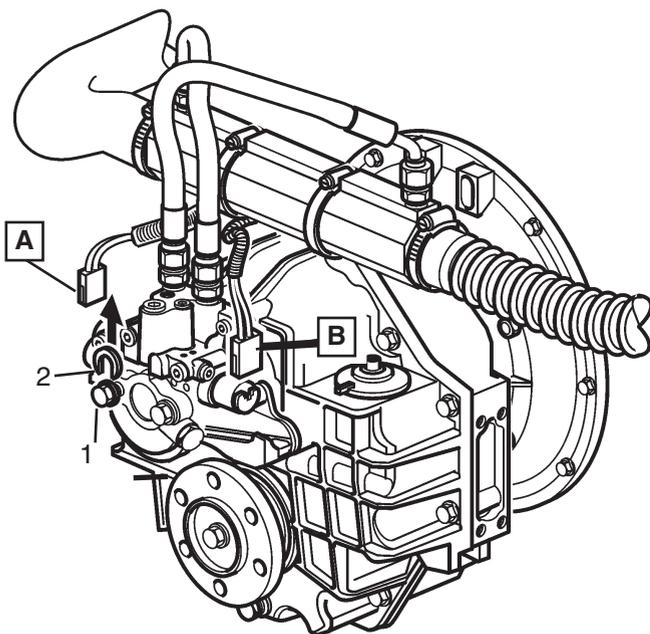


Drives

The drives gears are changed electronically using a gear lever carrier mounted in the engine compartment

Manual drive engagement

1. Stop the engine and take the starter key out of the starter switch.
2. Pull out the split pin (1) and lift the adapter (2) from the pin (3).
3. Place a screwdriver or similar tool in the adapter (2) hole and move the control wire horizontally.



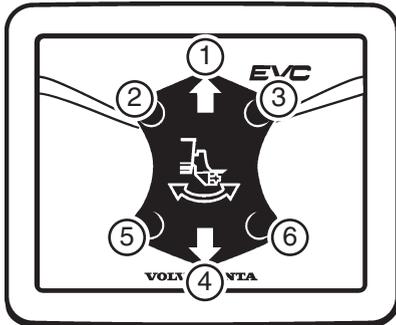
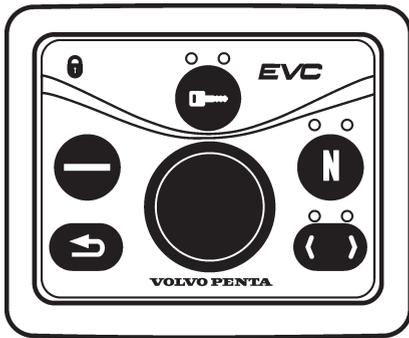
Reverse gear

This description is for manual engagement of the reverse gear, for forward travel.

Note. The descriptions refer to electrically shifted reverse gear.

Manual engagement of the reverse gear:

1. Stop the engine and remove the ignition key from the ignition lock.
2. Undo the screw (1) on the side **where the cable harness marked A is connected.**
3. Remove washer (2) and tighten the screw.
4. Undo cables A and B from the solenoid valves.



Emergency trimming

If a fault occurs which prevents the drive from being trimmed with the trim panel, it is possible to perform an emergency trimming, using the description below.

 **WARNING!** When emergency trimming is performed, the automatic stop will not work. The drive can be trimmed outside the trim ranges, this can damage boat or drive.

1. Press -button on the control panel and hold.
2. Trim the drive using the trim panel.

Engine stop after crash-stop

If the engine has stopped after a crash-stop, the following procedure has to be done before the boat can be manoeuvred:

1. Put the control levers in neutral position.
2. Acknowledge the alarm and stop the engine(s).
3. Wait until the system is shutdown properly, all lamps has gone out. Then start the system, not the engine.
4. Acknowledge the alarm and start the engine.
5. Stop the engine. Wait until the system is shutdown properly, all lamps has gone out. Then start the engine.

Fault-tracing

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

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

Symptom and possible cause

| | |
|---|---|
| Pop-ups are shown in the tachometer display | See the "Fault register" chapter |
| Starter motor not turning (or slow) | 1, 2, 3, 24 |
| Engine does not start | 4, 5, 6, 7, 24 |
| Engine starts but stops again | 6, 7, 24 |
| Engine difficult to start | 4, 5, 6, 7 |
| Engine does not reach correct speed at wide open throttle (WOT) | 5, 6, 7, 8, 9, 10, 11, 15, 18, 19, 20, 21, 24 |
| Engine knocks | 4, 5, 6, 7 |
| Engine runs unevenly | 4, 5, 6, 7, 10, 11 |
| Engine vibrates | 15, 16 |
| High fuel consumption | 8, 9, 10, 12, 15 |
| Black exhaust smoke | 10 |
| Blue or white exhaust smoke | 12, 22 |
| Low oil pressure | 13, 14 |
| Engine coolant temperature too high | 17, 18, 19, 20, 21 |
| None or poor charging | 2, 23 |

- | | | |
|---|---|--|
| 1. Discharged battery | 10. Insufficient air supply | 18. Blocked seawater intake/pipe/filter |
| 2. Loose connection/open-circuit | 11. Engine coolant temperature too high | 19. Circulation pump drive belt slipping |
| 3. Fuse tripped | 12. Engine coolant temperature is too low | 20. Defective impeller |
| 4. Lack of fuel | 13. Lubricating oil level too low. | 21. Defective/incorrect thermostat |
| 5. Fouled fuel filter. | 14. Blocked oil filter | 22. Lubricating oil level too high |
| 6. Air in the fuel injection system | 15. Defective/incorrect propeller | 23. Generator drive belt slipping |
| 7. Water/contaminants in the fuel | 16. Defective engine mounting | 24. Stored diagnostic trouble codes (NOTE! The codes can only be read and erased by a service technician.) |
| 8. Boat abnormally loaded | 17. Too little coolant | |
| 9. Fouling on underwater hull/drive/propeller | | |

Diagnostic function

The diagnostic function monitors and checks that the engine, stern drive/reverse gear and EVC system function normally.

The diagnostic function has the following tasks:

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

The diagnostic function affects the engine in the following ways when:

1. The diagnostic function has discovered a minor malfunction which does not damage the engine.
Reaction: The engine is not affected.
2. The diagnostic function has discovered a serious malfunction which will not immediately damage the engine (e.g. high coolant temperature):
Reaction: Engine power is reduced till the relevant value is normalized.
3. The diagnostic function has discovered a serious malfunction which will cause serious engine damage.
Reaction: Engine power is reduced.
4. The diagnostic function has discovered a serious malfunction which makes it impossible to control the engine.
Reaction: The reverse gear/drive is disengaged and engine speed is cut to 1000 rpm.
It is possible to do an emergency shift: Please refer to the "Emergency shifting" section.
5. The diagnostic function has discovered a serious malfunction on the sterndrive shift mechanism or in the engine fuel injection system.
Reaction: Engine is stopped
It is possible to do an emergency shift: Please refer to the "Emergency shifting" section. In serious emergency it is also possible to start the engine with gear engaged after acknowledging the alarm.

Malfunction message engine and EVC-system

If the diagnostic function discovers a malfunction, it warns the driver by showing pop-ups in the tachometer display and the buzzer will sound.

Pop-ups will alternate between "cause of fault" and "measures to take".

To acknowledge the alarm, press NAVIGATION WHEEL. When the fault has been acknowledged, the buzzer will become silent. Press NAVIGATION WHEEL. The pop-up will disappear and normal display window will be shown.

NOTE! To enable engine start the alarm must be acknowledged.



Danger pop-up

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

NOTE! Acknowledge the alarm and stop the engine at once.

Information regarding "cause of fault" and "measures to take" is found in chapter "Fault register".

Warning pop-up

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

NOTE! Acknowledge the alarm and stop the engine at once.

Information regarding "cause of fault" and "measures to take" is found in chapter "Fault register".

Caution pop-up

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

Acknowledge the alarm.

Information regarding "cause of fault" and "measures to take" is found in chapter "Fault register".



Faults are stored and malfunctions have been registered

Faults list

A faults list can be viewed from the MAIN MENU in the tachometer, if a fault is registered.

When in MAIN MENU, select FAULTS by pushing NAVIGATION WHEEL. Number after FAULTS indicates number of faults stored in faults list. Show faults in faults list by turning NAVIGATION WHEEL.

Shown fault pop-ups will alternate between "cause of fault" and "measures to take".

More information regarding "cause of fault" and "measures to take" is found in chapter "Fault register".

Erasing faults in faults list

Any fault pop-up in the diagnostic function are automatically erased every time the starter key is turned to the stop position (S).

NOTE! 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 to see whether there are any faults in the EVC system. If this is the case, new fault pop-ups are shown.

This implies that:

1. Faults which have been attended to or have disappeared are automatically erased.
2. Faults which have not been attended to must be acknowledged every time the system voltage is switched on.

Fault register

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

Explanation

Faults are presented with information about reason and proposed measures to be taken.

| 1. | 2. | 3. | 4. |
|---------------------|---|---|---|
| Description |  R |  |  |
| Explanation: | | | |
| Reaction: | | | |
| Action: | | | |

1. Description of current fault and measures to take.
2. Current warning lamp which flashes during an alarm. O/R means that an orange or red lamp flashes.
3. Audible warning
4. Current fault pop-up which is shown on the EVC tachometer display.

| | | |
|--|--|---|
| Engine speed |  R |  |
| Explanation: Fault in engine speed sensor. | | |
| Reaction: Engine power is reduced. | |  |
| Action: | | |
| <ul style="list-style-type: none"> • Please contact a Volvo Penta workshop. | | |

| | |
|--|---|
| Water in fuel |  O |
| Explanation: Water in water trap in fuel filters. | |
| Reaction: None | |
| Action: |  |
| <ul style="list-style-type: none"> • Empty the water trap underneath the fuel filters, please refer to "Maintenance: Fuel system". • Please contact a Volvo Penta workshop if the fault remains. | |

| | | |
|---|---|---|
| Seawater pressure |  R |  |
| Explanation: Seawater pressure too low. | | |
| Reaction: Engine power is reduced. | |  |
| Action: | | |
| <ul style="list-style-type: none"> • Check that the seawater filter is not blocked. Please refer to "Maintenance: Seawater system". • Check the impeller in the sea water pump. Please refer to "Maintenance: Seawater system". • Check that no leakage occurs. • Please contact a Volvo Penta workshop if the fault remains. | | |

Air temperature



Explanation: Charge air temperature too high.

Reaction: Engine power is reduced.

Action:

- Please contact a Volvo Penta workshop.



Coolant level



Explanation: Coolant level too low.

Reaction: Engine power is reduced.

Action:

- Check coolant level. Please refer to "Maintenance: Freshwater system".
- Check that no leakage occurs in auxiliary equipment connected to the engine cooling system.
- Please contact a Volvo Penta workshop if the fault remains.



Coolant pressure



Explanation: Coolant pressure too low.

Reaction: Engine power is reduced.

Action:

- Check the coolant level. Please refer to "Maintenance: Freshwater system".
- Check that the seawater filter is not blocked. Please refer to "Maintenance: Seawater system".
- Check the impeller in the seawater pump. Please refer to "Maintenance: Seawater system".
- Check that no leakage occurs.
- Check that no leakage occurs in auxiliary equipment connected to the engine cooling system.
- Please contact a Volvo Penta workshop if the fault remains.



Coolant temperature



Explanation: Ccoolant temperature too high.

Reaction: Engine power is reduced.

Action:

- Check coolant level. Please refer to "Maintenance: Fresh water system".
- Check that the seawater filter is not blocked. Please refer to "Maintenance: Seawater system".
- Check the impeller in the seawater pump. Please refer to "Maintenance: Seawater system".
- 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.



Fuel pressure**Explanation: Fuel pressure too low.****Reaction:** Engine power is reduced.**Action:**

- Check the fuel level.
- Open the fuel taps and check that no leakage occurs.
- Check that the fuel filters are not blocked. Please refer to "Maintenance: Fuel system"
- Please contact a Volvo Penta workshop if the fault remains.

**Fuel temperature****Explanation: Fuel temperature too high.****Reaction:** Engine power is reduced.**Action:**

- Check the fuel level.
- Check fuel cooler.
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.

**Engine oil level****Explanation: Oil level too low.**

NOTE! 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.

Reaction: Engine power is reduced.**Action:**

- Check the oil level in the engine. Please refer to "Maintenance: Lubrication system" to check and top the oil up.
- Check the oil filters. Please refer to "Maintenance: Lubrication system".
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.

**Engine oil pressure****Explanation: Oil pressure too low.****Reaction:** Engine power is reduced.**Action:**

- Check the oil level in the engine. Please refer to "Maintenance: Lubrication" to check and top the oil up.
- Check that the oil filters are not blocked.
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.



Engine oil temperature



Explanation: Engine oil temperature too high.

Reaction: Engine power is reduced.

Action:

- Check the oil level. Please refer to "Maintenance: Lubrication system".
- Check that the oil filters are not blocked. Please refer to "Maintenance: Lubrication system".
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.



Engine oil filter



Explanation: Oil pressure differential too big.

Reaction: Engine power is reduced.

Action:

- Check that the oil filters are not blocked. Please refer to "Maintenance: Lubrication system".
- Please contact a Volvo Penta workshop if the fault remains.



Crankcase pressure



Explanation: Crankcase pressure too high.

Reaction: Engine power reduced.

Action:

- Check that the crankcase ventilation is not blocked. Please refer to "Maintenance: Engine, general".
- Please contact a Volvo Penta workshop if the fault remains.



Exhaust temperature



Explanation: Exhaust temperature too high.

Reaction: Engine power is reduced.

Action:

- Please contact a Volvo Penta workshop.



Transmission oil pressure



Explanation: Transmission oil pressure too low.

Reaction: Engine power is reduced.

Action:

- Check oil level. Please refer to "Maintenance: Lubrication system".
- Check that the oil strainer is not blocked. Please refer to "Maintenance: Lubrication system".
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.



Battery voltage

Explanation: Battery voltage too low.

Reaction:

Action:

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

**Auxiliary stop**

Explanation: External stop signal.

Reaction: Engine stops or can not be started

Action:

- Check emergency stop button. Reset if necessary. Please refer to "Stopping the engine: Emergency stop"
- Please contact a Volvo Penta workshop if the fault remains.

**Primary battery**

Explanation: Poor battery or charging.

Reaction:

Action:

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

**Secondary battery**

Explanation: Poor battery or charging.

Reaction:

Action:

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

**30 V supply fuse**

Explanation: Fuse is broken.

Reaction:

Action:

- Please contact a Volvo Penta workshop.



EMS supply fuse  R 

Explanation: Fuse is broken.

Reaction:

Action:

- Please contact a Volvo Penta workshop.



Extra supply fuse  R 

Explanation: Fuse is broken.

Reaction:

Action:

- Please contact a Volvo Penta workshop.



Power Trim  O/R 

Explanation: Fault in Power trim system.

Reaction: Cannot change trim position .

Action:

- Emergency Trimming. Please refer to "In case of emergency: Emergency trimming".
- Please contact a Volvo Penta workshop if the fault remains.



Check shift actuator  R 

Explanation: Fault in shift actuator.

Reaction: Cannot engage gears. Engine in emergency mode.

Action:

- Emergency shifting. Please refer to "In case of emergency: Emergency shifting".
- Please contact a Volvo Penta workshop if the fault remains.



Check control lever  O/R 

Explanation: Fault in control lever.

Reaction: Engine in emergency mode. Gear to neutral.

Action:

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



Lever calibration



Explanation: Incorrect lever calibration.

Reaction: It is not possible to choose active helm station.

Action:

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



Check EVC system



Explanation: Internal fault in the EVC system.

Reaction: Engine power is reduced.

Action:

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



System failure



Explanation: Miscellaneous fault.

Reaction:

Action:

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



Technical Data

Engine

General information

| | | |
|---|-----------------------------|-----------------------------|
| After market designation | D4 - See table below | D6 - See table below |
| Engine model..... | See table below | See table below |
| Crankshaft power kW (hp)* | See table below | See table below |
| Propellershaft power kW (hp)* | See table below | See table below |
| Idling speed | 700 rpm | 600 rpm |
| Swept volume | 3.7 liter (1.0 US gals) | 5.5 liter (1.5 US gals) |
| Injection sequence..... | 1-3-4-2 | 1-5-3-6-2-4 |
| Direction of rotation (seen from front)..... | Clockwise | Clockwise |
| Max. forwards inclination | 10° | 10° |
| Max. rearwards inclination in operation | 20° | 20° |
| Max. sideways inclination in operation..... | 30° | 30° |
| Oil pressure, hot engine | | |
| Idling | 1.25 bar (18.1 psi) | 1.25 bar (18.1 psi) |
| Full speed | 4.5 bars (65 psi) | 4.5 bars (65 psi) |

Compressor

| | | |
|-----------------|---------------------------------|-------------------------|
| Oil volume..... | 0.1 liter (0.2 US pint) | 0.1 liter (0.2 US pint) |
| Oil grade. | Volvo Penta, part no. 1141641-9 | |

Cooling system

| | | |
|--------------------------------------|------------------------|--------------------------|
| Thermostats open/fully open | 82°C/92°C | 82°C/92°C |
| Fresh water system volume, app. | 13 liter (3.4 US gals) | 16.5 liter (4.4 US gals) |

Electrical system

| | |
|-----------------------------------|---------------------|
| System voltage | 12/24V |
| Alternator, rated power, max..... | 14V/115A 28V/80A |
| Starter motor, rated power..... | 12V/3.6 kW 24V/5 kW |

* According to ISO 8665

| After market designation | Engine model | Crankshaft power kW (hp) | Propellershaft power kW (hp) |
|--------------------------|--------------|--------------------------|-----------------------------------|
| D4-180 I-B | D4-180 I | 132 (180) | 128 (174) |
| D4-225 I-B | D4-225 I | 165 (225) | 160 (218) |
| D4-225 A-B | D4-225 A | 165 (225) | 158 (215) |
| D4-260 I-B | D4-260 I | 191 (260) | 186 (253) |
| D4-260 A-B | D4-260 A | 191 (260) | 184 (250) |
| D4-300 I-A | D4-300 I | 221 (300) | 212 (289) HS-63 / 214 (292) HS-80 |
| D4-300 A-A | D4-300 A | 221 (300) | 214 (292) |
| D6-280 I-B | D6-280 I | 206 (280) | 201 (274) |
| D6-280 A-B | D6-280 A | 206 (280) | 198 (269) |
| D6-310 I-B | D6-310 I | 228 (310) | 223 (303) |
| D6-310 A-B | D6-310 A | 228 (310) | 219 (298) |
| D6-330 I-B | D6-330 I | 243 (330) | 237 (323) |
| D6-330 A-B | D6-330 A | 243 (330) | 233 (317) |
| D6-350 A-B | D6-350 A | 257 (350) | 248 (337) |
| D6-370 I-B | D6-370 I | 272 (370) | 267 (363) |
| D6-370 A-B | D6-370 A | 272 (370) | 261 (355) |
| D6-435 I-A | D6-435 I | 320 (435) | 310 (422) |

Lubrication system

| | | |
|---|------------------------------|-------------------------|
| Oil volume, (incl. oil filter)..... | 12.5 liter (3.3 US gals) | 20 liter (5.28 US gals) |
| Oil volume, oil filter | 1.6 liter (0.4 US gals) | 1.6 liter (0.4 US gals) |
| Oil volume between min. and max. markings | 1.5 liter (0.4 US gals) | 3.5 liter (0.9 US gals) |
| Oil grade | See table below | |
| Viscosity | SAE 15W/40 (See table below) | |

| Oilgrade ¹⁾ | Sulfur content in fuel, by weight | |
|---|---|-----------------------|
| | < 0,5 – 1,0 % | > 1,0 % ³⁾ |
| | Oil change interval, reached first in operation | |
| All engines: VDS-2 and ACEA E7 ²⁾ or VDS-2 and Global DHD-1 or VDS-2 and API CH-4 or VDS-2 and API CI-4 | 200 h / 12 months | 100 h / 12 months |

- ¹⁾ When oil quality specifications are joined by “or” (Type 1, 2 and 3), **either** engine oil specification can be used. When oil quality specifications are joined by “and” (Type 2 and 3), the engine oil must fulfill both requirements.
- ²⁾ ACEA E7 has replaced ACEA E5, but if available ACEA E5 can be used.
- ³⁾ If sulphur content is > 1.0 % by weight, use oil with TBN >15.

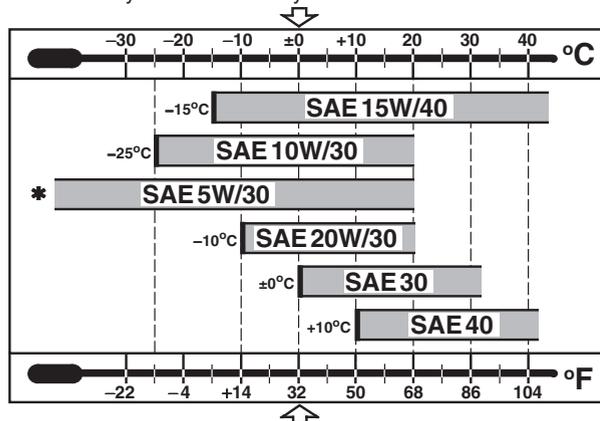
Note! Mineral based oil, either fully or semi-synthetic, can be used on condition that it complies with the quality requirements above.

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

Viscosity

Select the viscosity from the table below. **Note!** The temperature values refer to stable ambient temperatures.

* Refers to synthetic or semi-synthetic oils.



Fuel specification

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

- EN 590** (with nationally adapted environmental and cold requirements)
- ASTM D 975 No. 1-D and 2-D**
- JIS KK 2204**

Sulfur content: Complying with legal requirements in each country.

Fuels with low density (“urban diesel” in Sweden and “city diesel” in Finland) can cause a drop in output of 5% and an increase in fuel consumption of 2–3%.

Drive

DPH

| | |
|---|--|
| Oil volume..... | 5.4 liters (1.4 US gals) |
| Oil volume between min. and max. markings | 0.2 liter (0.4 US pint) |
| Oil grade and viscosity | VP 1141634 (API GL5 SAE 75W/90) Synthetic* |

DPR

| | |
|---|--|
| Oil volume..... | 4.2 liter (1.1 US qals) |
| Oil volume between min. and max. markings | 0.2 liter (0.4 US pint) |
| Oil grade and viscosity:..... | VP 1141634 (API GL5 SAE 75W/90) Synthetic* |

*NOTE. At long operational hours in warm waters
(above 25°C/77°F) VP 1141666 (API GL SAE 75W/140)

Synthetic oil should be used.

Reverse gear (excluding oil cooler)

HS45AE

| | |
|-----------------|-------------------------|
| Oil volume..... | 2.5 liter (0.7 US qals) |
| Oil grade | ATF (Dexron II, III) |

HS63AE

| | |
|-----------------|-----------------------|
| Oil volume..... | 4.0 liter (1 US qals) |
| Oil grade | ATF (Dexron II, III) |

HS63IVE

| | |
|-----------------|-----------------------|
| Oil volume..... | 4.0 liter (1 US qals) |
| Oil grade | ATF (Dexron II, III) |

HS80/85AE

| | |
|-----------------|---|
| Oil volume..... | 5 liter (1.3 US qals)/5.5 liter (1.5 US qals) |
| Oil grade | ATF (Dexron II, III) |

HS80/85IVE

| | |
|-----------------|--------------------------|
| Oil volume..... | 7.0 liter (1.8 US qals)/ |
| Oil grade | ATF (Dexron II, III) |

Power Trim

| | |
|-----------------|----------------------|
| Oil grade | ATF (Dexron II, III) |
|-----------------|----------------------|

Steering

Power steering

| | |
|-----------------|----------------------|
| Oil grade | ATF (Dexron II, III) |
|-----------------|----------------------|

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