# OPERATOR'S MANUAL

## Volvo Penta IPS
## Quadruple Installation

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Todos los datos recibidos son almacenados de forma in-

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

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

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

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Όλες οι πληροφορίες αποθηκεύονται από την AB Volvo Pen-

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

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

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

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

## CALIFORNIA

### Proposition 65 Warning

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

# Content

# Foreword

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

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

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

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

# Safety Information

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

**Check that you heave received the correct instruction book before you read on. If not, please contact your Volvo Penta dealer.**

This symbol is used in the instruction book and on the product, to call your attention to the fact that this is safety information. Always read such information very carefully.
**Safety texts in the instruction book have the following order of priority:**

### ⚠ DANGER!

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

### ⚠ WARNING!

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

### ⚠ CAUTION!

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

### IMPORTANT!

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

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

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

## Your new boat

Read the instruction books and other information carefully, which came with your new boat. Learn to handle the engine, controls and other equipment in a safe and correct manner.
If this is your first boat, or a type of boat you are not experienced in using, we recommend that you practice operating the boat in peace and quiet. Get to know the way the boat reacts to sea and to the controls under different speed, sea and loading conditions before you cast off for your first “real” maiden voyage.
Remember that the captain of every boat is required by law to know and to observe applicable rules for traffic and safety at sea. Get to know the rules which apply to you and your waters, by contacting the relevant authority or sea safety organization.
It is a good idea to go on some kind of boat operation course. We recommend that you contact a regional boat or sea safety organization to find a suitable course.

## Daily checks

Make it a habit to give the engine and engine bay a visual check before driving (before starting the engine) and after operation (when you have stopped the engine). This helps you to quickly discover whether any leakage of fuel, coolant, oil or any other abnormal event has happened, or is about to happen.

**Manoeuvring**
Avoid sudden or surprising rudder movements and gear shifting. There is a risk that passengers could fall over, or overboard.
A rotating propeller can cause severe injury. Check that there is nobody in the water before you engage forward / astern (reverse) drive. Never drive close to bathers or in areas where you could reasonably expect that people could be in the water.

## Fuel filling

There is always a risk of fire and explosion during fuel filling. Smoking is not permissible, and the engine should be stopped.
Never over-fill the tank. Shut the tank cap securely.
Only use the fuel recommended in the instruction book. The wrong grade of fuel can cause malfunctions or stop the engine. In a diesel engine, it can also cause the regulation rod to bind and the engine will over-rev, entailing a strong risk of personal injury and machinery damage.

## Do not start the engine

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

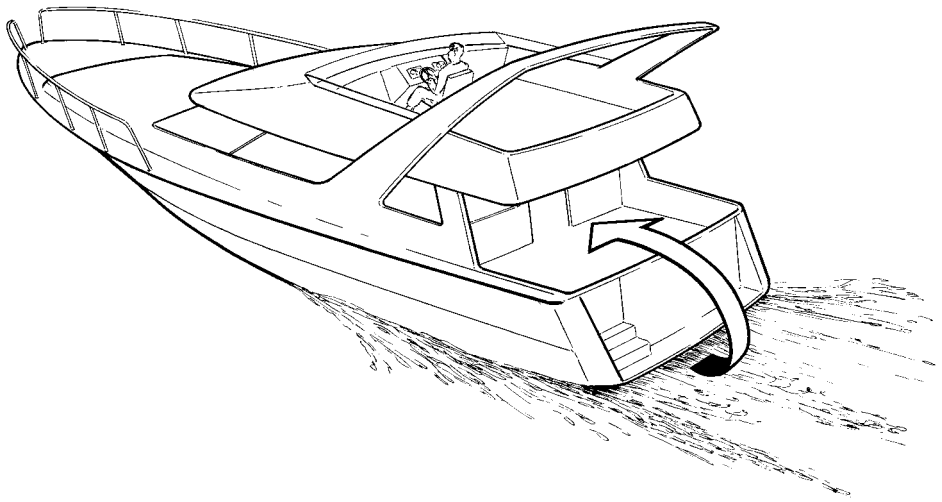
## Accidents and near misses

Life saving statistics show that inadequate care of boats and engines, and deficiencies in safety equipment are frequent causes of accidents and near misses at sea.
Make sure that your boat and engine are maintained in accordance with the advice in each instruction book, and that the necessary safety equipment is on board, and is in working condition.

## Carbon monoxide poisoning

When a boat moves forwards, an area of low pressure air forms behind the boat. In adverse conditions, this low pressure can be so strong that the boat's own exhaust fumes are sucked into the cockpit or cabin, which entails a risk of carbon monoxide poisoning for all aboard.
The problem of low-pressure suction is worst in high, wide boats with a square transom. But even in other types of boats, low-pressure suction can be a problem in some conditions, such as if you drive with the hood up. Other factors which increase the low-pressure effect are wind conditions, load distribution, pitching, trimming, open windows and ventilators etc.

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



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## Remember

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

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

## Preparations

### Knowledge

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

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

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

### Stop the engine

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

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

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

### Lifting the engine

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

### Before starting the engine

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

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

## Fire and explosion

### Fuel and lubrication oil

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

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

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

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

### Non-original components

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

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

### Batteries

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

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

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

### Start spray

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

## Hot surfaces and fluids

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

## Carbon monoxide poisoning

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

## Chemicals

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

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

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

## Cooling system

There is a risk of flooding when working on the seawater system. Turn off the engine and close the sea cock 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.

## Steering system

The boat has a advanced steering system. DO NOT change connectors, wiring or splice of the components.

Service must be done by approved workshops which have certifed personnel with qualified professional training.

## Electrical system

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

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

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

# Introduction

This Operator's Manual has been prepared to give you the greatest possible benefit from your Volvo Penta marine engine. It contains the information you need to be able to operate and maintain the engine safely and correctly. Please read the Operator's Manual carefully and learn to handle the engine, controls and other equipment in a safe manner before you cast off on your maiden voyage.
Always have the Operator's Manual available. Store it safely and do not forget to hand it over to the next owner if you sell your boat.

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

## Warranty

Your new Volvo Penta marine engine is covered by a limited warranty, under the conditions and instructions compiled in the Warranty and Service book.
Please note that AB Volvo Penta's liability is limited to the specification in the Warranty and Service book. Read it carefully, as soon as possible after delivery. It includes important information about warranty cards, service, maintenance, which it is the responsibility of the owner to know, check and carry out. If this is not done, AB Volvo Penta may fully or partly refuse to honour its warranty undertakings.
**Please contact your Volvo Penta dealer if you have not received a Warranty and Service book, or a customer copy of the warranty card.**

## Environmental care

All of us want to live in a clean, healthy environment. Where we can breathe clean air, see healthy trees, have clean water in lakes and seas, and be able to enjoy the sunlight without fearing for our health. Unfortunately, this is not self-evident these days, it is something all of us must work hard for.
As a manufacturer of marine engines, Volvo Penta has particular responsibility and for this reason, environmental care is a core value in our product development. Volvo Penta has a wide engine programme these days, where considerable progress has been made in reducing exhaust fumes, fuel consumption, engine noise etc.
We hope that you will be want to preserve these values. Always observe the advice in the instruction book about fuel grades, operation and maintenance, to avoid unnecessary environmental impact. Please contact your Volvo Penta dealer if you notice any changes such as increased fuel consumption or increased exhaust smoke..
Moderate your speed and distance so that wake and noise do not disturb or damage animal life, moored boats, jetties etc. Leave the archipelago and harbours in the same state you would like to find them. Remember to always hand in drained oil, coolant, paint and wash residue, used batteries etc. for destruction at a recycling station.
If we all pull together, we can make a valuable contribution to the environment together.

## Running in

The engine must be "run in" during its first 10 hours, as follows:
Use the engine in normal operation. Full load should only be applied for short periods. Never run the engine for a long period of time at constant speed during this period.
Higher oil consumption is normal during the running in period. For this reason, check the oil level more frequently than normally recommended.
After the first period of operation, the specified warranty inspection "First service inspection" can be done. For more information: Please refer to the Warranty and Service book.

## Fuel and oils

Only use the fuels and oils recommended in the instruction book. Other grades can cause malfunctions, increased fuel consumption and eventually even shorten the life of the engine.
Always change the oil, oil filter and fuel filter at the specified intervals.

## Service and spare parts

Volvo Penta marine engines are designed for high reliability and long life. They are built to withstand a marine environment, but also to have the smallest possible environmental impact. Through regular service and use of by Volvo Penta approved spare parts, these qualities are retained.
Volvo Penta's world-wide network of authorised dealers is at your service. They are Volvo Penta product specialists, and have the accessories, original spares, test equipment and special tools needed for high quality service and repair work.
Always observe the maintenance intervals in the Operator's manual, and remember to note the engine/transmission identification number when you order service and spare parts.

## Certified engines

If you own or operate an emission certified engine it is important to be aware of the following:

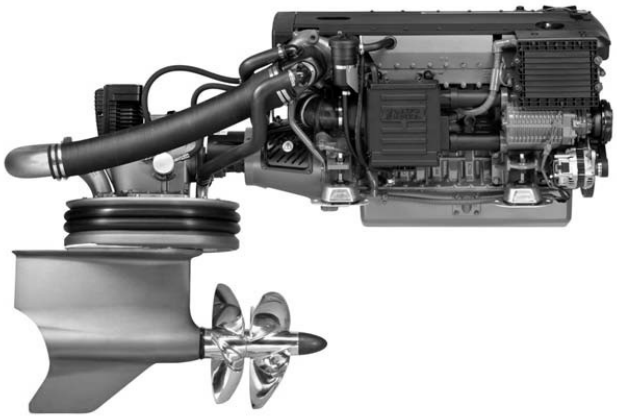
Certification means that an engine type has been checked and approved by the relevant authority. The engine manufacturer guarantees that all engines made of the same type are equivalent to the certified engine. **This makes special demands on the care and maintenance you give your engine, as follows:**

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

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

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

# Presentation



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Volvo Penta IPS (Inboard Propulsion System) is a concept which includes engine, propulsion unit and electronic vessel control (EVC).

**Engine**

The D6 engine is equipped with a common rail fuel injection system, double overhead camshafts, 4 valves per cylinder, turbocharger, compressor and air charge cooler.

**Propulsion unit**

The propulsion unit is equipped with forward facing counter-rotating propellers and an electronically controlled hydraulic clutch. It also has fully integrated functions such as electronic steering, exhaust outlet, cooling water intake and rudder indicator.

**Electronic Vessel Control (EVC)**

The Electronic Vessel Control (EVC) is an electrical system of components that monitors and controls the engine, propulsion unit and steering functions of the boat. The EVC system also has a diagnostic function that can discover faults in the handling of the boat or faults in Volvo Penta IPS (engine, propulsion unit and EVC).

**Main EVC components – their functions and locations**

There are several components of each type, one for each engine, and additional components for each station.

A **Servo Unit Steering (SUS)**
This component controls and monitors the steering function.

B **Electronically controlled hydraulic valves**
These components control the hydraulic clutch.

C **Engine Control Unit (E-ECU)**
This component controls and monitors the engine.

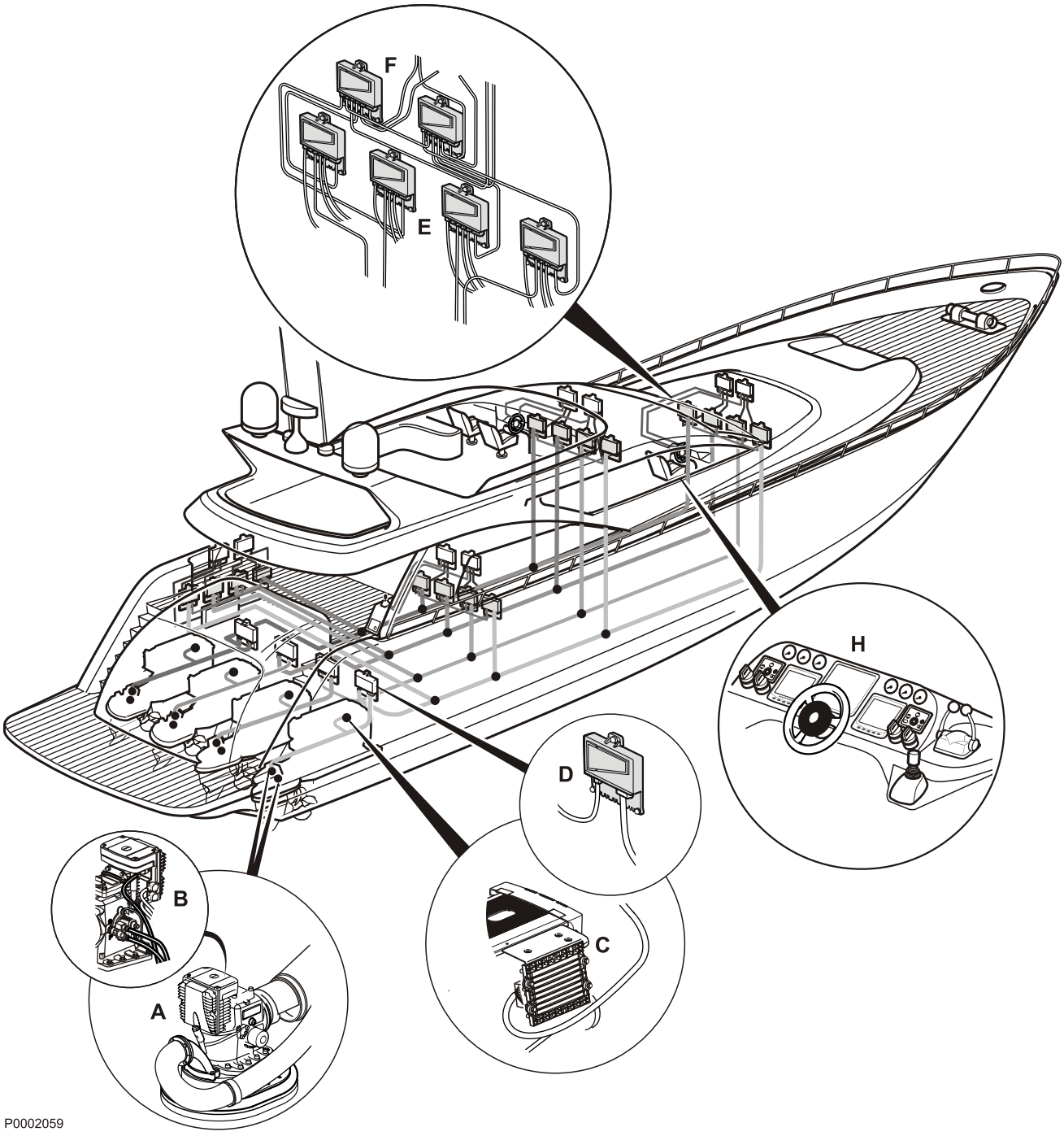
D **Power train Control Unit (PCU)**
This componet handles communication with the E-ECU. It monitors and controls the gear shifting, throttle and engine synchronization functions.

E **Helm station Control Unit (HCU)**
This component handles communication from and to the instruments, steering wheel and controls.

F **Triple Quadruple Interface (TQI)**
This component is a splitter box for wiring between the steering wheel/control levers/joystick and the HCU's.

G **Volvo Penta options (not shown in figure)**
The following components can be included in the EVC system to enable monitoring of non-engine data or other functions: Fresh water level sensor, fuel tank level sensor, multisensor (for speed, water temp and depth), autopilot interface and NMEA interface (allows non-Volvo Penta instrumentation e.g. chart plotters etc).

H **Electronic instruments and controls**
These components allow the operator to operate the boat, monitor EVC information (boat and engine data) and make operator settings in the EVC system.

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## Stations

There can be up to four different stations from which the boat can be operated. The following types of stations, equipped with Volvo Penta instruments and controls, are permitted on a tripple installation of Volvo Penta IPS:

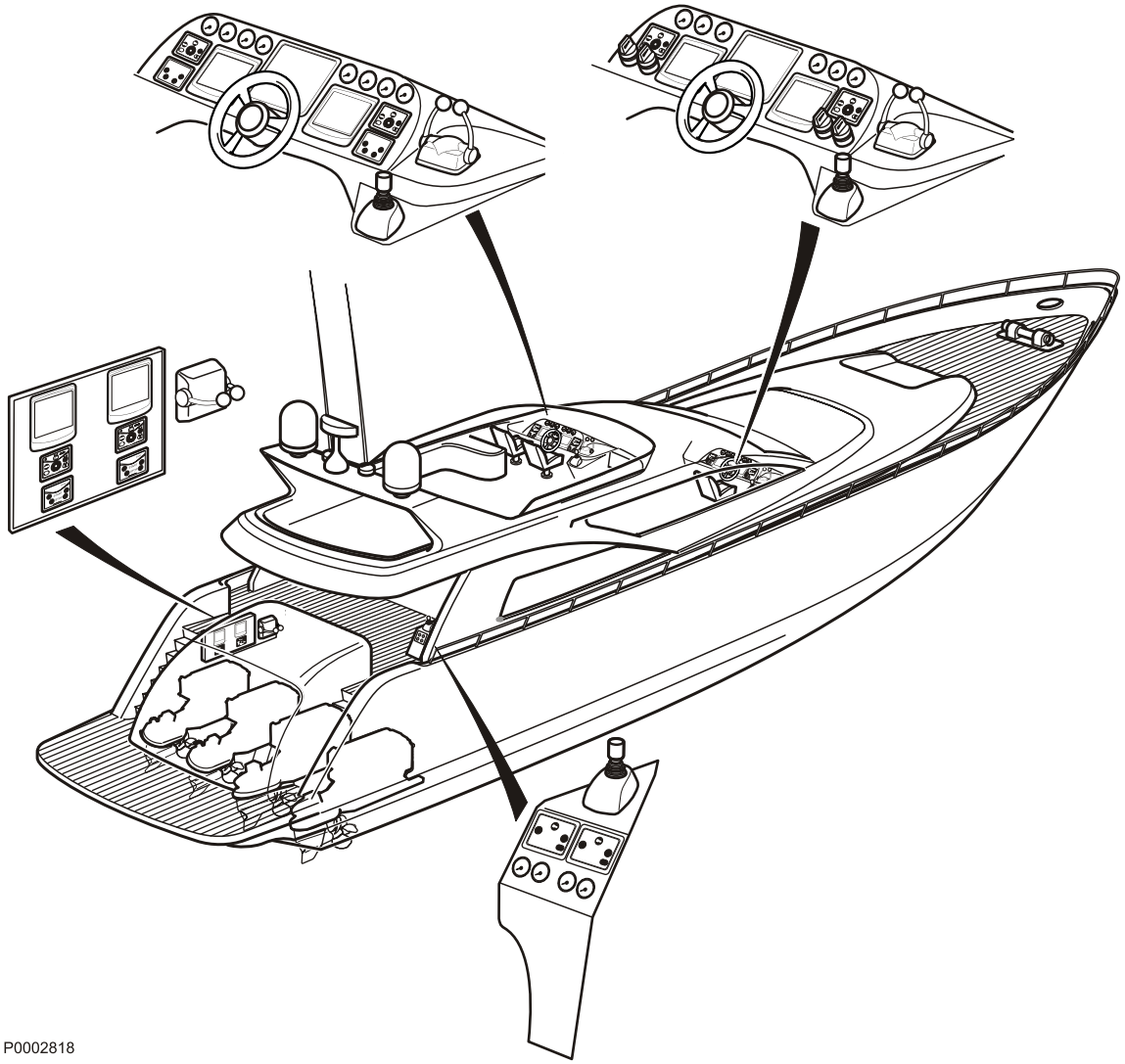
A Main station (standard)

B Flybridge station (optional)

C Engine room station (optional)

D Docking station (optional)

The station from which the boat is going to be operated always needs to be activated using the control panel. The engines in a quadruple installation are distinguished from each other by the numbers 1-4 from port side to starboard. Please refer to figure.



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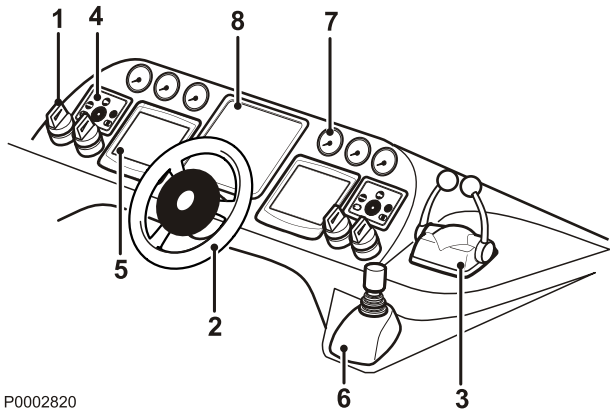

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**Main station**

The boat always has one main station. It is the only station equipped with ignition keys. The system voltage must be turned on here to allow another station to be used. The main station is equipped with conventional control levers for gear shift and throttle and as an option it can also be equipped with a joystick used for docking only (slow speed maneuvering).

**Standard instruments and controls:**

1 Ignition Keys (x 4)

2 Steering Wheel

3 Control Levers

4 EVC Control Panel (x 2)

5 EVC System Displays (x 2)

**Optional instruments and controls:**

6 Joystick (docking control)

7 Gauges

**Non Volvo Penta instruments and controls:**

8 Chart plotter

9 Autopilot (not shown in figure)

## Flybridge station (Secondary station)

There can be several flybridge stations. They are usually equipped in the same way as the main station but they have Start/Stop panels instead of ignition keys.

**Standard instruments and controls:**

1 Start/Stop Panels (x 2)

2 Steering Wheel

3 Control Levers

4 EVC Control Panel (x 2)

5 EVC System Displays (or Tachometers) (x 2)

**Optional instruments and controls:**

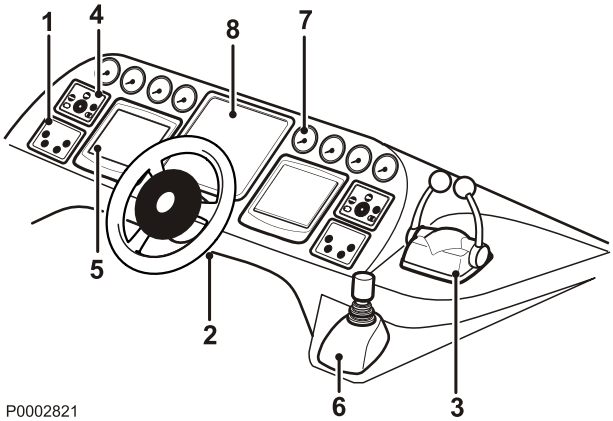
6 Joystick (docking control)

7 Gauges

**Non Volvo Pentas instruments and controls**

8 Chart plotter

9 Autopilot (not shown in figure)



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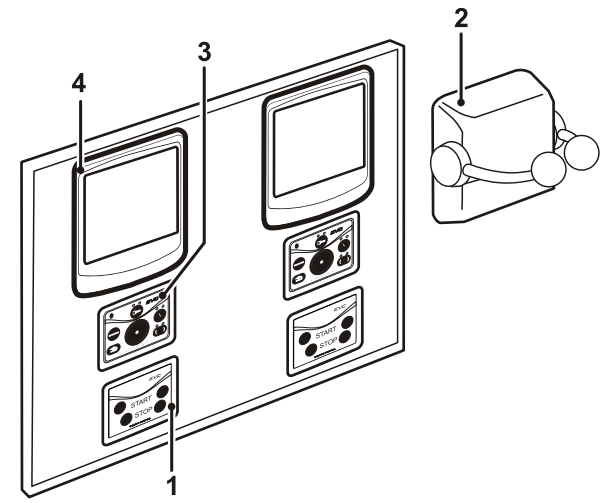


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### Engine room station

There can only be one engine room station. It is used for service work only and the control levers can only be used for throttle, not for gear shifting.

**Standard instruments and controls:**

1 Start/Stop Panels (x 2)

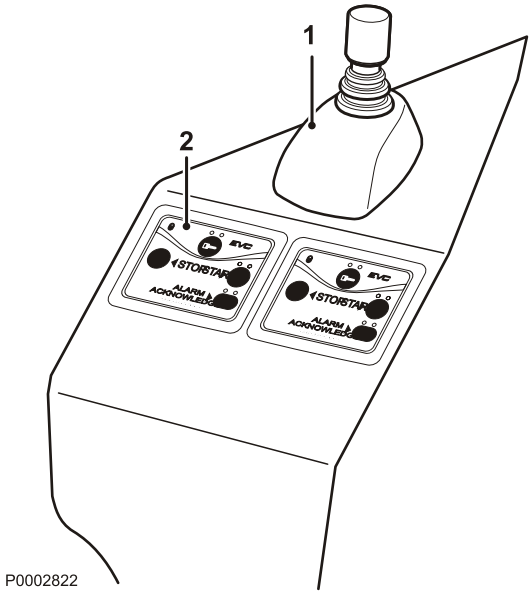
2 Control Levers (for throttle only)

3 EVC Control Panel (x 2)

4 EVC System Tachometers (or Displays) (x 2)

**Optional instruments and controls:**

5 Gauges (not shown in figure)

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### Docking station

There can be several docking stations. They are used for docking (maneuvering with joystick at low speed) only.

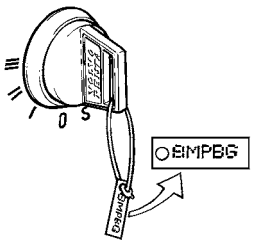
**Standard instruments and controls:**

1 Joystick (docking control)

2 Docking Station Panel (x 2)

# Instruments and Controls

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



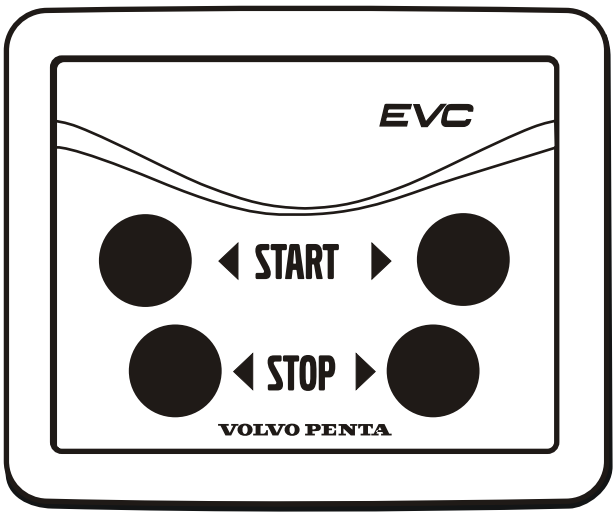

P0003068

## Ignition Lock

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

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

Read the starting instructions in chapter *Starting page 30* to ensure you use the correct start procedure.




P0002884

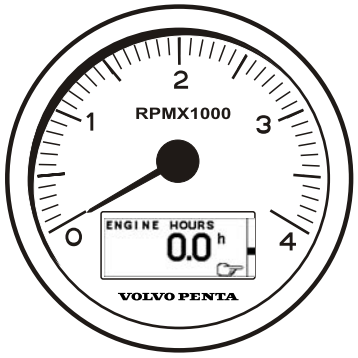
## Start/Stop Panel

The start/stop panel is used for starting and stopping the engine.
To start the engine it is necessary for the start key at the main station to be in the "**I**" operating position. The engine can only be stopped from an activated control panel.
Read the starting instructions in chapter *Starting page 30* to ensure you use the correct start procedure.

# Gauges

## Tachometer

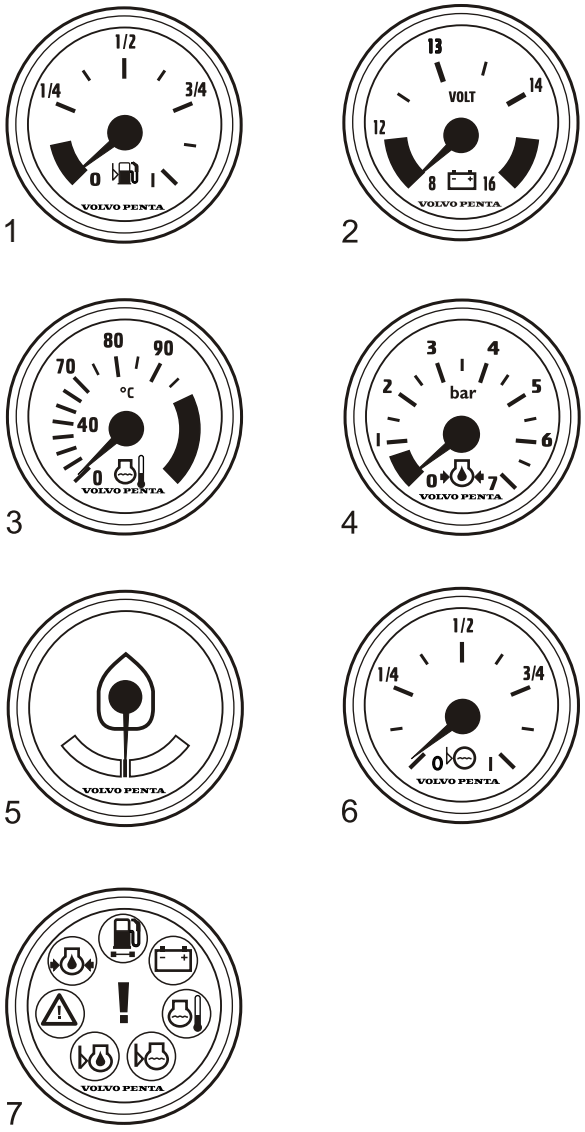
The tachometer displays engine speed; multiply the value shown on the dial by 1,000 to get the number of engine revolutions per minute.
Boat and engine information is displayed in the tachometer window. Information displayed depends on engine type, the number of sensors and which accessories are installed.




P0002372

## Optional instruments

These instruments are sold as engine options by Volvo Penta.




P0005255

1 **Fuel level gauge**
The fuel level gauge shows the quantity of remaining fuel.

2 **Voltmeter, battery charging**
The meter shows the alternator charge current. During operations the charge voltage should be around 14 V. When the engine is stopped and electrical power switched on the battery voltage should be around 12 V.
If a 24 V system is installed, the charge voltage should be around 28 V during operations.

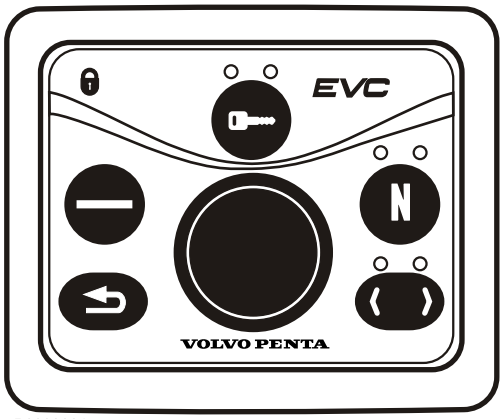
3 **Coolant temperature gauge**
The instrument shows engine coolant temperature. During operations coolant temperature should normally be between 75-90°C (167-194°F).

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

5 **Rudder position indicator**
The instrument shows rudder position.

6 **Fresh water level sensor**
Freshwater tank level gauge.

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



P0002664

# Control Panel

The control panel is used for station handling, disengaging the drive and to navigate the EVC system menu.
Always push the buttons firmly and for at least one second.

### Activation button

The control panel and station are activated by pushing the activation button once. Push twice to lock the station. On boats with only one station, this is always active.
The lamp above the activation button shows the status of the station.
**Red lamp**: Active station.
**Lamp off**: Station not activated.
**Lamp flashing**: A fault that limits the function of the station has been detected.

### Padlock

The padlock symbol lights when the station is locked with the activation button or if change of stations is under way, please refer to section *Helm Stations page 34*.
**Lit**: The station is locked and the boat can only be controlled from this station.
**Flashing**: Another station is locked.

### Neutral button

The neutral button is used to disengage the drive enabling the engine rpm to increase without affecting the drive, to warm up the engine. The lamp above the neutral button shows the status of the station.
**Green lamp**: Gear in neutral. The drive is in neutral position and the engine runs at idle speed.
**Lamp off**: The drive is engaged for movement forward/astern.
**Flashing lamp**: The drive is disengaged and the engine speed can be adjusted.

### Knob

Navigate the display menu by turning the knob.
Push the knob to confirm a selection or acknowledge an alarm.

### Tachometer Display Selection

Boats with one tachometer for port engine and one for starboard can choose which engine menu to handle from the station. The lamp above the button shows which engine is chosen, green lamp for starboard engine and red lamp for port engine.
**Lamp off**: Menu inactivated.
**Lamp lit**: Menu activated.

### Multifunction Button

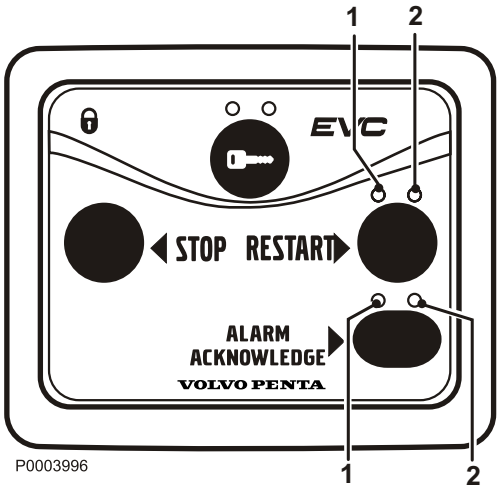
With the multifunction button the instruments and panels backlighting is adjusted.

Push the button for over a second to turn the backlighting on or off. The backlighting can be adjusted in five stages by repeatedly pushing the multifunction button quickly (less than 1 second).
If the button is pressed on an inactive station, operating information is shown on the display(s) and the menu structure is activated.

**Back Button**

Used to return a step up in the menu structure.

# Docking Station Panel




The docking station panel allow stopping and restarting of the engines and handling of faults when operating the boat from a docking station.
The docking function (maneuvering with the joystick) is enabled when the docking station is activated. Please refer to the section *Joystick page 24* for further information on docking.

Docking station can only be activated when the engines are running.
Always push the buttons firmly and for at least one second.

**Activation button**

Push this button on the docking station panel to activate and lock/unlock the docking station. Please refer to section *Instruments and Controls page 18* for further information.

**Stop and start buttons**

Push these buttons to stop or restart the engines. Both engines must be running when using the docking function.
**Lamp above the button:** White
Lit: Port engine (1)/Starboard (2) engine are/is running.
Off: Port engine (1)/Starboard (2) engine are/is shut off. Flashing and accompanied with a buzzer: The engine(s) has stopped without a stop request. Silence the buzzer with the Alarm acknowledge button and restart the engine(s).

**Alarm acknowledge button**

Push this button to acknowledge an alarm of a fault. A fault is always indicated with a flashing lamp above the button and a more serious faults is also indicated with a buzzer. When the fault is acknowledged the lamp will light continuously and the buzzer will silence. The fault pop-up must be read and acknowledged on a station that is equipped with displays. Please refer to the “Operation” chapter, section “Acknowleging alarms and messages”.

**Lamp above the button:** Red
Flashing: Port (1)/Starboard (2) engine has a fault. Lit: The fault is acknowledged.

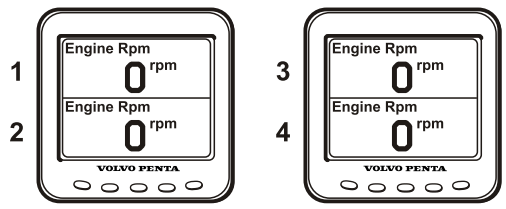
**Acknowledging faults on Docking Station**

Since a docking station is not equipped with displays and a control panel, an alarm of a fault is handled in a different way.
On a docking station a fault is always indicated with a flashing red lamp above the Alarm acknowledge button the docking station panel. The flashing lamp indicates which engine (1/2/3) is faulty. A more serious fault is also indicated with a buzzer.

1 Acknowledge the fault with the Alarm acknowledge button. The lamp above the button stops flashing and lights continuosly. The buzzer is silenced.

2 Activate a station that is equipped with displays in order to read and acknowledge the fault pop-up.

3 Take the recommended actions. Please refer to *Fault Code Register page 42*.

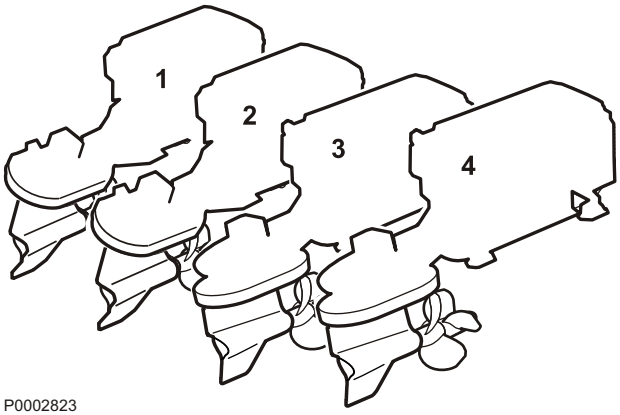


P0006681

# EVC System Display

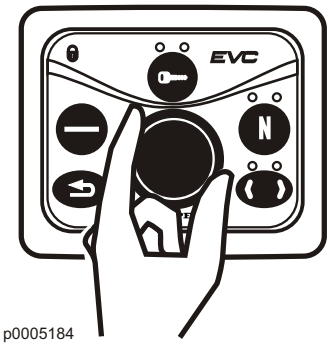
The EVC system displays or the display in the EVC system tachometer allow the operator to monitor information from the EVC system such as various gauges, trip data (optional), multisensor data (optional) and various kinds of messages and alarms.

The operator can also retrieve faults that have been set in the system and make various boat and operator settings for the EVC system via the displays and control panels. Please refer to section *Fault Handling page 39* and *Settnings menu page 99*.



P0002823

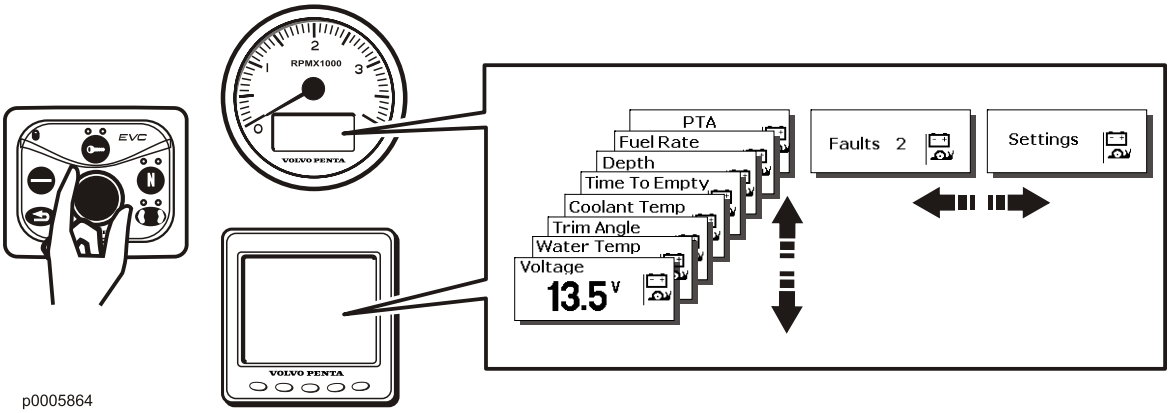
The port side display represents the two engines and propulsion units (1 and 2) on port side and the starboard display represents the two engines and propulsion units (3 and 4) on the starboard side. Each engine/propulsion unit has its own window in the displays.



p0005184

To chose which information to show, select which of the dispalys to alter by repetedly push the ◀▶ on the solitary control panel. Then turn the knob until prefered information is shown, please refer to section *Instruments and Controls page 21*.

# EVC menu

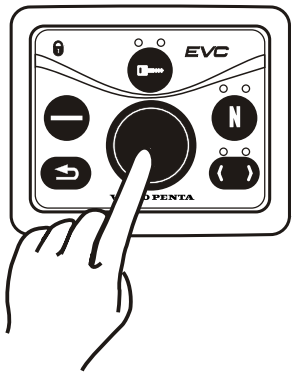


p0005864

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

Only installed functions are shown in the menu.

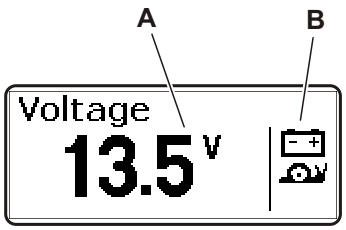
Turn the knob to navigate through the menus.




P0005872

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

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




P0001006

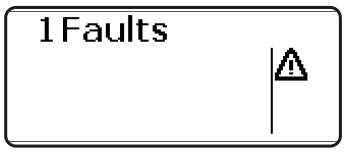
A This field displays engine operating data.

B This field displays warning symbols and active function symbols.


P0001015

## Settings

Turn the control panel wheel until the start screen for the settings menu is displayed. Press the wheel to reach the sub menus.
Turn to move between the available setting functions.
For further information, refer to section *Settnings menu page 99*.



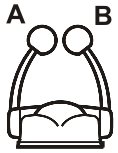

P0001315

## Fault

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

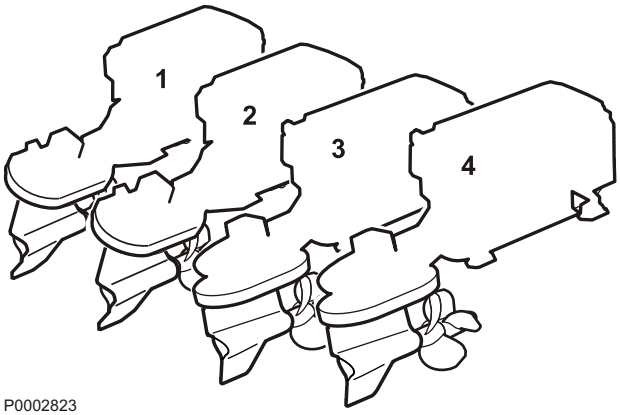
# Controls

## Control Lever



p0006684

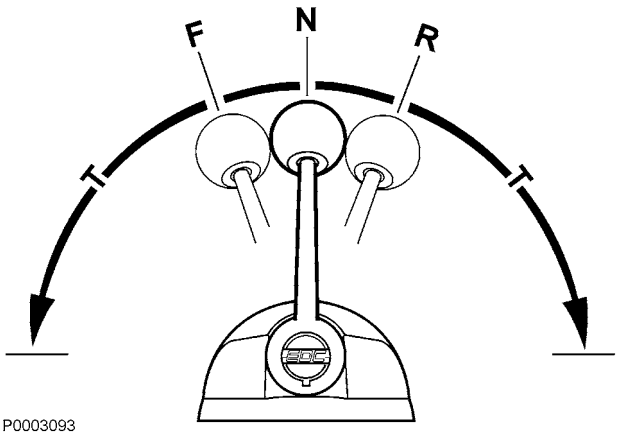
Both the adjustment of engine speed and the gear shift function are controlled using the control levers. The port side control lever (**A**) controls the port side engines and propulsion units 1 and 2, The starboard control lever (**B**) controls the starboard engines and propulsion units 3 and 4.



P0002823

## Single Lever Control

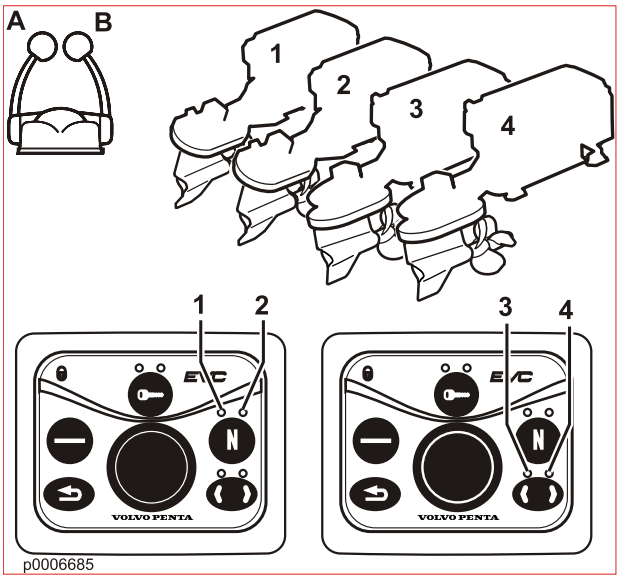
### Maneuvering



P0003093

A single-lever control operates both gearshift and throttle functions with the same lever.
The engine can only be started with the control lever in the neutral position.

- **N** = Neutral position. Reverse gear/drive disengaged and engine at idle.
- **F** = Reverse gear/drive engaged for forward motion.
- **R** = Reverse gear/drive engaged for rearward motion.
- **T** = Engine rpm control (throttle).




## Disconnecting the gearshift function

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

If the control panels are situated far apart, disengage one side at a time. Port side panel controls the port control lever (**A**) and starboard side panel controls the starboard control lever (**B**).

1 Put the control levers in neutral (**N**).

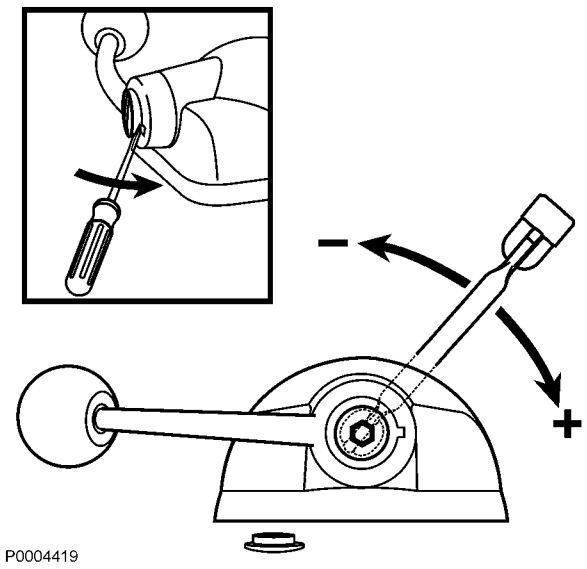
2 Depress the control panel neutral button (**N**) and keep it depressed at the same time as the lever is moved forwards to the gearshift position (**F**).

3 Release the neutral button. The green indicator will flash as confirmation that the gearshift function is disconnected and the that lever will only affect engine revolutions.

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

**⚠ CAUTION!**

Take care not to engage the drive by mistake.




## Adjusting the friction brake

The lever is fitted with a friction brake to allow adjustment for easier or stiffer movement as required. The friction brake only affects movement of the throttle control lever.

1 Stop the engine.

2 Move the control lever forward so that the groove in the lever hub is accessible.

3 Remove the plug with the aid of a screwdriver.

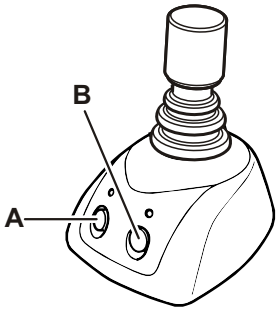
4 Adjust the friction brake (wrench, 8 mm) by turning the bolt clockwise (+) for stiffer lever movement, and counterclockwise (-) for easier movement.

5 Reinstall the plug.

# Joystick

Volvo Penta IPS Joystick is a control used for docking and maneuvering in low speed. The joystick makes it possible to rotate the boat and maneuver the boat in different directions – sideways, diagonally, forward and backward.

Learn to handle the joystick in a safely and correct manner before you start using the function in a marina.



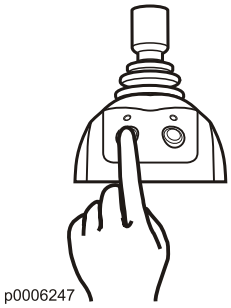

A. Docking (ON/OFF)
B. Boost (ON/OFF)

When the docking function is active the engine speed is reduced and the boat can only be maneuvered with the joystick.

**Activating the docking function**

Before activating the docking function the following has to be fulfilled:

- the engines must to be running
- the controls must to be in neutral
- the helm station must be active
- the joystick in its middle position



p0006247

1 Activate the docking function by pressing the docking button (**A**) on the joystick.

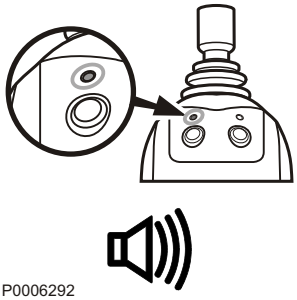
2 A sound signal confirms that the docking function is active and the lamp by the docking button is lit.

3 To inactivate the function press the docking button. To confirm that the function is inactivated the signal sounds twice and the lamp goes out.

4 The docking function is also deactivated if the controls is moved out of neutral.

**Activating the boost function**

If the driver needs extra power, e.g. in windy weather or if there is a strong currant, the boost function can be activated.



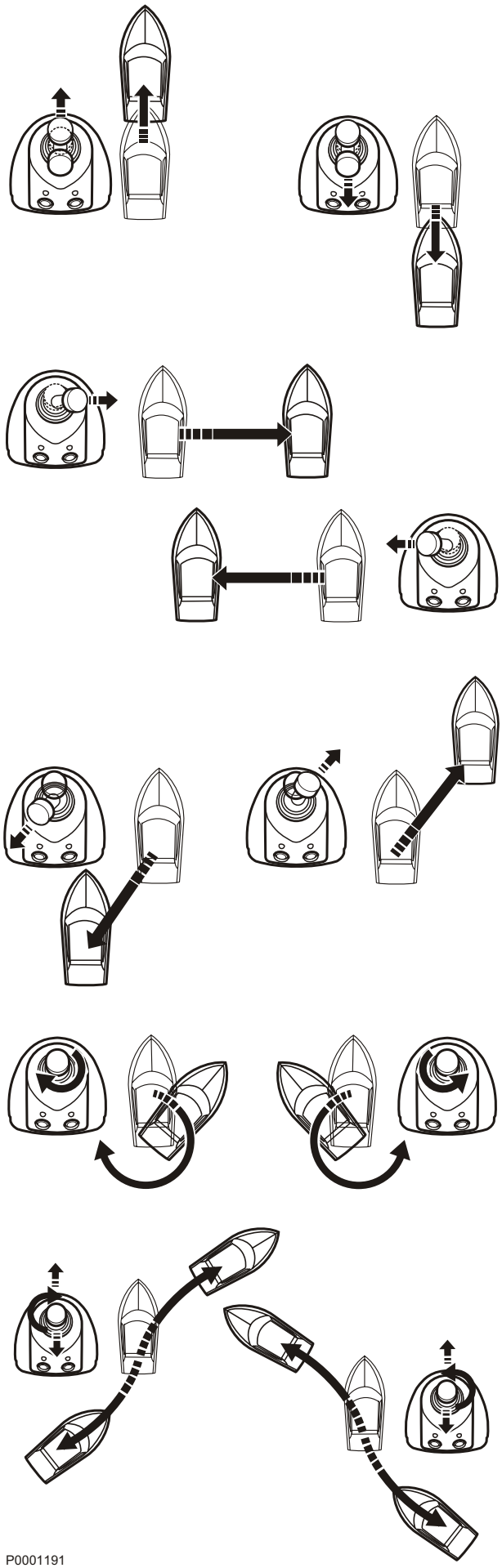
P0006292

1 Activate the boost function by pressing the boost button (**B**) on the joystick.

2 A sound signal confirms that the function is active and the lamp by the button is lit.

3 Inactivate the function press the boost button. To confirm that the function is in active the signal sounds twice and the lamp goes out.

4 The system is now back in docking mode.




## Maneuvering with joystick

To maneuver the boat move the joystick forwards, backwards, sideways or by turning the top of the joystick, see figure.

## IMPORTANT!

The boat keeps moving even after the joystick is released, compensate this by moving the joystick in opposite direction.

# ACP

Volvo Penta ACP (Active Corrosion Protection) protects against galvanic corrosion by controlling an electric current that can be monitored by the engine electrical system.

It is preferable to connect the boat to shore supply, if such is available. If shore power is unavailable, ACP utilizes the batteries, as it is connected to the boat's 12 V/24 V system. If the batteries begin to discharge, the ACP switches from primary to secondary protection. The IPS is then protected by the consumption of a sacrificial zinc anode installed in the ACP unit on the transom.

When the primary protection is in use, a small quantity of chlorine gas is produced by the ACP; if desired it can be switched off temporarily. The ACP then switches over to secondary protection.
The ACP reverts automatically to normal mode after 4 hours; earlier reversion can be arranged in the settings menu (see below) or when ignition is switched on.

## Protection levels

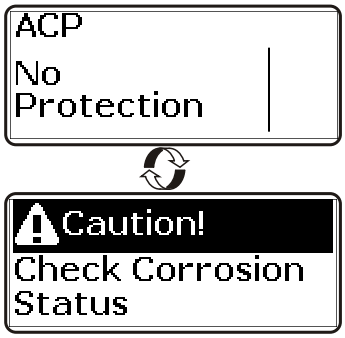
The ACP has three protection levels; the active level is displayed in the EVC menu.


P0001217

- Good Protection; the IPS unit is optimally protected by the ACP function.


P0003747

- Limited Protection; secondary protection - the IPS has complete corrosion protection via the sacrificial anode.
  Check that the batteries are being charged by shore power; alternatively, start the engine so that the alternator charges the batteries.
  There is no risk of corrosion as the sacrificial anode protects the IPS. However, seek service for system checks at the first suitable opportunity if the system remains in the limited protection mode for more than approx. 2 hours.
  If the system remains in this mode for a longer break in operations, more than 8 weeks, service should be sought for system checks.




P0001218

- No Protection; risk of corrosion, system gives warning alarm. The display switches between the two screens.
  Seek service for system checks.


P0001203

P0001203

- If the ACP is set to inactive, the system cannot identify ACP status and three lines will be shown on the display.
  If this should occur when the system is not set to inactive, seek service for checks.
  ACP will also show the three lines during one minute after ignition is turned on, thereafter it will show current protection level.


P0001015

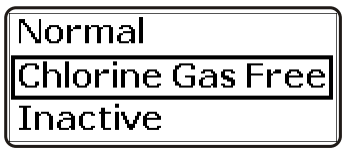
P0001015

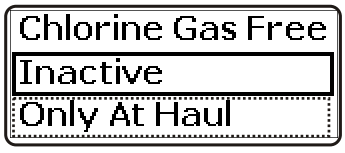
**Settings**

ACP has three function modes; these are set in the EVC menu under Settings/ACP. Refer to *Settnings menu page 99*, section *ACP*.


P0001022

P0001022

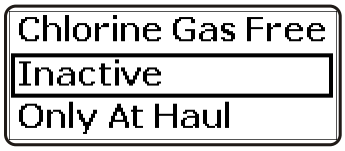



P0001021

P0001021

- Normal means that the system is active and working in the optimal manner.
- Chlorine Free means that the system has switched over to protection by the zinc anode for 4 h, resulting in no chlorine gas being given off.




P0003049

P0003049

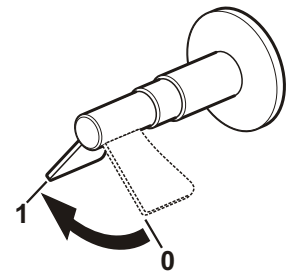
- Inactive; this mode should only be used when the boat is taken out of the water on to dry land.
  To avoid fault codes, select inactive mode before lifting the boat out of the water. In this mode the ACP no longer monitors the corrosion condition, but the IPS is protected by the zinc anode.
  The system is re-started when the ignition is switched on; inactive mode switches to normal mode.

# Starting

Make a habit of visually checking the engine, engine bay and transmission before start. This will help you to discover quickly if anything abnormal has happened, or is about to happen. Also check that instruments and warning displays show normal values when you have started the engine.
To minimize cold start smoke we recommend the installation of an engine heater or engine bay heater if temperatures below +5° C are encountered.

**⚠ WARNING!**

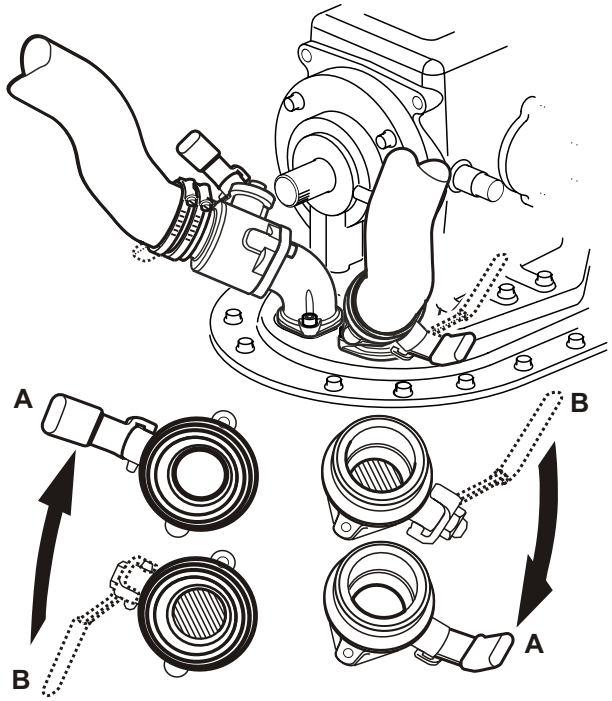
Never use start spray or similar products as starting aid. Explosion risk!




P0002431

# Before Starting

- Check the engine and drive units oil level.
- Check the coolant level.
- Open the sea cocks.
  Position A open. Position B closed.
- Open the fuel cock.
- Turn the main switches on.
  **IMPORTANT!**
  Never disconnect the current with the main switches when the engine is running. The alternator and electronics could be damaged.
- Start the engine bay fan, where fitted, and allow it to run for at least four minutes.
- Check there is sufficient fuel for the planned trip.

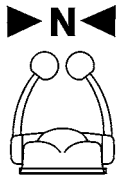



P0002851

# Starting the Engine

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

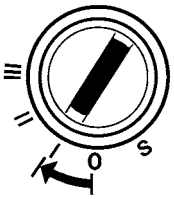
## Put the drive in neutral




P0003087

Put the drive in neutral by moving the control levers to neutral at all stations.

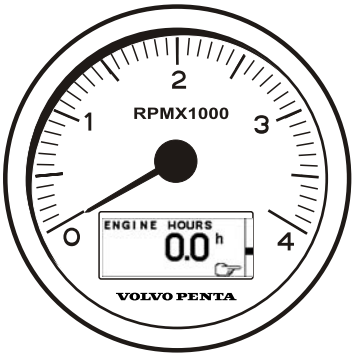
## Turn the ignition on




P0003022

Turn the starter key of each engine to position **I** to switch the ignition on.

## Check the tachometer display




P0002372

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

P0002435

## Check lamps

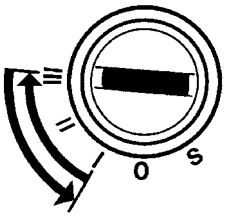
Each time the ignition is turned on, all lamps in the alarm instrument are illuminated. Check that all lamps light up and go out. If a lamp flashes a fault has been registred, please refer to section *Fault Handling page 39* for further information and recomended actions.
If the boat has more than one station, it has to be activated before the lamps can be checked.

## Start the engines

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

### Start using the ignition switch

Turn the key of each engine to position **III**. Release the key and let it spring back to position **I** as soon as the engine has started.
If repeated start attempts are needed, the key must be turned back to position **0** first.

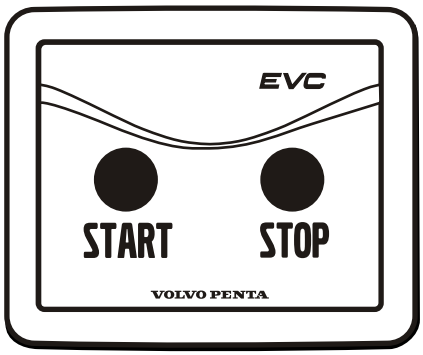



### Starting with the starter button

Press the starter button for each engine. Release the button as soon as the engine has started.
If you start from a secondary station, the starter keys at the main station must be in position **I**.

### Overheating protection

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



P0005860

## Read the instruments and warm the engine up

Allow the engines to idle for the first ten seconds. Check that instruments and warning displays show normal values. Check that no alarms are displayed and no warning lamps are flashing. If an alarm is registred, please refer to section *Fault Handling page 39* for further information and recomended actions.
Warm the engine up at low speed and low load, so normal operating temperature is reached before full power is used.

## IMPORTANT!

Never race the engine when it is cold.

# Operation

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

**⚠ WARNING!**

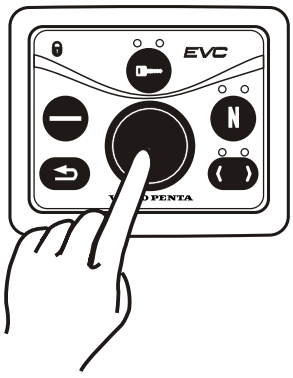
A rotating propeller can cause serious injury. Check that nobody is in the water before engaging ahead or astern. Never drive near bathers or in areas where people could be in the water.

## Reading the Instruments

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

## Alarms

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



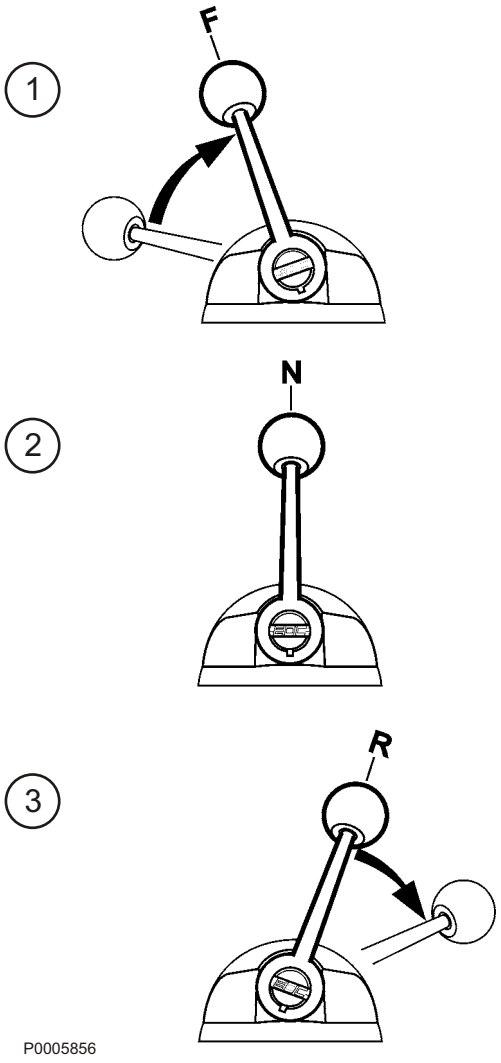
P0005872

1 Read the alarm/fault message.

2 Acknowledge the alarm by pressing the knob on the control panel.

3 Take the indicated actions, see chapter *Fault Code Register page 42*.

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



P0005856

# Maneuvering

Shifting between forward and reverse should be done at idling. Shifting at higher engine speeds can be uncomfortable for passengers and cause unnecessary stress on the transmission 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/reverse operation as follows:

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

**⚠ WARNING!**

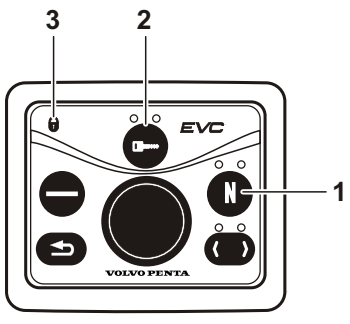
Never shift to reverse when the boat is planing.

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

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

### IMPORTANT!

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



P0006366

## Helm Stations

### Changing and activating stations

#### Changing stations

1 Put the gear in neutral.
The lamp above the neutral button (**1**) is lit when the gear is in neutral.

2 Unlock, if locked, the station you leave by pushing the activation button (**2**).

3 Activate the station you change to by pressing the activation button (**2**).
The lamp above the activation button lights when the station is active.

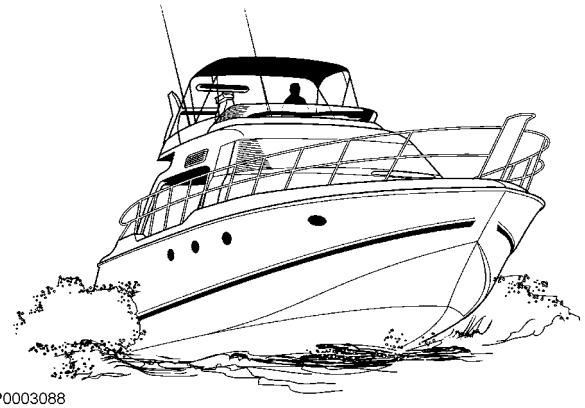
An active station is indicated by the lit lamp above the activation button.
Is the light above the activation button off, the station is inactive.

If the padlock sign (**3**) flashes the station can not be activated. Another station is either active and locked, or active with the gear engaged (not in neutral)
A flashing light above the activation button (**2**) indicates a fault that limits the functionality of the station. The fault is also indicated by a pop-up appearing in the display, please refer to section “Fault handling”.

**Locking/Unlocking station**

Is a station locked it is only possible to start or stop the engine and change stations from this station.
Lock an active station by pressing the activation button (**2**). Unlock an active, locked station by pressing the activation button (**2**). The padlock sign (**3**) on the control panel indicates whether the station is locked (lit) or not (off).

## Cruising Speed



P0003088

For best fuel economy operations at full must be avoided. We recommend a cruising speed that is at least 10% below the maximum engine revolutions at top speed (full throttle).
Depending on hull type, the choice of propeller, the load and sea state etc., the maximum revolutions at top speed may vary, but they should be within the full throttle range; refer to the “Technical data” chapter.

If the engine does not reach its maximum throttle range it can depend on a number of factors mentioned in the “Fault tracing” chapter.
Select a propeller with greater pitch if actual engine revolutions exceed the full throttle range. Contact your Volvo Penta dealer for advice.

# Engine Shutdown

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

## Stop the Engine

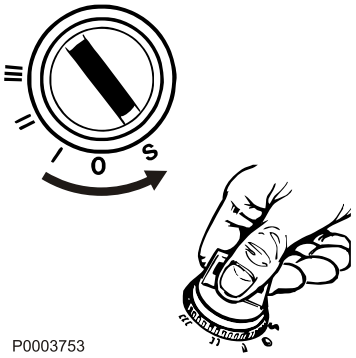
If a station is active and locked the engines can only be started and stopped from that station.

### IMPORTANT!

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

### IMPORTANT!

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

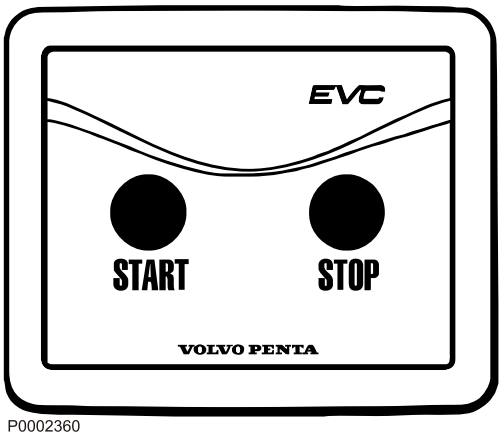


P0003753

### Stop with key

1 Disengage the drive by putting the control lever in neutral.

2 Turn the keys to stop position “**S**”. Keep the key turned until the engines stops. The key will automatically return to the “0” position when it is released and can then be removed.
The starter keys must be in the “0” position or removed before main switches are switched off.

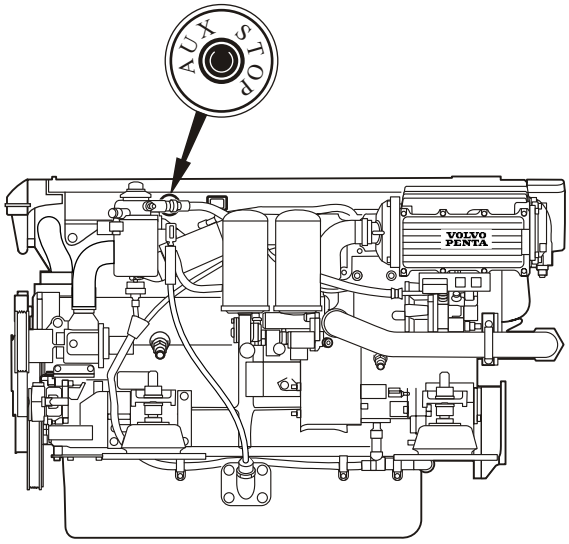


P0002360

### Stopping with the stop button

1 Disengage the drive by putting the control lever in neutral.

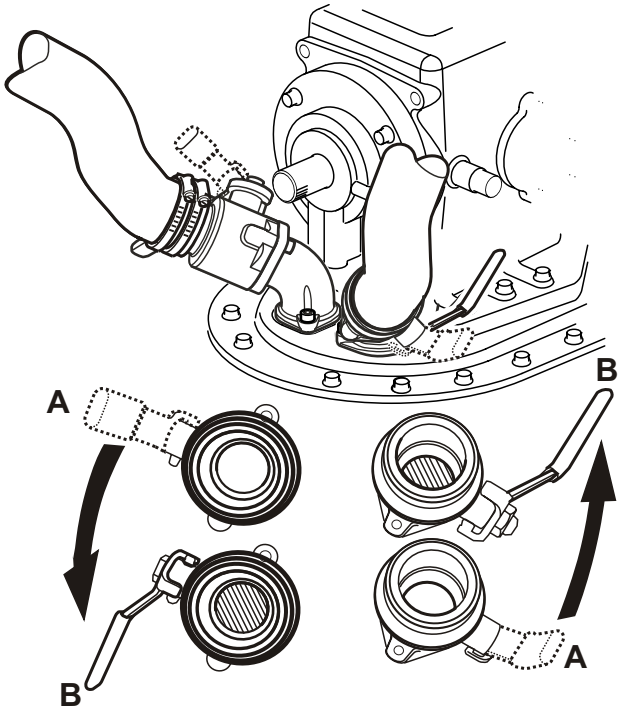
2 Push the stop buttons. Release the buttons when the engines have stopped.




P0003709

### Auxiliary stop

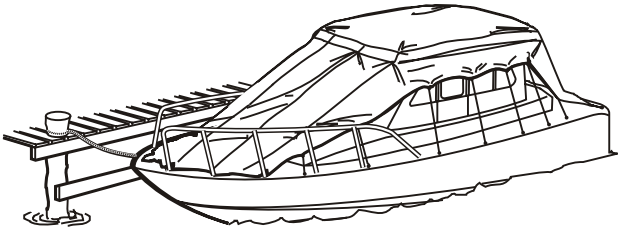
If the engine cannot be stopped in a normal procedure, it is possible to stop the engine via auxiliary stop mounted on the side of the engine.




P0002849

# After Engine Shutdown

- Check the engine and engine bay for leakages.
- Close the fuel taps.
- Close the two sea cocks at each propulsion unit. Position A open. Position B closed.
- Take an hour meter reading and carry out preventive maintenance according to the maintenance schedule.
- Turn off the main switches before any long stoppage.



P0002451

**Operation break with the boat in water**

If the boat is not used, but left in the water, the engine must be warmed up at least once every fortnight. This prevents corrosion damage in the engine.
If you expect the boat to be unused for two months or more, it must be laid up, please refer to *Storage page 95*

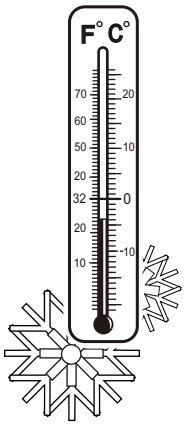
**Operation break with the boat out of water**

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 must be cleaned with emery paper to remove any oxidation.
If you expect the boat to be unused for two months or more, it must be laid up, please refer to *Storage page 95*.

### IMPORTANT!

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

## Cold Weather Precautions

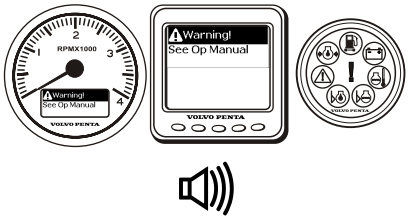



P0005905

If the engine bay cannot be kept frost free, the raw water system must be drained and the freshwater system coolant must have sufficient frost protection to prevent frost bursting; refer to the sections *Seawater System, Draining page 77* and *Maintenance page 73* respectively for more detailed information.
Check the charge status of the battery. A poorly-charged battery can freeze and burst.

# Fault Handling

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




P0006368

## Alarm handling

### Fault information from engine and EVC system

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

Information regarding ”cause of fault” and ”measures to take” is found in chapter *Fault Code Register page 42*.

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

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

## Acknowledging alarm

1 Push the knob on the control panel to ackowledge the alarm. The buzzer becomes silent.

2 Read the alarm or message in the pop-up.

3 Push the knob on the control panel again and the pop-up disappears.

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

### Popup windows

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


P0004987

### Danger

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

Acknowledge the alarm and stop the engine immediately.

**DANGER!** Stop the engine immediately.


P0004986

### Warning

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

Acknowledge the alarm and stop the engine at once.

**WARNING!** Stop the engine.


P0004985

### Caution

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

Acknowledge the alarm.

**CAUTION!** See operator's manual.


P0004375

## Faults list

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

Push the knob on the control panel to open the menue.
Turn the knob to see all faults registred.
The popup toggles between cause of fault and tasks to perform.

## Erasing faults in faults list

Acknowledged faults that has been stored automatically erased every time the starter key is turned to the stop position (**S**).
Stop the engine and check that the ignition key(s) is (are) in position **0** in all control positions.

When system voltage is switched on again, the diagnostic function checks whether there are faults in the EVC system. If this is the case, new fault pop-ups are shown.
Faults which have been attended to or have disappeared are automatically erased.
Faults which have not been attended to must be acknowledged every time the system voltage is switched on.

# Fault Code Register

## ⚠ CAUTION!

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

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

**Explanation of fault message**

A Description of current fault, affect on the system and measures to take.

B Current warning lamp which flashes during an alarm. O/R means that an orange or red lamp flashes.

C Audible warning.

D Fault pop-up which is shown on the EVC tachometer display.

**A.**

**Explanation:**
Battery voltage too low.

**Symptom:**
None.

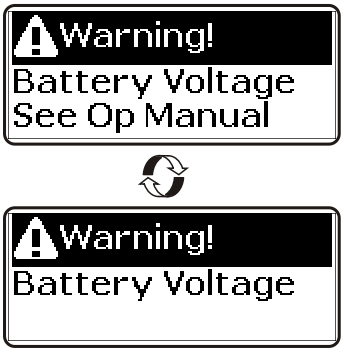
**Action:**

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

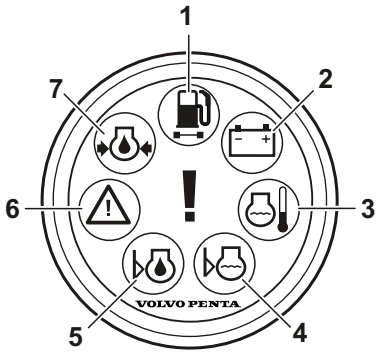
**B.** 


**C.** 

**D.**




P0005024




P0004761

1 Is the orange “water in fuel” lamp lit there is to much water in the water separator on the fuel pre-filter.

2 Is the charging lamp lit the alternator has stopped charging.

3 Is the coolant temperature lamp lit the coolant temperature is to high.

4 Is the orange coolant level lamp lit during operation the coolant level is to low.

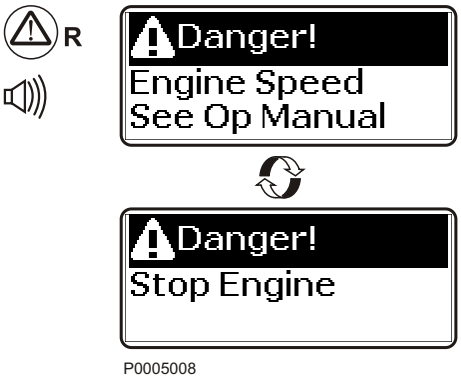
5 Is the orange oil level lamp lit during operation the engine oil level is to low.

6 Is the red (**R**) warning lamp lit during operation a serious malfunction has been discovered.
Is the orange (**O**) warning lamp lit during operation a malfunction has been discovered.

7 Is the red oil pressure lamp lit during operation the engine oil pressure is to low.

## Engine Speed

**Explanation:**
Fault in engine speed sensor.
**Symptom:**
Engine power is reduced.
**Action:**
Please contact a Volvo Penta workshop.



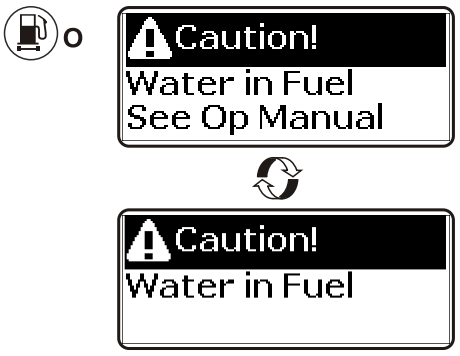

P0005008

**DANGER!** Engine Speed See Operator's Manual
Stop engine

## Water in Fuel

**Explanation:**
Water in water trap in fuel filters.
**Symptom:**
None.
**Action:**

- Empty the water trap underneath the fuel filters. Se *Maintenance page 71*.
- Please contact a Volvo Penta workshop if the fault remains.

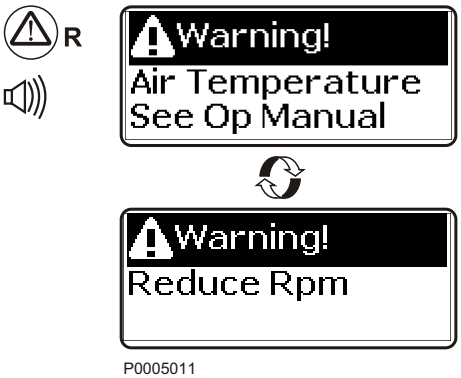



P0001200

**CAUTION!** Water in Fuel
See Operator's Manual

## Air Temperature

**Explanation:**
Charge air temperature too high.
**Symptom:**
Engine power is reduced.
**Action:**
Please contact a Volvo Penta workshop.




P0005011

**WARNING!**
Air Temperature See Operator's Manual

Reduce rpm

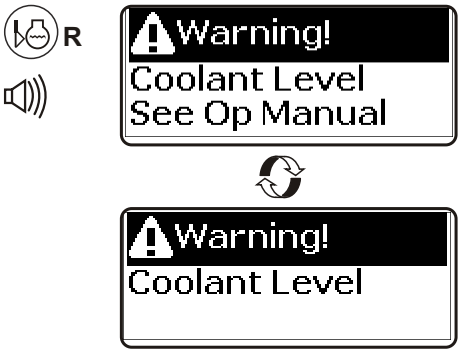
## Coolant Level

**Explanation:**
Coolant level too low.

**Symptom:**
None.

**Action:**

- Check coolant level. Se *Coolant Level, Checking and Topping Up page 75*.
- Check that no coolant leakage occurs in auxiliary equipment connected to the engine cooling system.
- Please contact a Volvo Penta workshop if the fault remains.




P0005012

**WARNING!** Coolant Level See Operator's Manual

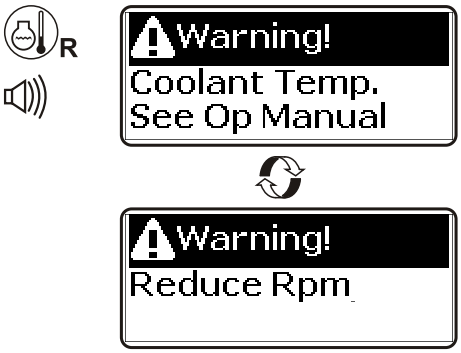
## Coolant Temperature

**Explanation:**
Coolant temperature too high.

**Symptom:**
Engine power is reduced.

**Action:**

- Check coolant level. Se *Coolant Level, Checking and Topping Up page 75*.
- Check that the seawater filter is not blocked. Se *Seawater Filter, Check and Cleaning page 80*.
- Check the impeller in the seawater pump. Se *Impeller, Check and Change page 78*.
- Check that no leakage occurs.
- If the cooling water flow ceases, the exhaust hose should be inspected internally and replaced if the hose shows signs of damage.
- Please contact a Volvo Penta workshop if the fault remains.




P0005014

**WARNING!** Coolant Temperature See Operator's Manual
Reduce rpm

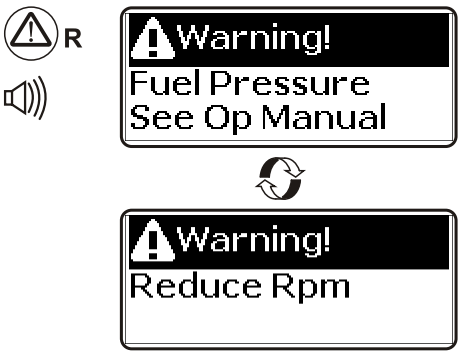
## Fuel Pressure

**Explanation:**
Fuel pressure too low.

**Symptom:**
None.

**Action:**

- Check fuel level.
- Open the fuel taps and check that no leakage occurs.
- Check that the fuel filters are not blocked. Replace filters if necessary. Se *Maintenance page 71*.
- Please contact a Volvo Penta workshop if the fault remains.




P0005015

**WARNING!** Fuel Pressure See Operator's Manual
Reduce rpm

## Engine Oil Level

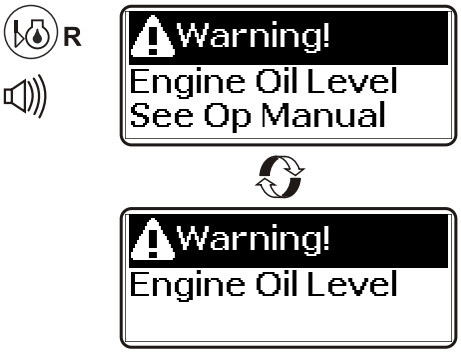
**Explanation:**
Oil level too low.

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

**Symptom:**
None.

**Action:**

- Check the oil level in the engine. Se *Oil level, checking and topping up page 69*.
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.




P0005017

**WARNING!** Engine Oil Level See Operator's Manual

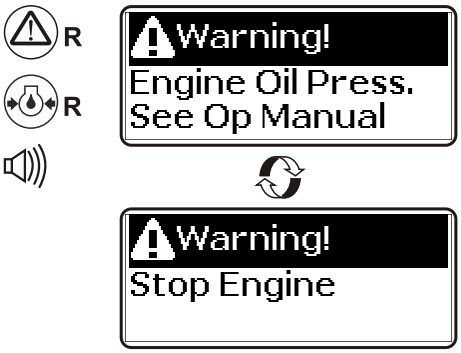
## Engine Oil Pressure

**Explanation:**
Oil pressure too low.

**Symptom:**
Engine power is reduced.

**Action:**

- Check the oil level in the engine. Se *Oil level, checking and topping up page 69*.
- Check that the oil filters are not blocked. Replace filters if necessary.
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.




P0005018

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

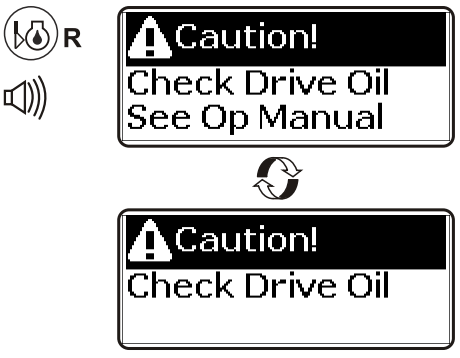
## Check Drive Oil

**Explanation:**
Oil level too low.

**Symptom:**
Engine power is reduced.

**Action:**

- Check the oil level in the engine. Refer to *Maintenance page 87*.
- Check the oil filters.
- Check that no leakage occurs.
- Please contact a Volvo Penta workshop if the fault remains.




P0001194

**CAUTION!**Check Drive OilSee Operator's Manual

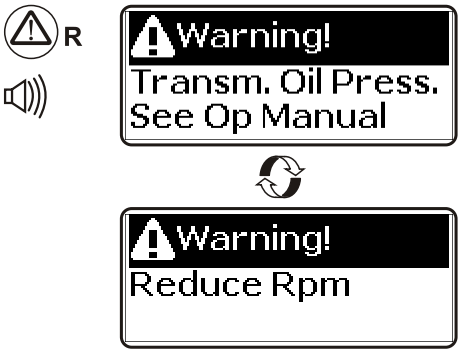
## Transmission Oil Pressure

**Explanation:**
Reverse gear oil pressure too low.

**Symptom:**
None.

**Action:**

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




P0005023

**WARNING!** Transmission Oil Pressure See Operator's Manual

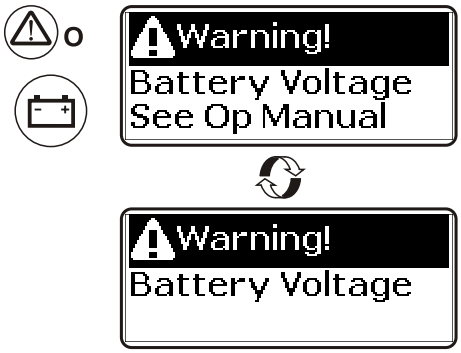
## Battery Voltage

**Explanation:**
Battery voltage too low.

**Symptom:**
None.

**Action:**

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




P0005024

**WARNING!** Battery Voltage See Operator's Manual

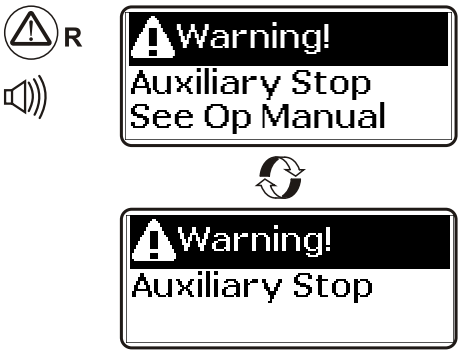
## Emergency Stop Switch

**Explanation:**
External stop signal.

**Symptom:**
Engine stops or can not be started.

**Action:**

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




P0005025

**WARNING!** Emergency Stop Switch See Operator's Manual

## Primary Battery

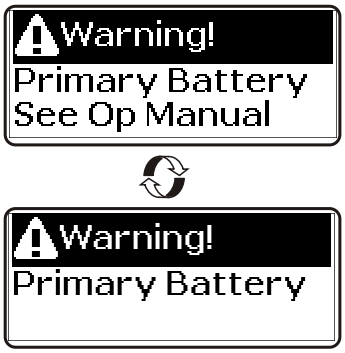
**Explanation:**
Poor batteries or charging.

**Symptom:**
None.

**Action:**

- Check the batteries fluid level. Se *Battery, Maintenance page 83*.
- Check belt tension. Se *Drive Belt, Check and Change page 67*.
- Please contact a Volvo Penta workshop if the fault remains.

R




P0005026

**WARNING!** Primary Battery See Operator's Manual

## Check control lever

**Explanation:**
Fault in control lever.

**Symptom:**
Engine in emergency mode. Gear to neutral.

**Action:**

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

R


P0005031

**WARNING!**Check control lever See Operator's Manual

O


P0005032

**CAUTION!**Check control leverSee Operator's Manual

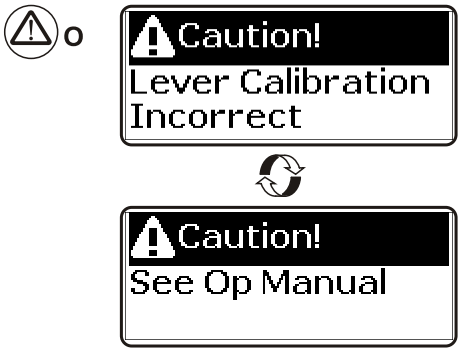
## Lever Calibration

**Explanation:**
Incorrect lever calibration.

**Symptom:**
Impossible to select active station.

**Action:**

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




P0005033

**CAUTION!** Lever Calibration Incorrect-See Operator's Manual

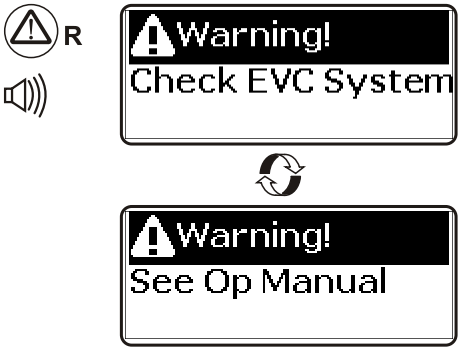
## Check EVC system

**Explanation:**
Internal fault in EVC system.

**Symptom:**
Engine power is reduced.

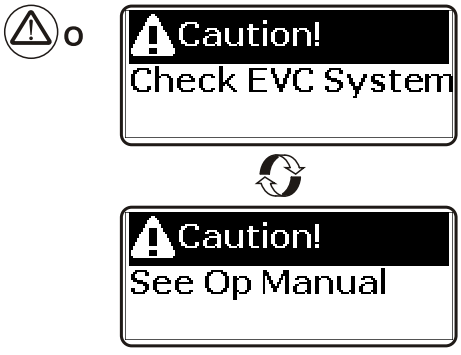
**Action:**

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




P0005034

**WARNING!**Check EVC systemSee Operator's Manual




P0005035

**CAUTION!**Check EVC systemSee Operator's Manual

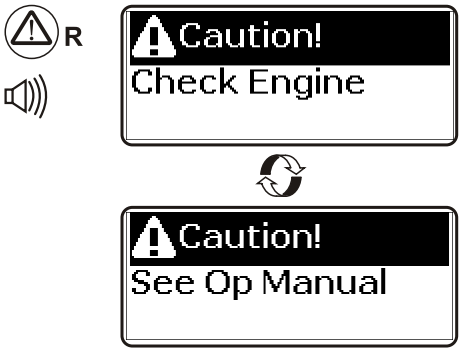
## Check Engine

**Explanation:**
Miscellaneous system faults.

**Symptom:**
None.

**Action:**

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




P0005036

**CAUTION!** Check Engine See Operator's Manual

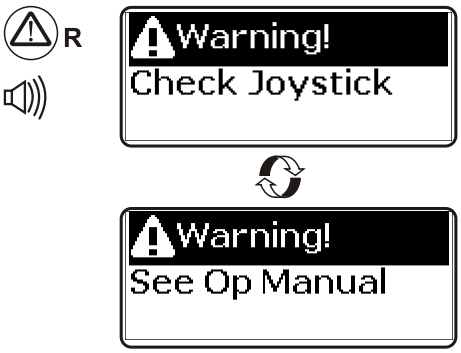
## Check joystick

**Explanation:**
Faulty joystick.

**Symptom:**
Engine power is reduced.

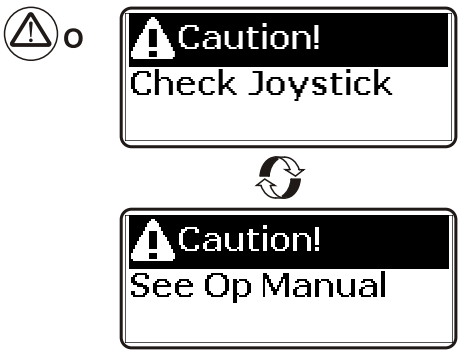
**Action:**

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




P0005037

**WARNING!**Check joystickSee Operator's Manual




P0005038

**CAUTION!**Check joystickSee Operator's Manual

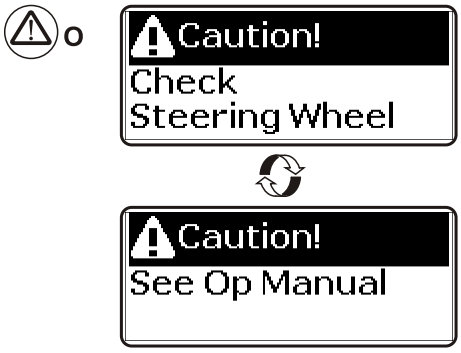
## Check steering wheel

**Explanation:**
Faulty steering wheel unit.

**Symptom:**
Engine power is reduced.

**Action:**

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




P0005039

**CAUTION!** Check steering wheel See Operator's Manual

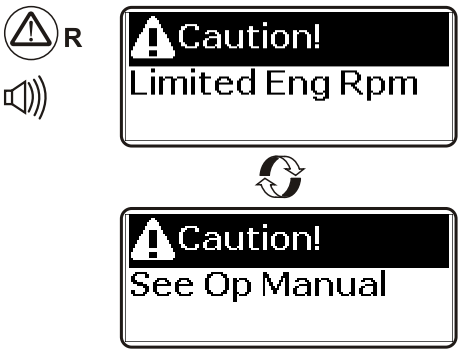
## Limited Engine RPM

**Explanation:**
Fault in steering system.

**Symptom:**
Engine power is reduced.

**Action:**

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




P0005040

**CAUTION!** Limited Engine RPM See Operator's Manual

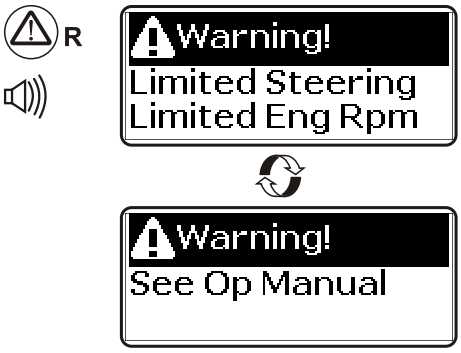
## Limited steering

**Explanation:**
Fault in steering system.

**Symptom:**
Engine power is reduced.Limited steering.

**Action:**

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




P0005041

**WARNING!** Limited steering Limited Engine RPM
See Operator's Manual

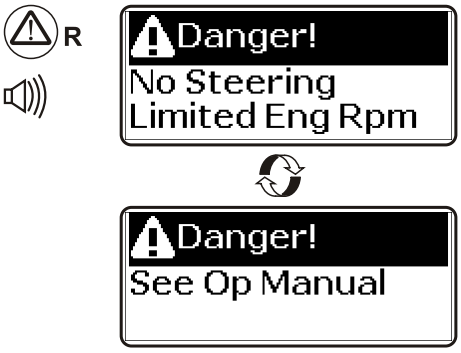
## No Steering

**Explanation:**
Faulty steering wheel unit.

**Symptom:**
Engine power is reduced.No steering.

**Action:**

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




P0005042

**DANGER!** No Steering Limited Engine RPM
See Operator's Manual

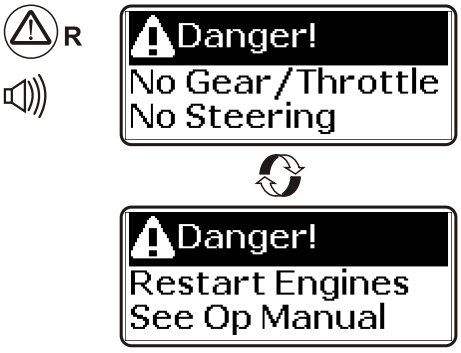
## No Gear/Throttle, No Steering

**Explanation:**
Fault in steering system.

**Symptom:**
No steering.No drifting.

**Action:**

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




P0005043

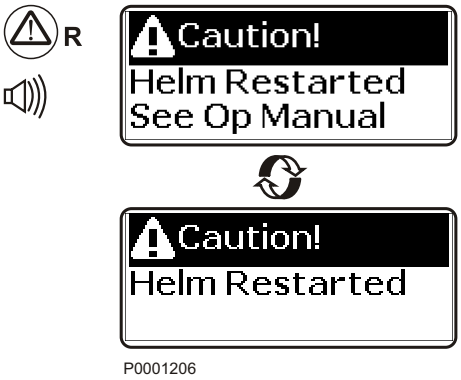
**DANGER!** No Gear/Throttle, No Steering
Restart Engines See Operator's Manual

## Helm Restarted

**Explanation:**
Lost active helm during crank.

**Symptom:**
None.

**Action:**
Restart engine(s).




P0001206

**CAUTION!** Helm Restarted See Operator's Manual

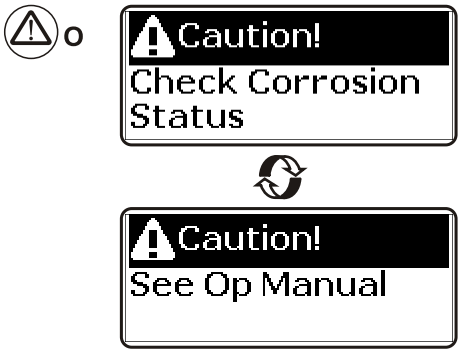
## Check corrosion status

**Explanation:**
Corrosion protection not guaranteed.

**Symptom:**
None.

**Action:**

- Check that the batteries are charged by land current or by the alternator.
- Please contact a Volvo Penta workshop if the fault remains.




P0001209

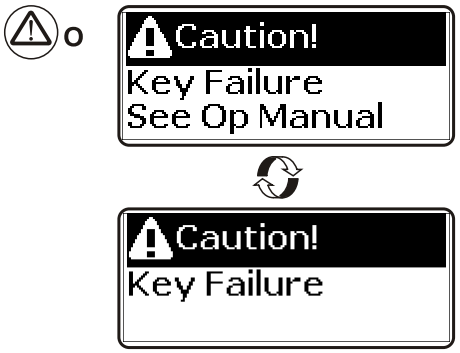
**CAUTION!**Check corrosion statusSee Operator's Manual

## Key Failure

**Explanation:**
Key or start panel out of order.

**Symptom:**
None.

**Action:**
Please contact a Volvo Penta workshop.




P0001199

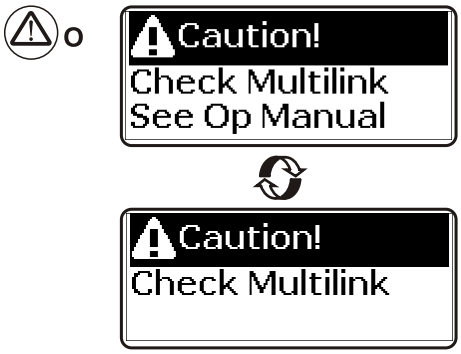
**CAUTION!** Key FailureSee Operator's Manual

## Check Multilink

**Explanation:**
Fault in multilink communication.

**Symptom:**
Possible loss of engine synchronization or loss of display(s).

**Action:**
Please contact a Volvo Penta workshop.




P0001204

**CAUTION!** Check Multilink See Operator's Manual

# In Case of Emergency

## In Case of Emergency

This chapter describes emergency operation methods.

**NOTICE!** A boat with a quadruple installation is not likely to experience a serious fault on all engines and propulsion units simultaneously. If a serious fault occurs which prevents one or up to three engine(s) and propulsion unit(s) from working normally it will still be possible to operate the boat to your destination using the control levers and the steering wheel. If at least one engine and propulsion unit on each side is working it is also possible to operate the boat with the joystick, though it will be with less power than normal.

**CAUTION!** If one or up to three engine(s) stops working, or operates at reduced engine speed, it is recommended to avoid operating at wide open throttle or high speeds for longer periods. The engine load for the engine(s) that is (are) still working will be much higher than it normally should be when all engines are working and this could cause excessive wear to the engine (s) and propulsion unit(s).

# Running Aground

If the boat has been run aground or into an object in a way that may have damaged any of the propulsion units or propellers, the boat must be run (if possible) at reduced speed or towed to the nearest harbor. Take the boat out of the water and let an authorized Volvo Penta workshop inspect the propulsion units and propellers. Undetected damage could lead to serious propulsion unit damage.

# Starting Using Auxillary Batteries

P0002107

**⚠ WARNING!**

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

**⚠ WARNING!**

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

1 Check that the auxiliary battery has the same voltage as the engine system voltage.

2 Connect the red positive cable to the plus (+) terminal on the discharged battery and then to the plus terminal on the auxiliary battery.

3 Connect the black start cable to the minus (–) terminal on the auxiliary battery and to a place a little distance away from the discharged battery, e.g. the start motor's negative terminal.

**⚠ WARNING!**

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

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

**⚠ WARNING!**

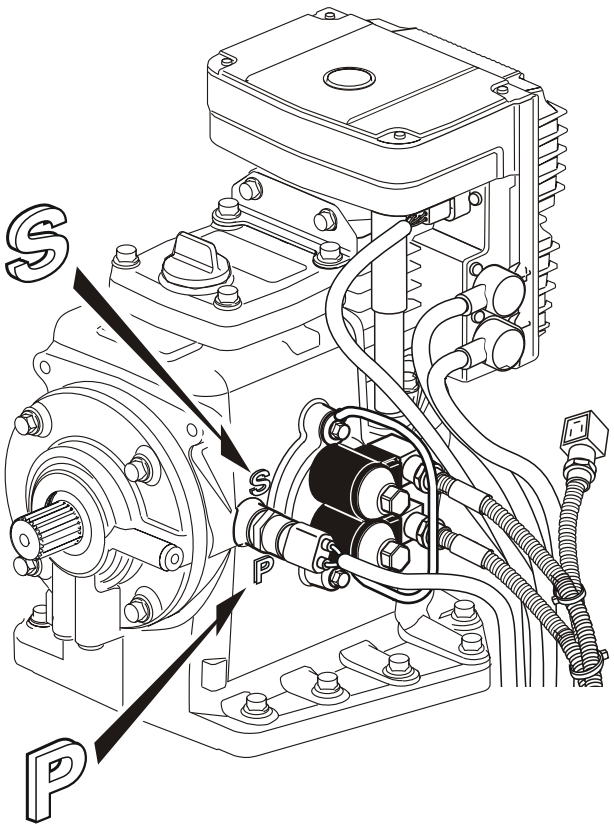
Working with, or going close to a running engine is a safety risk. Watch out for rotating components and hot sufaces.

**⚠ WARNING!**

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

Do not bend over any of the batteries either.

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



P0002853

# Emergency Shifting

If a fault occurs which prevents gear shifting with the control levers, it is possible to shift manually using the description below.

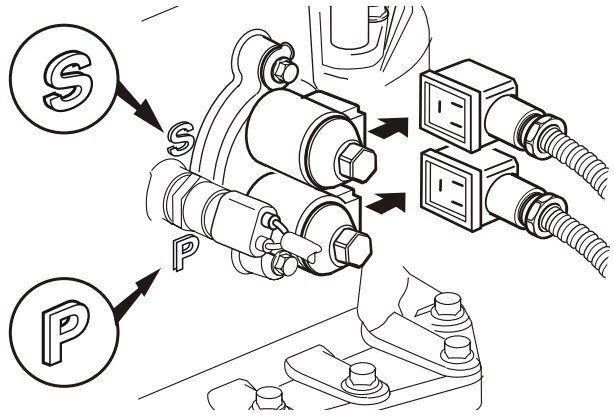
**NOTICE!** The following procedure can be performed with the engine(s) shut down or running.

**⚠ WARNING!**

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

**NOTICE!** The marking “P” (Primary) is for forward gear and the marking “S” (Secondary) is for reverse gear.

1




P0002854

**Manual engagement – forward gear:**

1 Undo the two connectors, marked “Secondary” and “Primary”, from the solenoid valves.

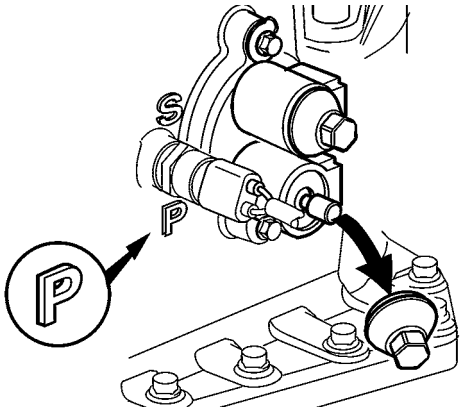
2 Remove the cap nut from the lower solenoid valve marked “P” (forward gear).

3 Release the spring loaded button by pushing and at the same time turning it 1/2 turn counter-clockwise. The gear is now engaged for forward motion and cannot be disengaged by the control lever.

**Manual disengagement:**

4 Lock the spring loaded button in position by pushing and at the same time turning it clockwise 1/2 turn. The gear is now disengaged.

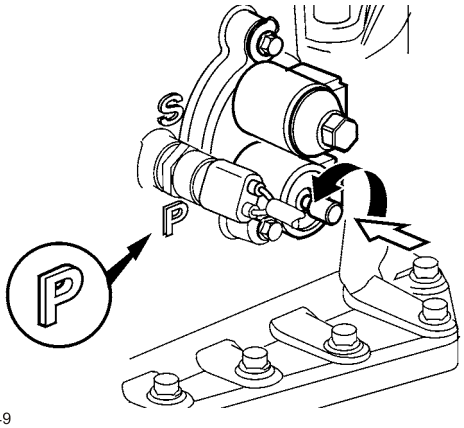
2




**Manual engagement/disengagement – reverse gear:**

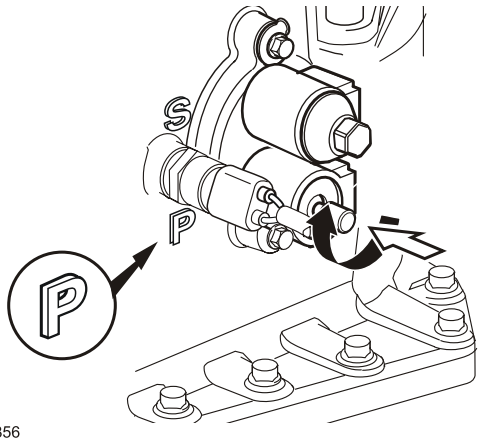
Use the same procedures as above but engage/disengage with the valve marked “S” (reverse gear) instead.

3

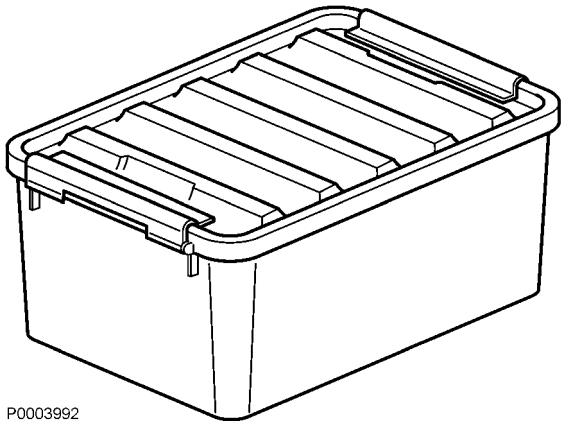



P0004249

4




P0002856



P0003992

## Emergency Alignment, Propulsion Unit

If a fault occurs which prevents one or several propulsion units from being operated with the steering wheel it is possible to align the propulsion unit(s) for straight forward operation manually using the description below.

If one or several propulsion units can be operated by the steering wheel, this emergency operation is not necessary. However, it could be that the steering ability is badly unbalanced if the non working propulsion unit (s) is locked in a disadvantageous angle, then alignment of the non working propulsion unit(s) will improve the steering ability. The operator determines whether the alignment is necessary or not, in order to maneuver the boat in a safe way to the nearest harbor.

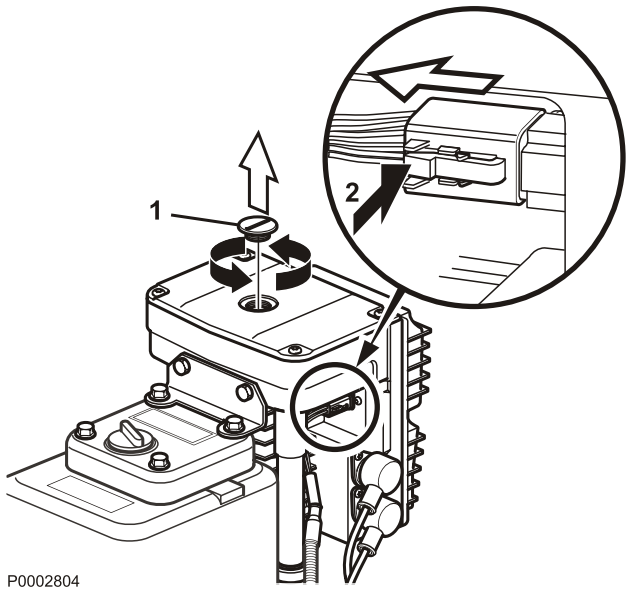
If steering is out of order on all propulsion units, align all propulsion units and use control levers to steer the boat.

The tools needed during this operation are delivered in a special tool box together with the boat.

### ⚠ WARNING!

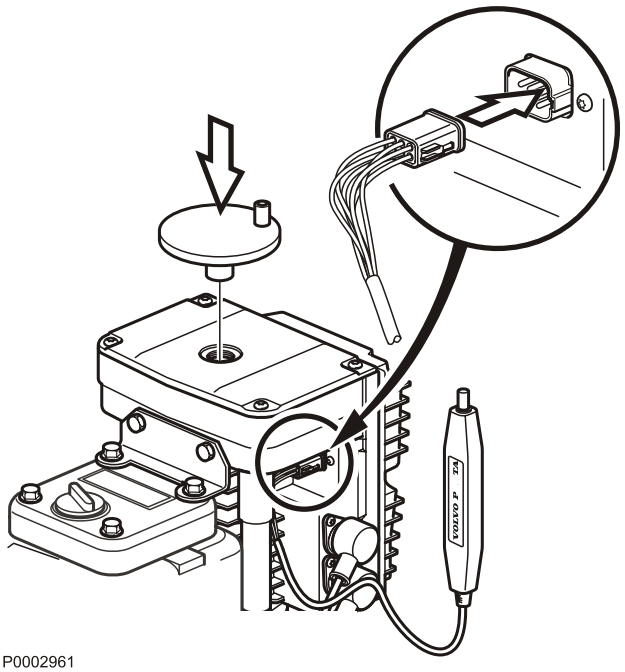
Working with, or going close to a running engine is a safety risk. Watch out for rotating components and hot sufaces.

The following procedure can be carried out with the engines running, even though it is not recommended. Wear hearing protection when in the engine room as there is a risk of harmful sound levels.



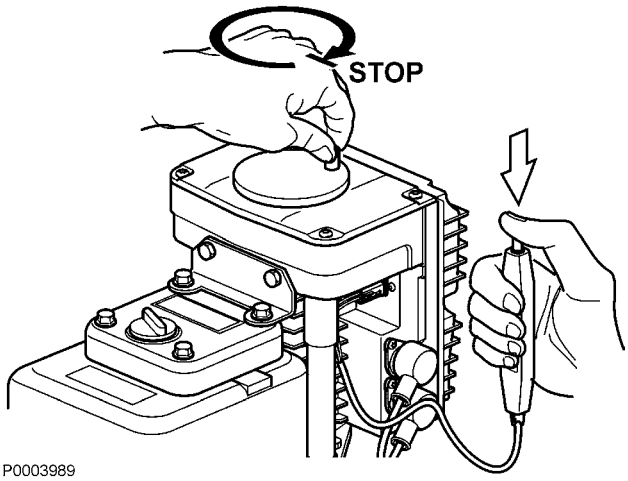

P0002804

1 Unscrew and remove the plug (**1**). Disconnect the cable by pressing down the lock (**2**) and at the same time wiggle the connector in “forward” position.



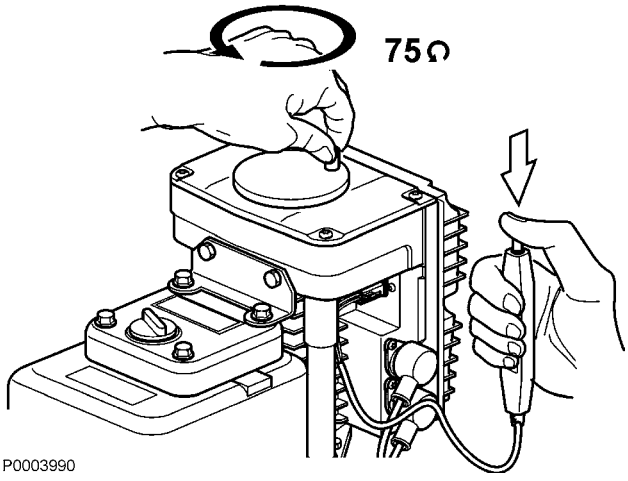
P0002961

2 Connect the switch and fit the red crank tool.



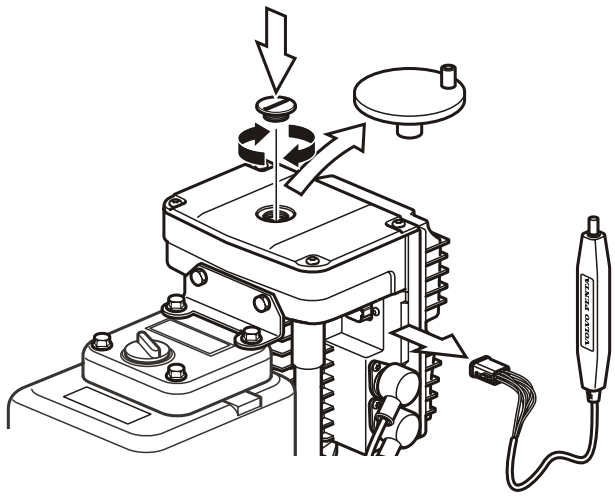

P0003989

3 Press the switch button down and keep it pressed while turning the crank tool carefully to an end position. When the end position is reached, stop turning. The end position feels like a compression spring.
**IMPORTANT!**
Do not force the crank tool beyond the end position, it could damage the propulsion unit.



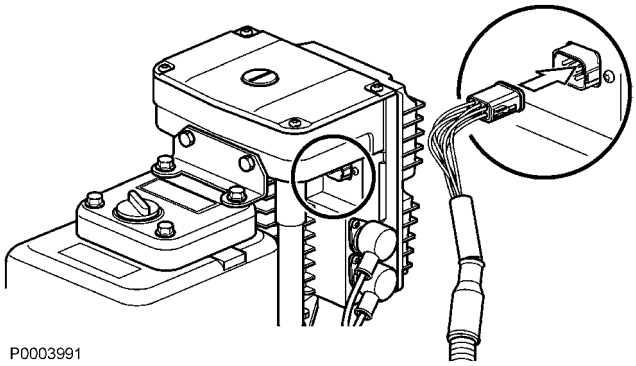

P0003990

4 Turn the crank tool back 75 turns. The propulsion unit is now aligned for straight forward motion.



P0002802

5 Remove the crank tool. Disconnect the switch by pressing down the lock and at the same time unplugg the switch by slowly wiggling it (please refer to procedure in step 1).
Screw back the plug.



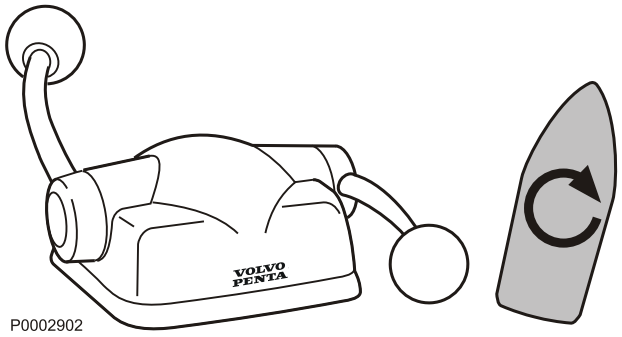
P0003991

6 Reconnect the cable you disconnected in step 1.

## Emergency steering with control levers

If a fault occurs which prevents all propulsion units from being operated with the steering wheel, align all the propulsion units and use the steering method described below to reach nearest habor.

If one or several propulsion units can be operated by the steering wheel, the steering method described below is not needed.

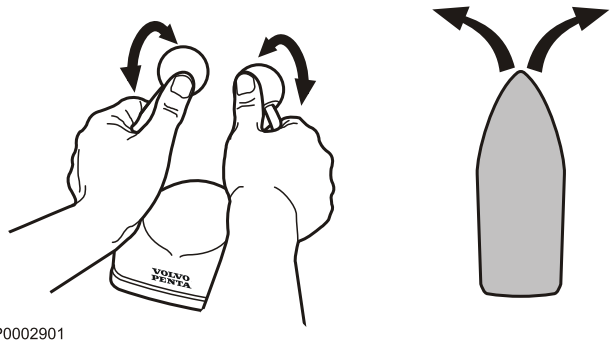



P0002902

**Rotate the boat**

Put one control lever in the position for forward and put the other control lever in the position for reverse. Use a suitable engine speed for maneuvring.

The direction of rotation is determined by the lever which is put in the position for reverse. If the boat is to move to starboard, the starboard control lever should be put in the position for reverse.




P0002901

**Steering the boat**

Put the control levers in forward. Use a suitable engine speed for maneuvring.

The direction of the steering is determined by the use of the control levers. If the boat is to turn to starboard, reduce speed on starboard engine. The greater the difference in speed between the control levers the more the boat turns. To make a sharp turn, move one of the control lever to reverse for a moment.

# Maintenance Schedule

## Maintenance Schedule

### Maintenance Schedule

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

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

### FSI

| **First service inspection, after 20–50 running hours[1)]** | |
|---|---|
| Coolant level and antifreeze mixture | **I** |
| Drive belt (tension) | **I** |
| Seawater filter | **I C** |
| Drive-unit, oil level | **I** |
| Corrosion protection (space between IPS-housing and clamping ring) | **I** |
| Instrument panel function | **I** |
| **Start and warm up engine** | |
| Inspection with VODIA (Diagnostic Tool) | **I** |
| Engine and transmission, oil / fuel / water leakage | **I** |
| Engine and transmission, noises | **I** |
| **Stop Engine** | |
| Engine Oil and Oil Filters/By-pass filter | **R** |
| **Restart engine** | |
| Oil pressure / oil leakage | **I** |

1) Or within 180 days of the date of delivery, or the end of the first season, whichever comes first.

| **Daily, Before First Start** | |
|---|---|
| Engine and engine room. General inspection | **I** |
| Checking Engine Oil Level | **I** |
| Check coolant level. | **I** |
| Drive-unit, oil level | **I** |
| Leakage and function check | **I** |

| **Every 14 days** | |
|---|---|
| Drive belts, wear | **I** |
| Seawater Filter, Check and Cleaning | **I C** |
| Batteries, electrolyte level | **I** |

## A

| Every 100–200 hours / at least every 12 months, included in extended protection | |
|---|---|
| Engine Oil and Oil Filters/By-pass filter[1)] | **R** |
| Primary Fuel Filter, Draining Condensate | **I** |

1) Oil change intervals vary, depending on engine type, oil grade and sulfur content of the fuel. See chapterl *Technical Data page 113*. Change the filters during each oil change.

## B

| Every 200 hours / at least once a year, included in extended protection | |
|---|---|
| Filter for crankcase ventilation | **R** |
| Air filter insert | **R** |
| Fuel pre-filter and fuel fine filter | **R** |
| Drive belt (tension) | **I** |
| Compressor, oil level | **I** |
| Seawater pump impeller | **I** |
| Sacrificial anodes (charge air cooler and heat exchanger) | **I** |
| Corrosion protection (space between IPS-housing and clamping ring) | **I** |
| Engine and propulsion unit. Clean and touch up paintwork as required | **I C** |
| All hoses and pipes – Check the condition and re-tighten the hose clamps | **I** |
| Exhaust hose and cooling water hoses<br>– Check hoses/ pipes, connections and clamps | **I** |
| Inspection with VODIA (Diagnostic Tool) | **I** |

## C

| Every 400 hours / at least once every 12 Months, included in extended protection | |
|---|---|
| Drive-unitt. Oil and oil filter | **R** |
| Drive-unit. Function check of seawater cock | **I** |
| Drive-unit and transom. Corrosion protection (sacrificial anodes) | **I** |
| Drive-unit antifouling coating. Repair as required | **I** |

## D

| Every second year | |
|---|---|
| Coolant | **R** |

## E

| Every 600 hours / at least every 5 years | |
|---|---|
| Turbocharger, inspect / clean as required | **I C** |
| Drive-unit. Function and wear<br>– Propellershaft (check straightness)<br>– Steering | **I** |

**F**

| **Every 1200 hours / at least every 5 years** | |
|---|---|
| Drive Belt | **R** |
| Drive belt, compressor | **R** |
| Compressor, oil | **R** |
| Heat exchanger | **I C** |
| Charge air cooler | **I C** |
| Propellershaft seal | **R** |

# Maintenance

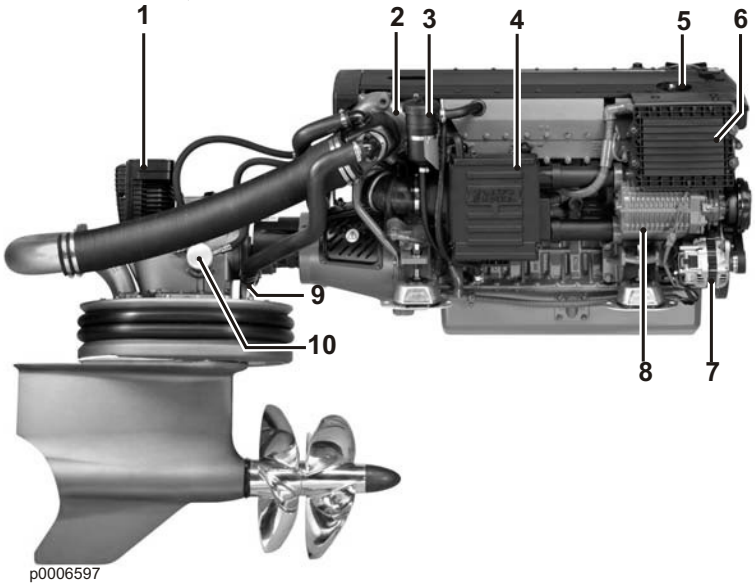
This chapter contains general technical information and instructions on how the prescribed maintenance items must be carried out. Read through the instructions carefully before starting work. The times when maintenance items must be carried are indicated in the *Maintenance Schedule page 61*.
Read through the safety precautions for maintenance and service in the *Safety Information page 4* chapter before work on the engine is begun.

**⚠ WARNING!**

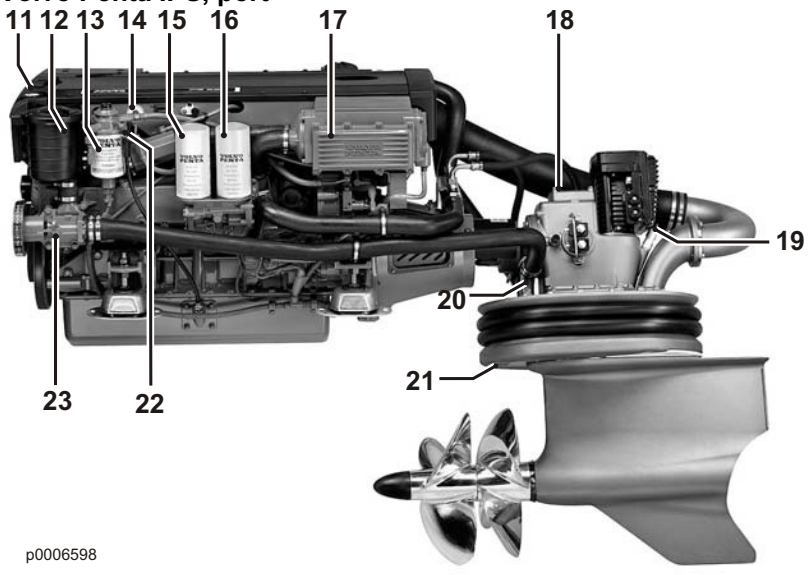
Care and maintenance work should be done with the engine stopped unless otherwise specified. Stop the engine before opening or removing the engine hatch/hood. Make it impossible to start the engine by removing the start key and cutting the system voltage with the main switches.

## Orientation

**Volvo Penta IPS, starboard**

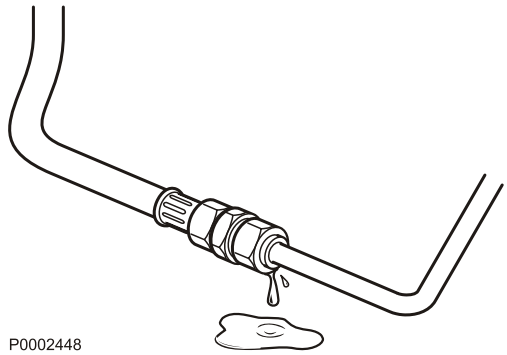



**Volvo Penta IPS, port**




1 Volvo Penta IPS, Servo Unit
2 Turbocharger
3 Crankcase ventilation filter
4 Air filter
5 Oil filler cap
6 Engine control unit
7 Alternator
8 Compressor
9 Water shut off valve, propulsion unit
10 Oil filter, propulsion unit
11 Expansion tank
12 Sea water filter
13 Fuel filter
14 Aux stop
15 Oil bypass filter
16 Oil filter
17 Charge air cooler
18 Oil filler cap, propulsion unit
19 Oil dipstick, propulsion unit
20 Water shut off valve, propulsion unit
21 Cooling water intake unit
22 Oil dipstick, engine
23 Sea water pump

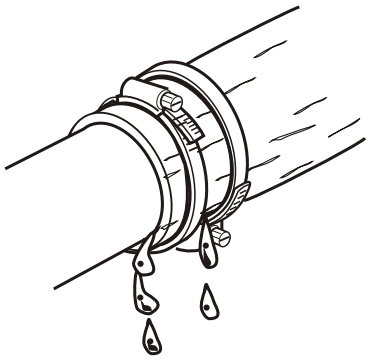
# Engine, General



P0002448

## General inspection

Make a habit of visually checking the engine and engine bay before starting, and after operations when you have stopped the engine. This will help you to discover abnormalities quickly, or if something is about to happen.
Look especially carefully for oil, fuel and coolant leakages, loose bolts, worn or poorly-tensioned drive belts, loose cable connections, damaged electrical cables and hoses. This inspection only takes a few minutes and can prevent serious malfunctions and expensive repairs.



P0002455

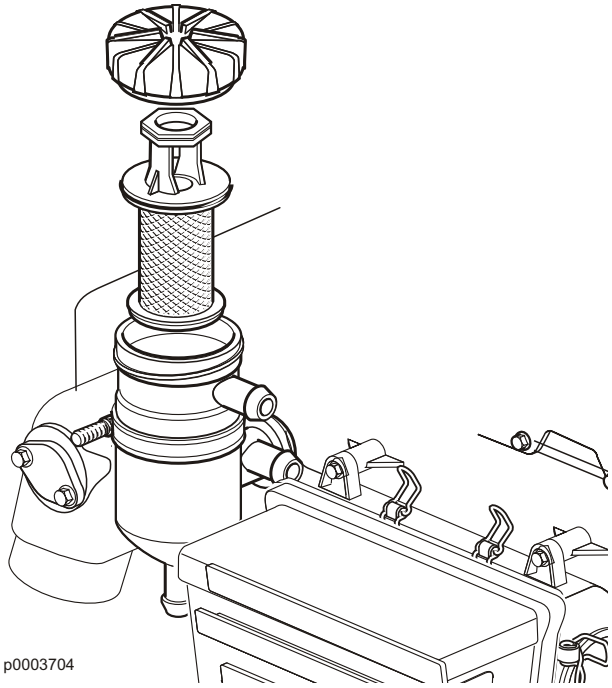
**⚠ WARNING!**

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

**⚠ WARNING!**

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

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




## Crankcase Ventilation. Filter Change

1 Unscrew the cover and remove the old filter.

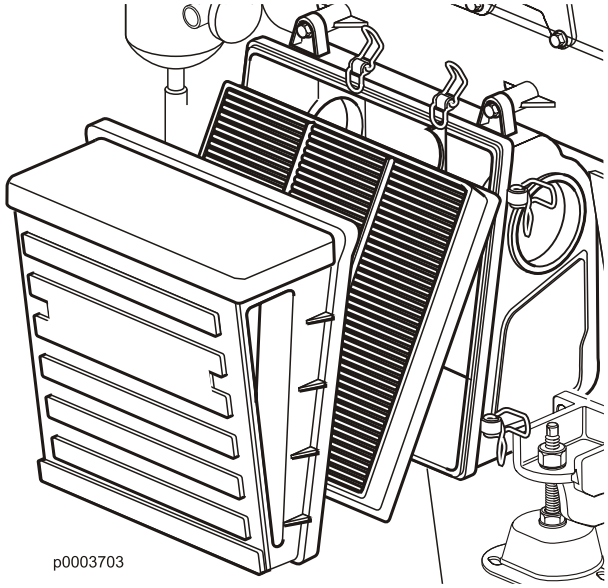
2 Clean the filter cover/housing as necessary. Be careful to prevent contamination from entering the engine.

3 Install the new filter.

4 Screw the cover back in place.

### IMPORTANT!

Scrap the old filter. They may not be cleaned.




## Air Filter, Change

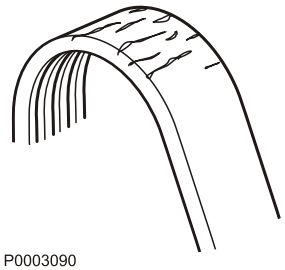
1 Unscrew the air filter cover and remove the old filter.

2 Clean the air filter cover/housing as necessary. Be careful to prevent contamination from entering the engine.

3 Install the new filter and air filter cover.

### IMPORTANT!

Scrap the old filter. They may not be cleaned.



P0003090

# Drive Belt, Check and Change

## ⚠ WARNING!

Stop the engine before doing any maintenance work.

**General**

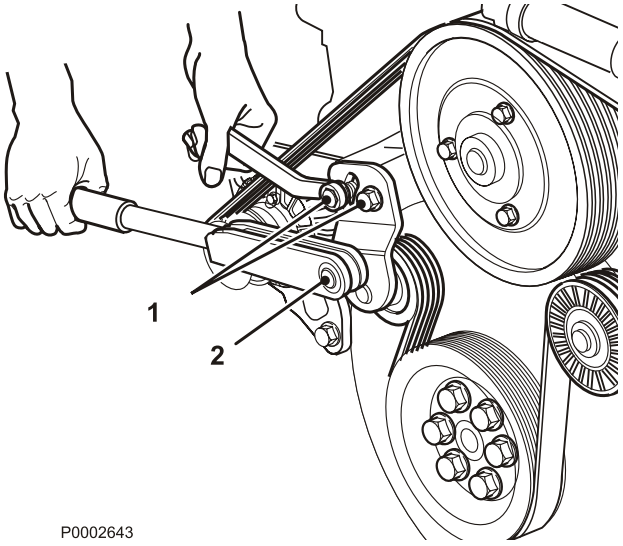
Check belt tensions and condition regularly. A belt that is tensioned too tightly may damage bearings, while a belt too-loosely tensioned may slip.

Check and adjust the belt after operation, while the belt is still warm.

## IMPORTANT!

Always replace a belt that appears worn or has cracks (belts that work in pairs shall always be changed together).

## Adjusting/replacement of drive belts



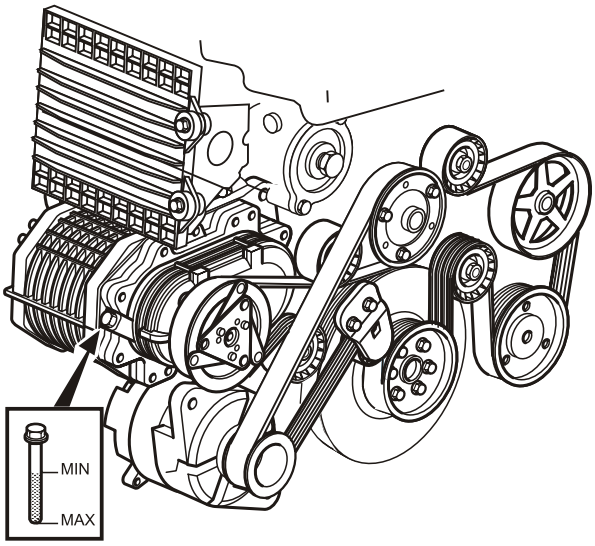

P0002643

The standard alternator and water pump are driven by a poly-V belt for the best function and lifespan. Replace/tension the belt as follows:

1 Loosen the screws (**1**) on the tension roller bracket. Remove and replace the belt as required.

2 Tension the belt by applying a torque to the tensioning roller square fitting (**2**) of **70 Nm** (52 lbf.ft). Lock the tensioning roller using screws (**1**). The screws must be tightened to **50 Nm** (37 lbf.ft).

3 Repeat the procedure when the engine is warm: Loosen screws (**1**) and tension the belt.




P0002655

## Compressor, checking oil

**Checking and filling**

1 Unscrew and lift up the oil dipstick. Dry the oil off. Screw the oil dipstick down as far as it will go and then unscrew and lift up.

2 Check that the oil level is between the MAX and MIN marks. Check that the dip stick is screwed fully home so that the reading is correct. If the dipstick is not screwed fully home, the oil level will be above the MIN mark even if the oil level is correct.

3 Fill with oil as required, use the dipstick hole. Oil quantity and grade, see section *Technical Data page 113*.

### IMPORTANT!

The oil level shall be between the MAX and MIN marks on the dipstick.

**Compressor, oil change**

1 Run the engine until it reaches normal operating temperature.

2 Pull up the oil dipstick

3 Remove the plug and let the oil run out.

4 Replace the plug and fill with oil to the correct level.

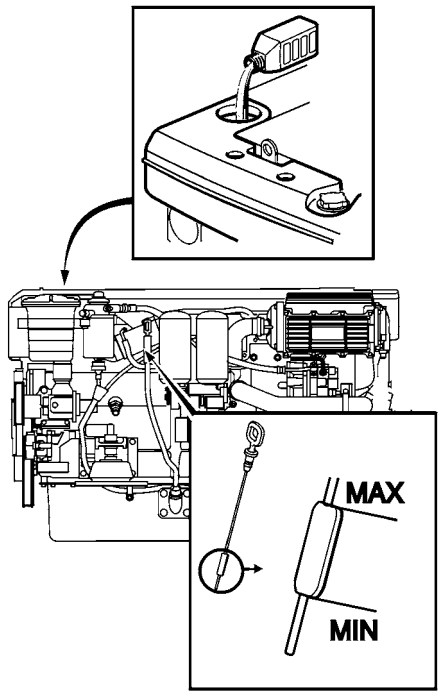

P0002089

# Lubrication System

Oil change intervals can vary depending on oil grade and sulphur content of the fuel, please refer to *Technical Data page 113*.

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

If you want longer oil change intervals than given in the table *Technical Data page 113*, the condition of the oil must be checked by the oil manufacturers through regular oil testing.




P0003706

## Oil level, checking and topping up

The oil level must be within the marked area on the oil dipstick and must be checked daily before the first start.

Check the oil level a while after the engine has been switched off. The oil in the engine needs some time to return to the sump before a correct oil level check can be performed.
Wait 15 minutes if the engine has been run at normal operating temperature. Wait an hour if the engine has been idling.

The oil level shall be between the MAX and MIN marks on the dipstick. Levels that are higher or lower than these marks can damage the engine.

### IMPORTANT!

Do not fill over the limit for max. oil level. Use only oil of the recommended grade, refer to *Technical Data page 113*.

1 Fill the oil slowly via the filling hole on the top of the engine.

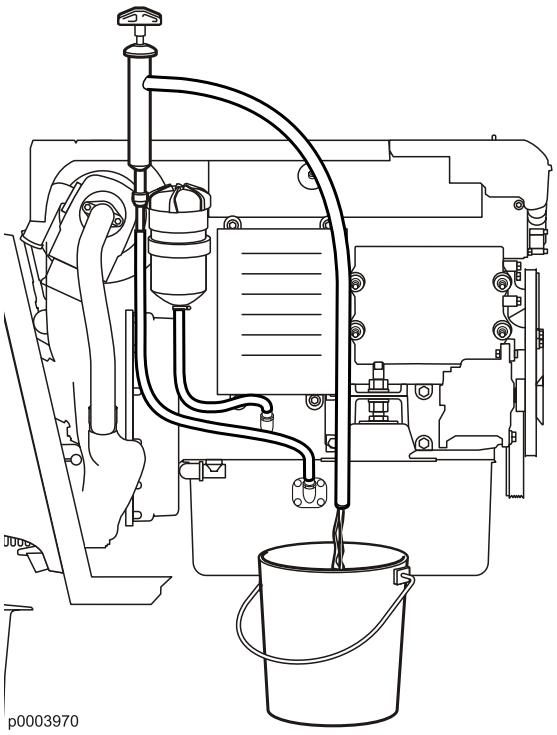
2 Wait 5 minutes to allow the oil time to reach the sump before checking the level again.

3 Then check the level again.

**NOTICE!** The volume between MAX and MIN is about 3.5 litre (0.9 US gal).

## Engine Oil, Change

Always follow the recommended oil change interval. Use only oils of the recommended grades; refer to the *Technical Data page 113* section.




**⚠ WARNING!**

Hot oil and hot surfaces can cause burns.

1 Run the engine until warm so that the oil is easier to pump. Then stop the engine and wait 10 minutes.

2 Connect the oil suction pump to the draining pipe. Pump out the oil.

3 Replace the oil filter and by-pass filter at every oil change, see section *Oil Filter/By-pass Filter, Change page 70*.

4 Fill with oil to the correct level through the filling hole on the top of the engine. Oil quantity, see section *Technical Data page 113*.

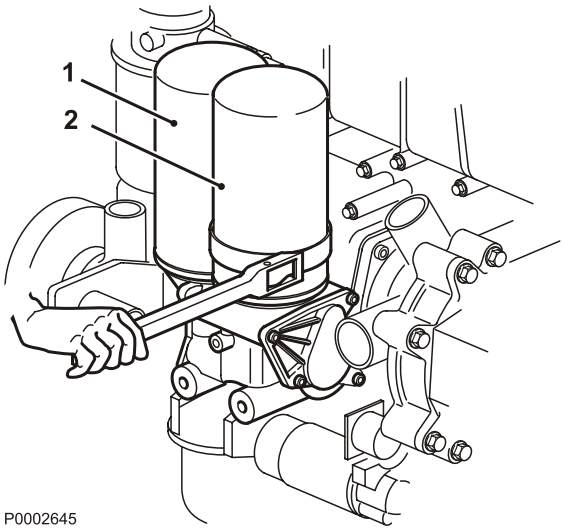
5 Start the engine. Run the engine until it reaches normal operating temperature. The oil level shall be checked with the engine warm.
Check that the low oil pressure lamp goes out and that there are no leaks around the oil filter.

6 Turn off the engine. Wait ten minutes before checking the oil level. Top up as needed.

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

## Oil Filter/By-pass Filter, Change

The oil filter and by-pass filter must be replaced at every oil change.
Deposit the old filter at a waste management facility.




**⚠ WARNING!**

Hot oil and hot surfaces can cause burns.

1 Put a suitable container under the filter to collect any spilled oil.

2 Clean the filter bracket.

3 Unscrew the by-pass filter (**1**) and the oil filter (**2**) with a suitable filter puller.

4 Check that the mating surfaces on the filter bracket are clean and that no remnants of the old gaskets are left.

5 Moisten the gaskets on the new filters with engine oil.

6 Screw on the filter by hand until the rubber gasket touches the filter bracket mating surface. Then tighten an additional 3/4 turn.

7 Start the engine, run at low idle, and check that no leakage occurs. Check the oil level after the engine has stopped.

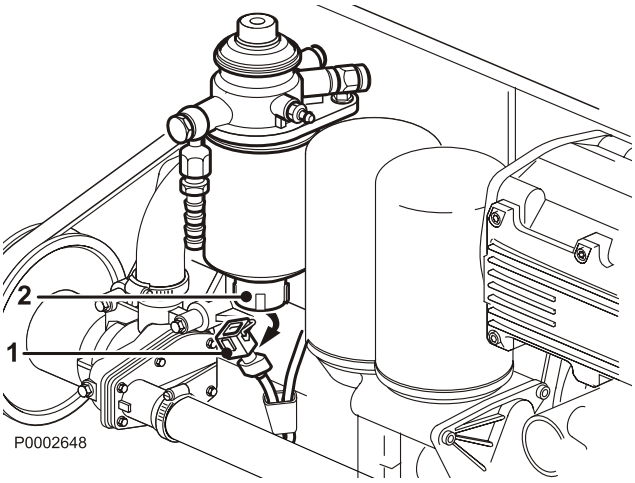
# Fuel System

Only use the grades of fuel recommended in the fuel specification, see *Technical Data page 114*. Always observe the greatest cleanliness during re-fuelling and work on the fuel system.
All work on the unit injectors of the engine must be carried out by an authorized workshop.

**⚠ WARNING!**

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

## Engine Fuel Filter Replacement




1 Close the fuel tap(s).

2 Clean the filter bracket and install a suitable vessel under the filter.

3 Remove the connector piece (**1**) from the water separator (**2**). Unscrew the filter. Use a filter wrench if necessary.

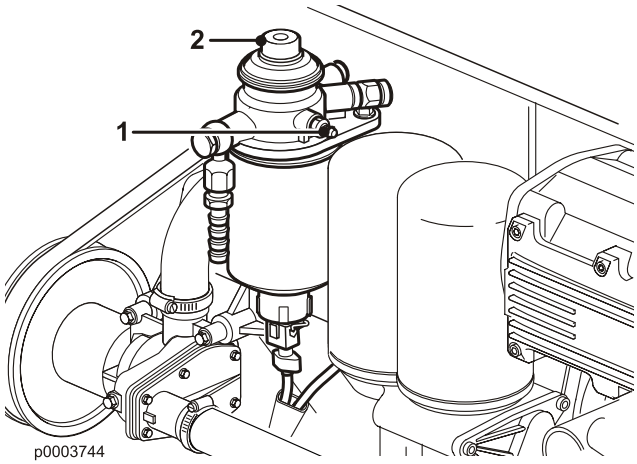
4 Clean the sealing surfaces on the filter holder. Make sure that the filter is clean and that the sealing rings are undamaged. Moisten the seal rings with engine oil.
**IMPORTANT!**
Do not fill the new filter with fuel before installation. Dirt may get into the system and cause damage and malfunctions.

5 Screw on the new filter by hand until the gasket just bottoms on the sealing surface. Then tighten a further 1/2 turn. Install the water separator and connect the union.

6 Open the fuel cock.

7 Bleed the fuel system, see section *"Fuel system, bleeding"*.

8 Start the engine and check that there are no leaks.




## Fuel system, breather

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

### IMPORTANT!

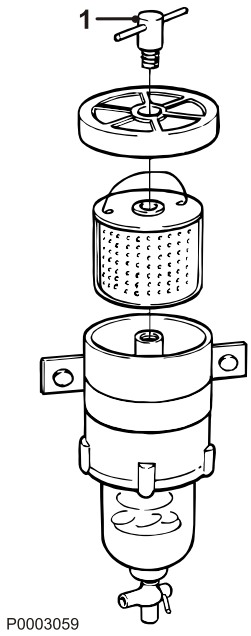
Never disconnect the pressure pipe.

1 Connect a transparent hose to the bleed nipple (**1**). Feed the hose to a container to avoid spillage.

2 Open the bleeding nipple and pump fuel with the hand pump (**2**) until the fuel is free from bubbles. Close and tighten the bleed nipple.

3 Pump a further 10 times on the hand pump. Resistance in the hand pump can feel heavy, but this is completely normal and necessary to bleed the system.

4 Remove the hose and fit the protective cap to the bleed nipple.




## Fuel Pre-filter, Change

### ⚠ WARNING!

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

1 Close the fuel stop cock on the fuel tank. Place a container beneath the fuel filter.

2 Remove the cover by loosening screw (**1**).

3 Replace the insert and refit the cover.

4 Open the fuel stop cock and bleed the fuel system, see section *“Fuel system, bleeding”*.

5 Start the engine and check for leaks.

6 Hand in the scrapped filter at a recycling depot.

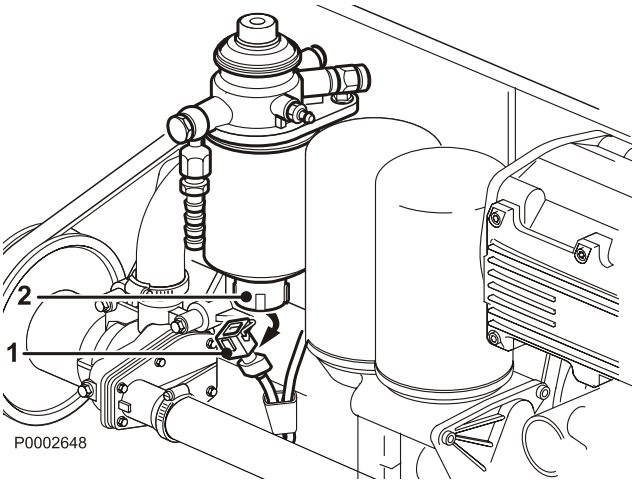
## Water in Fuel

If the EVC system warns for too much water in the fuel pre-filter, the water separator needs emptying.

### IMPORTANT!

Do not continue operating if there is water in the water separator, it can damage the engine.

**Draining the fuel filter**

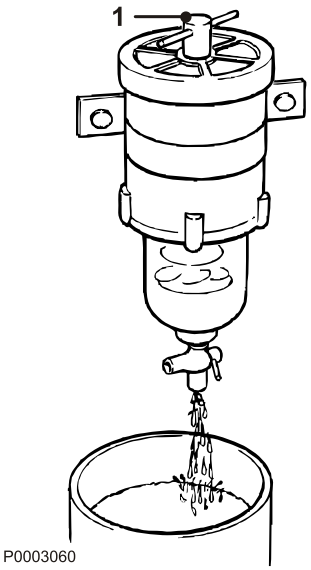



1 Stop the engine and remove the ignition key from the ignition lock.

2 Remove the connector piece from the water separator (1).

3 Place a container under the fuel filter and carefully unscrew the water separator (2) sufficiently for the water to run out. Then screw in the water separator until it bottoms against the filter. Then tighten an additional 1/4 to 1/2 turn.

4 Refit the connecting piece (1).




**Draining the fuel pre-filter (extra equipment)**

1 Place a container beneath the fuel filter.

2 Open the bleed screw (1) on the fuel filter about 4 turns.

3 Drain the water and contaminants via the plug in the bottom of the filter.

4 Bleed the fuel system.

**NOTICE!** Wait a few hours after switching the engine off before draining the filter.

# Freshwater System

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

We recommend “Volvo Penta Coolant, Ready Mixed”, or “Volvo Penta Coolant” (concentrated) mixed with pure water according to specifications. Refer to the table *Water Quality page 114*. Only coolant of this grade is suitable for, and approved by, Volvo Penta. The use of anti-corrosion agents alone is not permitted in Volvo Penta engines. Never use water alone as the coolant.

### IMPORTANT!

Coolant of a suitable chemical composition must be used all year round. This applies even when there is

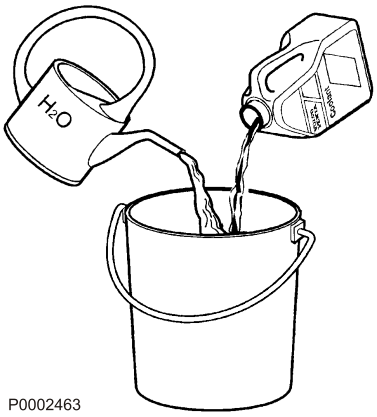
P0002092

no risk for frost damage, so that the engine always has complete corrosion protection. Future warranty claims related to engine and accessories may be refused if an unsuitable coolant has been used, or if the instructions for coolant mixture have not been followed.

The corrosion protection additives become less effective over time, which means that the coolant must be changed at regular intervals; refer to the *Maintenance Schedule page 61*. The cooling system must be flushed whenever the coolant is changed, refer to the *Freshwater system, Flushing* section.

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

**“Volvo Penta Coolant, Ready Mixed”** is a ready-mixed coolant, 40 % “Volvo Penta Coolant” and 60 % water. This mixture protects the engine from corrosion damage, cavitation damage and frost bursting down to –28 °C (–18 °F).



P0002463

## Coolant, Mixing

### ⚠ WARNING!

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

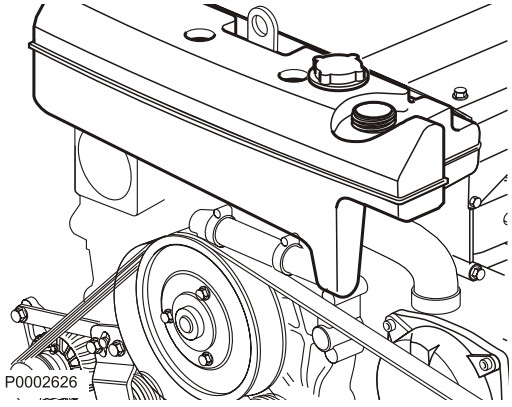
### IMPORTANT!

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

**Mix: 40 % "Volvo Penta Coolant" (conc. coolant) and 60 % water**

This mixture protects against internal corrosion, cavitation and frost bursting down to –28 °C (–18 °F). At 60 % glycol concentration, the freezing point is lowered to –54 °C (–65 °F).
Never mix more than 60 % concentrate (Volvo Penta Coolant) in the coolant. A greater concentration provides reduced cooling effect with the risk for overheating and reduced frost protection.

The coolant must be mixed with distilled, deionized water. The water must fulfill the requirements specified by Volvo Penta; refer to *Water Quality page 114*.
It is extremely important that the system is filled with the correct coolant concentration. Mix in a separate clean vessel before filling the cooling system. Make sure that the liquids mix.


P0002626

## Coolant Level, Checking and Topping Up

### ⚠ WARNING!

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

1 Turn the filler cover slowly counter-clockwise and release any pressure from the system before removing the cover completely.

2 Top the coolant up as necessary. The coolant level shall be between the MAX and MIN marks on the expansion tank.

3 Screw the filler cover on.

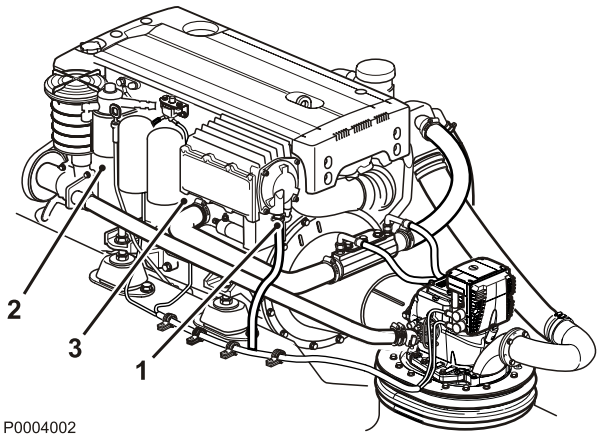
## Freshwater System, Draining

**⚠ WARNING!**

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

**⚠ WARNING!**

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



P0004002

1 Remove the filler cover on the expansion tank to speed up the coolant drainage.

2 Loosen the hose (**1**) mounted on the intercooler and connect to the drain cock (**2**) on the heat exchanger. Open the cock (**2**). Let all the coolant run out into a container.

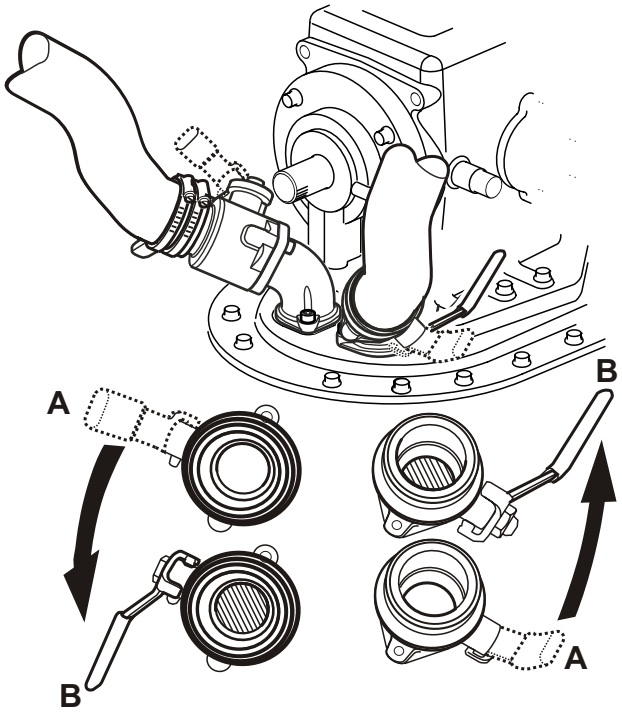
3 Screw in the stop cock.

4 Move the hose to the drain cock (**3**) on the engine block and continue draining the coolant.

5 Close the cock and put the hose back on the intercooler.

6 Collect the old coolant and hand it to a re-cycling station for disposal.

# Seawater System



P0002849

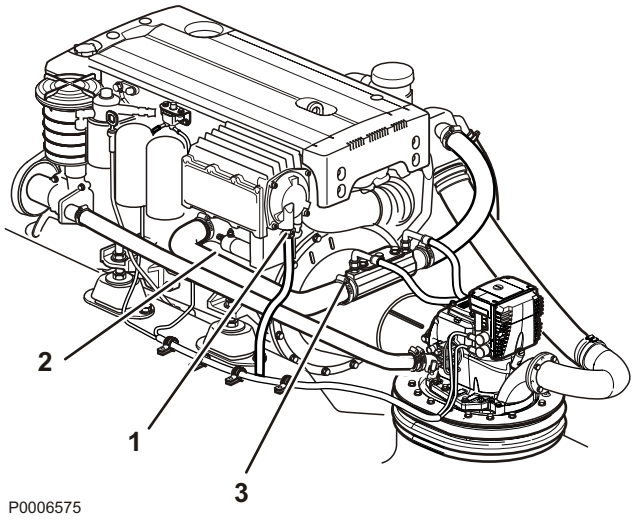
The raw water system is the engine's external cooling system. On IPS engines, the raw water pump sucks in water via the IPS cooling water inlet, through the IPS unit oil cooler to the raw water pump. The water then passes through the raw water filter before being pumped through the fuel cooler, intercooler, engine oil cooler and heat exchanger. Finally the water is fed out through the exhaust elbow, where it is mixed with the exhaust gases.

**⚠ WARNING!**

If the boat is in the water while working on the seawater system the two seawater cocks on the propulsion units must be closed. Otherwise there is a risk of flooding of the engine compartement and sinking of the boat. The boat must be brought up on land if this is not possible.

A Open

B Closed



P0006575

## Seawater System, Draining

### ⚠ WARNING!

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

To prevent frost damage, the raw water system must be drained during cold weather if there is a risk for frost. An alternative to draining is to keep the engine room warm using an approved heater fan.

**Draining:**

1 Close the sea cocks.

2 Open the drain stop cock (**1**) by unscrewing it carefully.

3 Drain the coolant into a container. Screw in the stop cock by hand.

4 Move the hose on the stop cock (**1**) and connect to stop cock (**2**).
Open stop cock (**2**) and drain all coolant. Close the stop cock.

5 Refit the drain hose to stop cock (**1**).

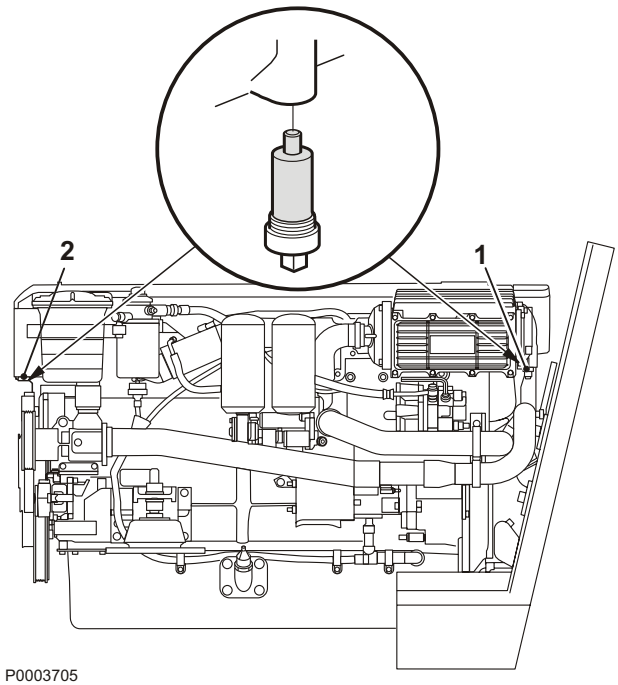
6 Remove hose clamp (**3**) and release the end of the hose. Drain the coolant from the hose and oil cooler.
Refit the end of the hose.

7 Open the sea cocks and check for leaks.

## Zinc Anodes, Check and Change

**⚠ WARNING!**

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




P0003705

1 Close the sea cock(s).

2 Drain the raw water as described in *Seawater System, Draining page 77*.

3 Remove the zinc anodes from the heat exchanger (**1**) and intercooler (**2**).

4 Check the zinc anodes and replace if consumed to more than 1/3rd of original size. If not, clean the zinc anodes with Emery cloth to remove the oxide layer before re-installing them.
**IMPORTANT!**
Use emery paper. Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.

5 Install the zinc anodes. Make sure there is good metallic contact between the anode and the metal contact point.

6 Close the drain cocks.

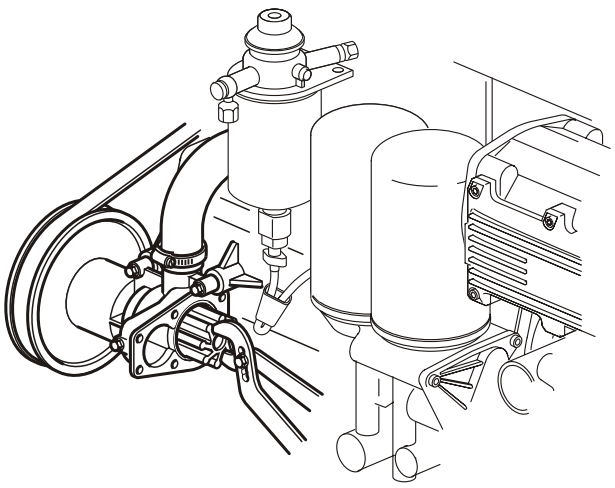
7 Open the sea cock(s), before starting the engine.

8 Check that there are no leaks.

## Impeller, Check and Change

**⚠ WARNING!**

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



P0002636

1 Remove the cover from the raw water pump and remove the impeller.
If the impeller is cracked or damaged it must be replaced.

2 If the pump shaft can be turned by hand, the flange must be replaced.

3 Lubricate the pump housing and inside of the cover with a little glycerin.
**IMPORTANT!**
The impeller will be damaged if other types of lubricant than glycerin are used.

4 Press the impeller in with an anti-clockwise rotating movement.

5 Fit the sealing washer on the center bearing of the shaft. Install the cover with a new O-ring.

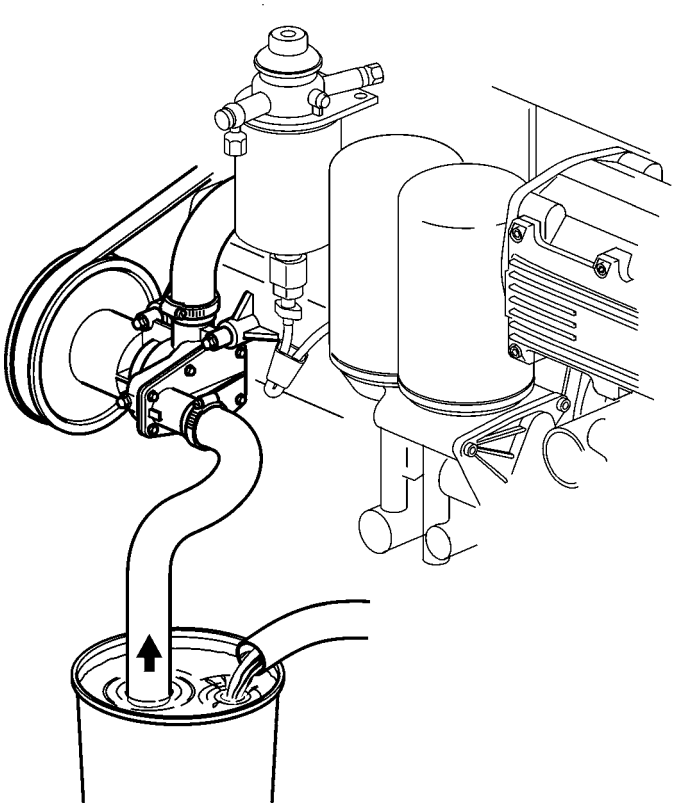
## Seawater System, Cleaning and Inhibiting

To prevent the build up of deposits and salt crystals in the seawater system it must be flushed with freshwater. The system must also be preserved when the boat is going to be layed up on land for longer periods than two month.

This procedure can be performed with the boat either in or out of the water.

### ⚠ WARNING!

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



1 If the procedure is performed up on land, open the outlet seawater cock on the propulsion unit..
If the procedure is performed in the water, detach the exhaust outlet hose from the (closed) outlet sewater cock.

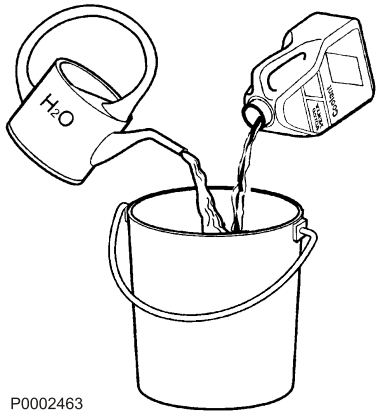
2 Detach the hose from the seawater pump and connect a draining hose with one end dipped into to a bucket filled with fresh water. Keep the bucket filled.
**IMPORTANT!**
The impeller could be damaged if the pump runs dry.

3 If the procedure is performed up on land, check that nothing will get splashed by the water from the exhaust outlet on the propulsion unit.
If the procedure is performed in the water, secure a container at the end of the exhaust outlet hose.

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 for a few minutes. Stop the engine.

5 For preservation fill a bucket with antifreeze mixture 40% anti freeze and 60% freshwater to inhibit the system. Secure a container at the exhaust outlet.

6 Connect the inlet seawater hose to the seawater pump.
If the procedure is performed in the water also connect the exhaust outlet hose on the outlet seawater cock.



P0002463

7 The antifreeze mixture should be left in the system while the boat is not used. Before starting to use the boat again drain the mixture and clean the system using the same procedure as above.

8 Deposit antifreeze mixture at a properly designated waste site.

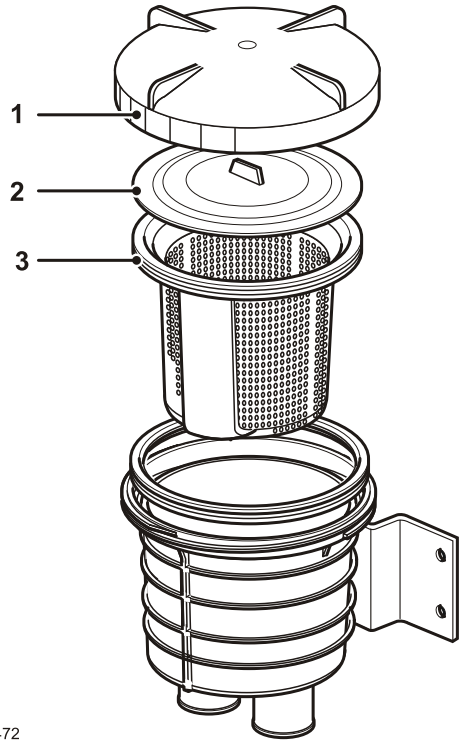
9 Check that the system is intact and that there are no leaks.

## Seawater Filter, Check and Cleaning

**⚠ WARNING!**

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

If the water where the boat is used contains contaminants, seaweed, etc. the filter should be checked more frequently than stated in the maintenance schedule. Otherwise there is a risk that the filter may be blocked resulting engine overheating.



P0002472

1 Close the sea cock.

2 Unscrew the cover (**1**) and remove the sealing plate (**2**).

3 Lift out the insert (**3**) and clean it.

4 Replace parts as illustrated.

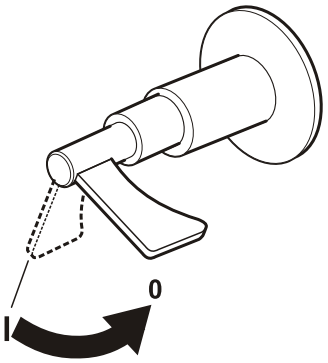
5 Open the sea cock and check for leaks.

# Electrical System

**⚠ WARNING!**

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

## Main Switch



P0002576

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

### IMPORTANT!

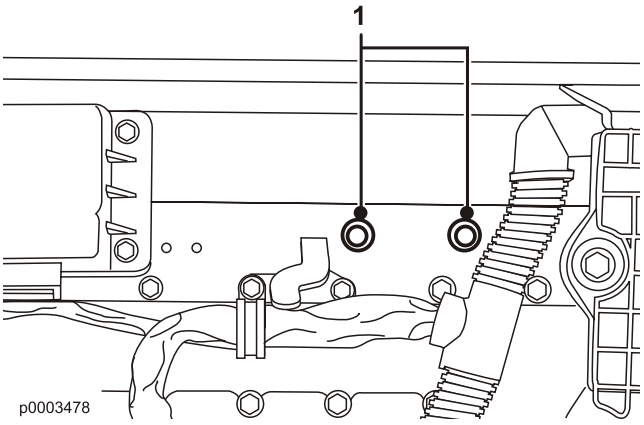
Never disconnect the current with the main switches when the engine is running, the alternator and electronics could be damaged

## Fuses

**12–volt system (engine)**

The engine is fitted with automatic circuit breakers. 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.
Resetting will take place automatically.



p0003478

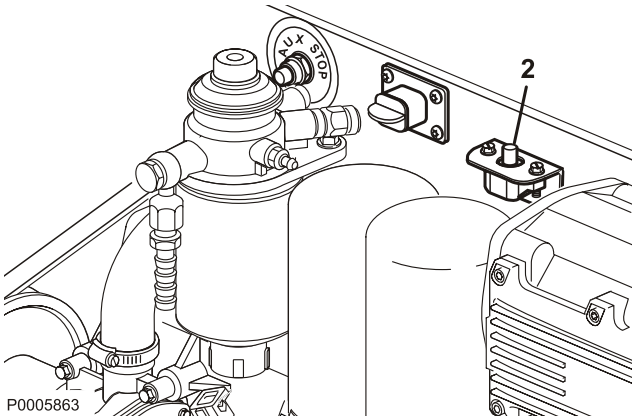
**24–volt system (engine)**

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 breakers (**1**) (red button).

### IMPORTANT!

Always investigate the cause of the overload. If the fuse trips frequently, contact an authorized Volvo Penta workshop.




## IPS

The drive unit has an automatic circuit breaker (**2**). The circuit breaker cut the power if the drive unit system is overloaded. Reset by pressing in the circuit breaker (**2**).

## IMPORTANT!

Always investigate the cause of the overload. If the fuse trips frequently, contact an authorized Volvo Penta workshop.


# Electrical Connections

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

P0002107

## Battery, Maintenance

### ⚠ WARNING!

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

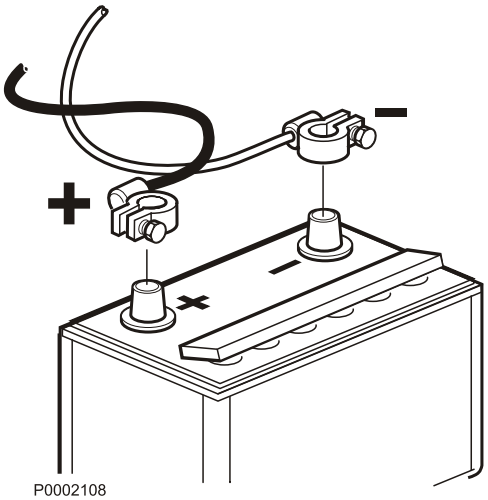
### ⚠ WARNING!

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

### ⚠ WARNING!

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

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




P0002108

### Connecting and disconnecting the battery

#### Connecting

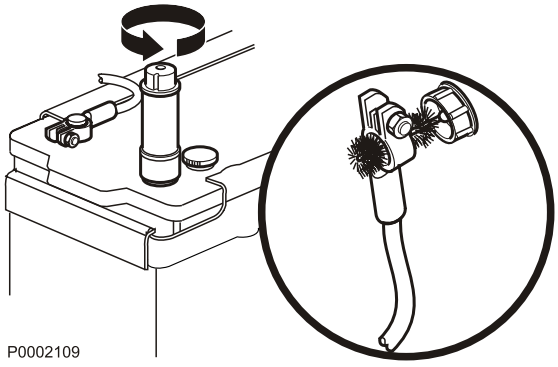
1 Connect the + cable (red) to the + pole on the battery.

2 Connect the – cable (black) to the – pole on the battery.

#### Disconnecting

1 Remove the – cable (black).

2 Remove the + cable (red).



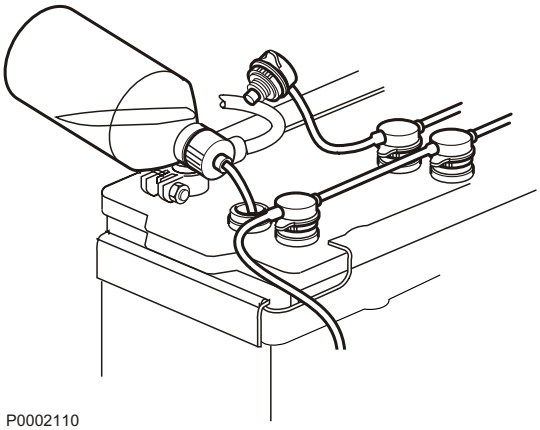
P0002109

#### Cleaning

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

#### Filling

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



P0002110

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

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

## Battery, Charging

P0002107

**⚠ WARNING!**

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

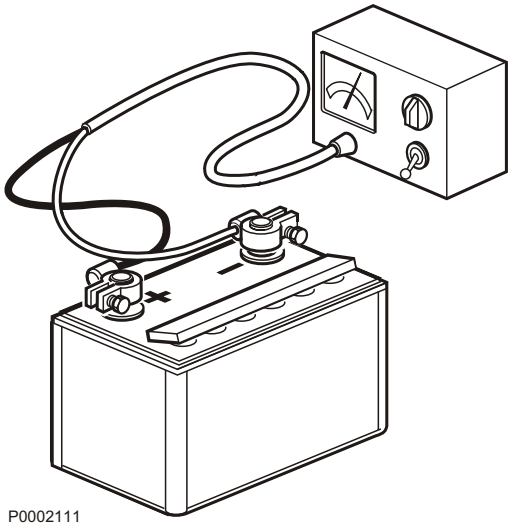
**⚠ WARNING!**

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

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

**⚠ WARNING!**

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


P0002111

**IMPORTANT!**

Observe the instruction manual for the battery charger carefully. To avoid the risk of electrochemical corrosion when an external charger is connected, the battery cables should be removed from the batteries before the charger is connected.
Always switch off the charging current before the charging clips are removed.

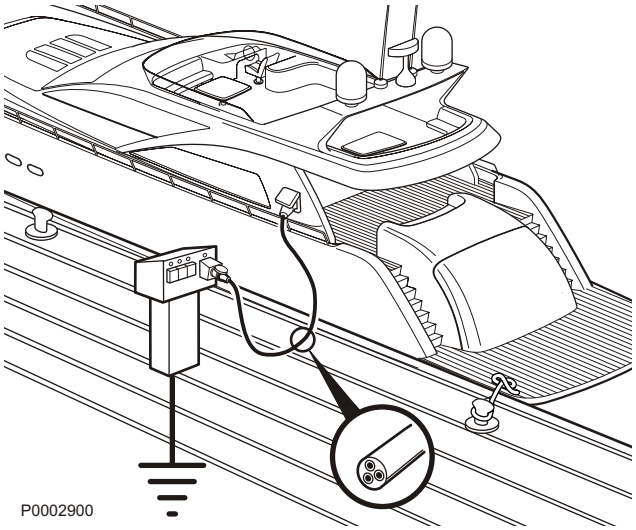
- Charge batteries if they have become discharged. During charging, unscrew the cell plugs but leave them min the plug holes. Ventilate well, especially if the batteries are charged in an enclosed space.
- If the engine is not used for a longer period of time, the batteries should be fully charged, then possibly trickle charged (please refer to the battery manufacturer's recommendations). Batteries are damaged by being left discharged, and can also freeze and burst easier in cold weather.
- Special instructions apply to **boost charging**. Boost charging can shorten battery life, and should therefore be avoided.

## Electrical Installations

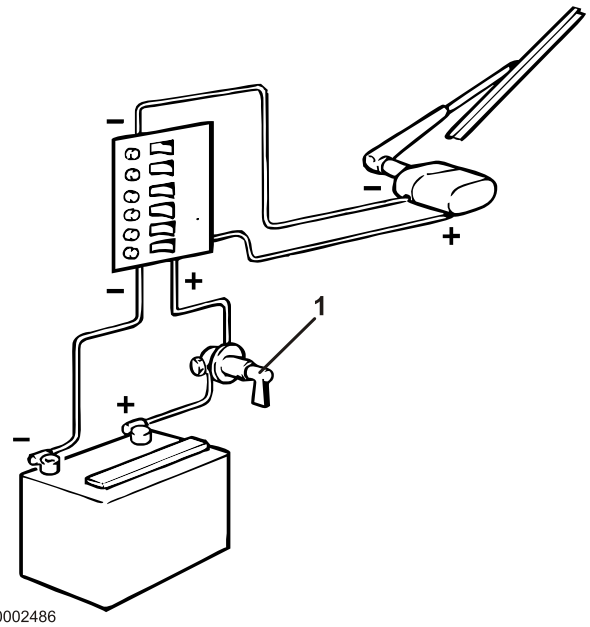
An incorrectly-carried-out electrical installation may generate leakage current from the electrical system. Leakage current can in turn render galvanic protection insufficient in respect of propellers, propeller shafts, rudder posts, keel etc and may cause damage through electrochemical corrosion.

**⚠ WARNING!**

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



P0002900




P0002486

## Always consider the following:

1 If shore power is connected it must always be ground protected ashore, never in the boat. Furthermore, the shore power installation should be equipped with a ground fault interrupter.
The shore power installation (transformer, inverter, battery charger etc.) must be designed for marine use **where the high-tension side is galvanically separated from the low-tension side.**

2 Electrical cables must be run and clamped such that there is no risk of exposure to chafing, damp or bilge water.

3 Ground protection for radios, navigation instruments, rudder, boarding ladders or other equipment where separate cables for ground protection are present, must be clustered to a common ground connection that is not connected to the engine or reverser gear.

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

4 The start battery must have a main switch (**1**) connected to the battery's plus (**+**) side. The main switch must break the circuit to all equipment and be switched off when the boat is not in use.

5 If an auxiliary battery is used a main switch must be placed between the auxiliary battery's plus (**+**) terminal and the circuit breaker panel for the boat's electrical equipment. The main switch must break the circuit to all equipment connected to the auxiliary battery and must be switched off when power is no longer required. All equipment connected to the auxiliary battery must have separate main switches.

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

# Drive

The propulsion unit has an electronically controlled hydraulic clutch. Two soleniod valves, primary (forward gear) and secondary (reverse gear), is controlled by electrical signals from the operator’s control levers.

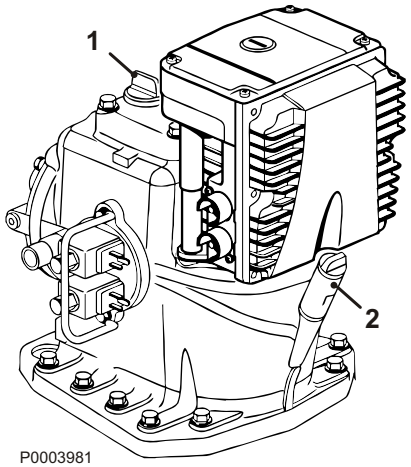
The propulsion unit's lubrication system is equipped with an oil filter and an oil cooler.

The propulsion unit is protected against galvanic corrosion. This protection consists of sacrificial anodes. An active corrosion protection, ACP, is optional. Faulty electrical installation can also cause the breakdown of the galvanic protection. Damage due to electrolytic corrosion occurs rapidly and is often extensive. For further information please refer to *Maintenance page 81*.

## Oil level, checking and topping up

### IMPORTANT!

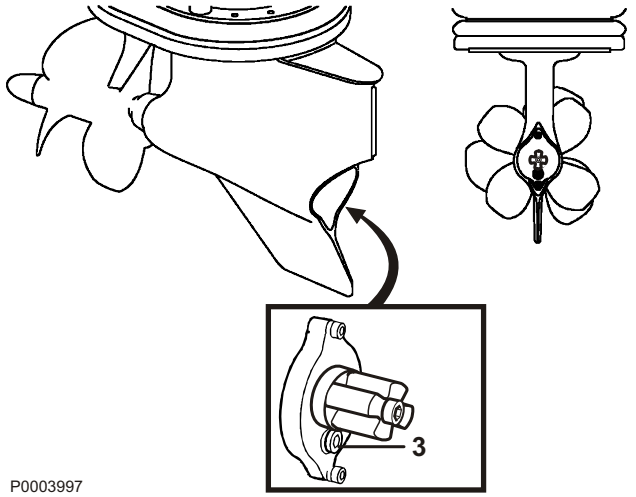
The propulsion unit must be shut down for at least 12 hours before a correct oil level check can be done. Check the oil level every day before starting the engine.




Open the oil filler cap (**1**) slowly so that any overpressure is released. Remove the dipstick (**2**) by turning it anti clockwise. Dry off the dipstick and reinstall it in the propulsion unit, screw 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 up the oil through the filling hole (**1**). For oil grades and volume, please refer to *Technical Data page 113*.

While checking the oil level, ensure there are no signs of water dilution. The oil should have a golden brown hue. If the oil is thin and greyish it is probable water diluted. If so, always let the propulsion unit be checked by a Volvo Penta workshop.




P0003997

### Changing oil and filter

1 Open the oil filling (**1**) cap slowly so that any over-pressure is released. Unscrew the draining plug (**3**) and allow the oil to run out.

2 Change the filter.

3 Refit the drain plug with a **new** gasket.

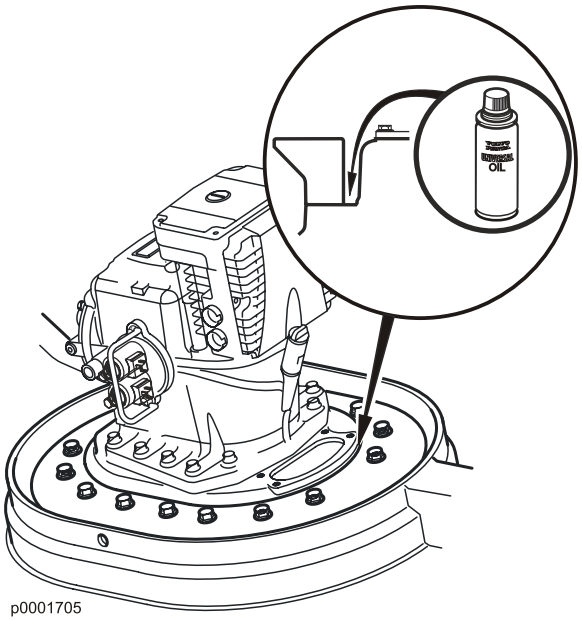
**NOTICE!** Always replace the gasket when the drain plug has been removed.

4 Measure up the correct quantity of oil and fill the propulsion unit with the oil via the oil filling hole. For oil grades and volume, please refer to *Technical Data page 113*.

### IMPORTANT!

Never over-fill the propulsion unit. The oil level must always be within the recommended levels, otherwise the gear change function will be impaired.

## Corrosion protection, checking and changing



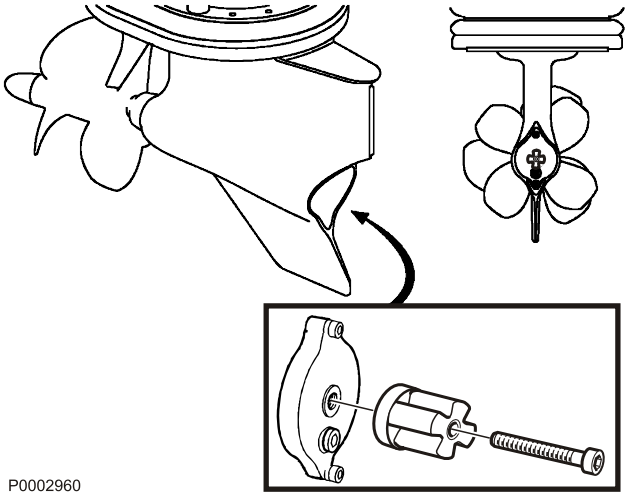
p0001705

### Checking the corrosion protection between the housing and the clamping ring

Check that the space between the propulsion unit housing and the clamping ring are entirely coated with corrosion protection, Volvo Penta P/N 9510227. If the coating needs to be renewed, follow the instructions below:

1 Clean and dry off the space between the housing and the clamping ring.

2 Spray a liberal coating of corrosion protection in the space between the housing and the clamping ring.



P0002960

## Checking/changing the corrosion protection – Sacrificial anodes

Check the sacrificial anodes regularly. There are two anodes per propulsion unit, one is attached to the propulsion unit and one is attached to the transom. Please refer to the figures. Replace an anode when approximately 1/3 of the anode has been eroded.

When the boat is kept laid up on land 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 boat the sacrificial anodes must be cleaned.

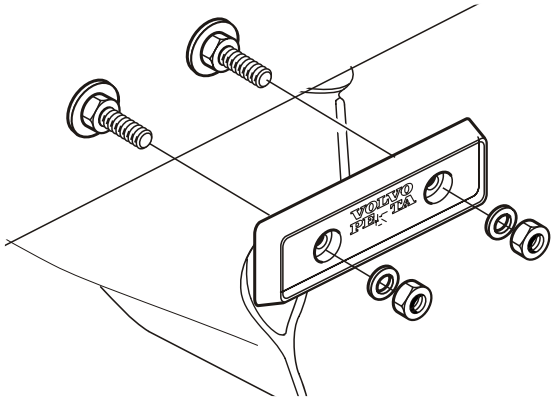
The anode in the exhaust outlet is made of iron and doesn't have to be cleaned.

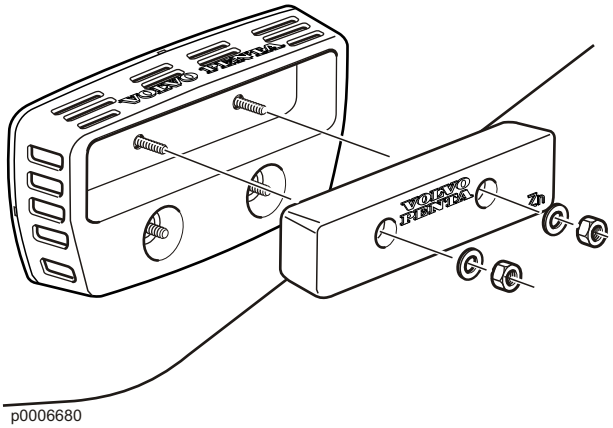
## IMPORTANT!

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

### Changing the corrosion protection

All anodes are secured with screws or with nuts. Undo the screw or the nuts holding the anode. Clean the contact surface and fit the new anode. Tighten the new anode so that there is a good electrical contact.

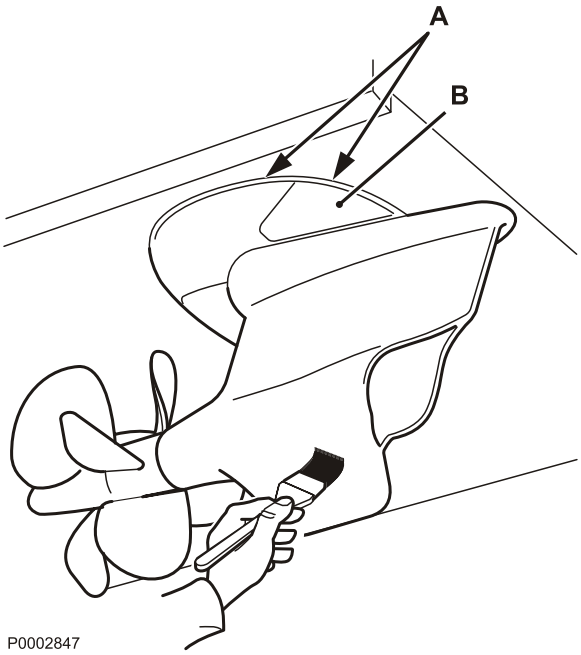




p0006680

## ACP, Active Corrosion Protection

Boats equipped with ACP (optional) has a zink anode built-in the ACP unit, see figure. Replace the anode when approximately 1/3 of the anode has been eroded.



P0002847

## Inspecting the propulsion unit coating

The propulsion unit and propellers have an antifouling coating applied from delivery. Inspect the coating annually and scrape off any loose coating and apply a fresh coating. Volvo Penta recommends the coating “Prop speed ®“. For instructions on how to apply the coating, please refer to the instructions that come with the “Prop speed ®“.

**NOTICE!** Do not apply coating in the grove (**A**) between the propulsion unit and the hull or on the exhaust pad (**B**).

Wait for the coating to dry before launching the boat.

## Painting the 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. Check the legislation that applies where the boat is to be used.

**NOTICE!** Always abide by these regulations. In many cases it is completely forbidden to use them on pleasure boats, for example in freshwater.

Tin-based agents (TBT) must not be used.

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 paint must probably be used.

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

**NOTICE!** Do not paint in the grove (**A**) between the Propulsion unit and the hull or on the exhaust pad (**B**).

Wait for the paint to dry before launching the boat.

# Propeller

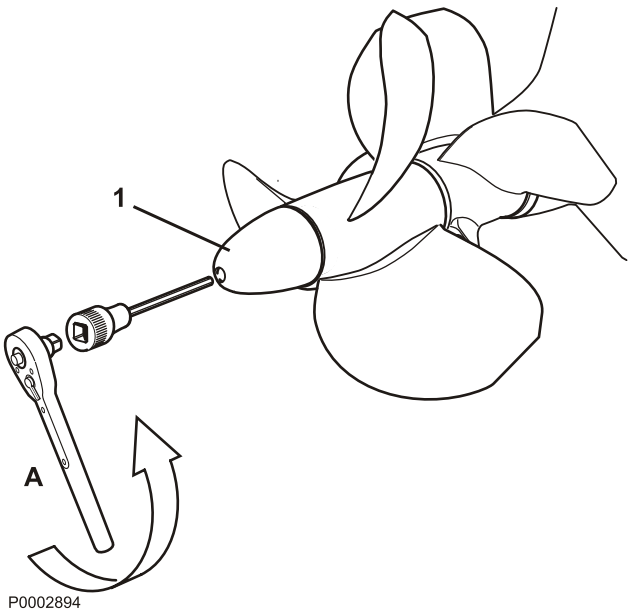
## ⚠ WARNING!

**Make sure the engine can not start during work on propeller(s); remove ignition key(s) and shift drive into forward or reverse.**

**NOTICE!** Damaged propellers should be replaced immediately otherwise there is high risk of serious damage to the propulsion unit. Operating the boat with a damaged propeller should be undertaken with extreme care and only at reduced engine speeds.

## Propulsion unit propellers

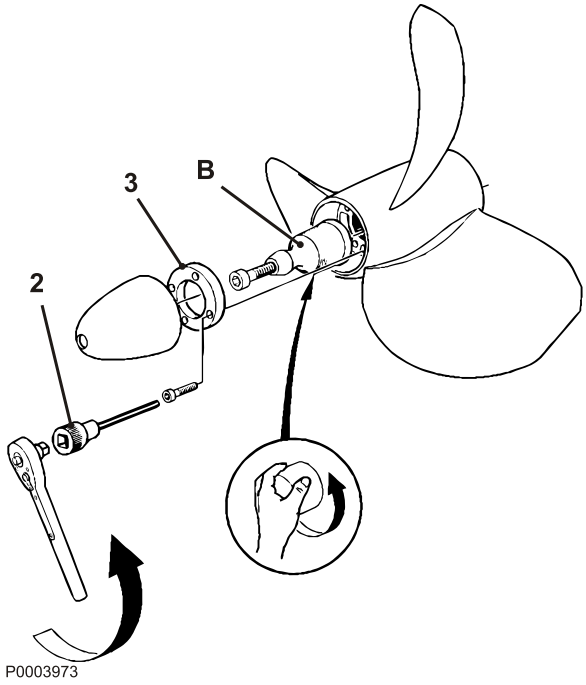
**NOTICE!** A special tool (**A**) for removing and fitting the propellers is supplied together with the propulsion unit. Please refer to the figure.




### Dismantling

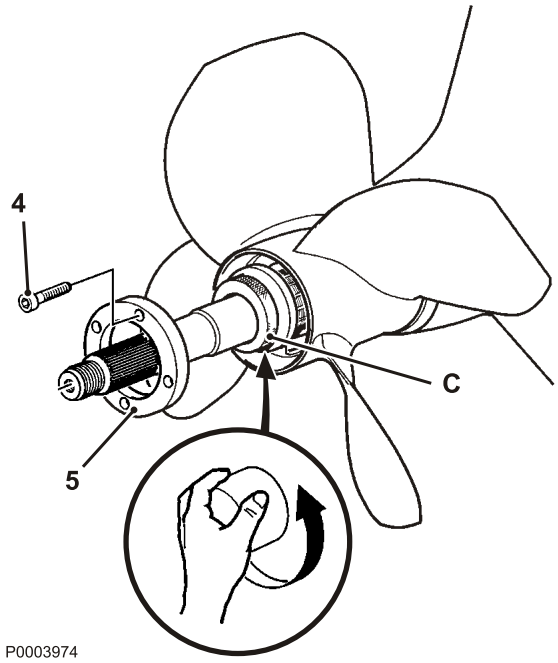
1 Take the igniton keys out of the ignition locks.

2 Remove the spinner (**1**) using the special tool.



P0003973

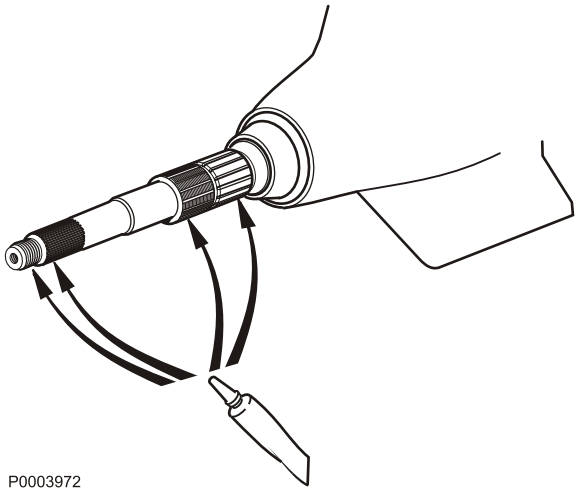
3 Undo the locking ring with the accompanying special tool by unscrew the four socket cap screws (**2**). Remove nut (**B**) and locking ring (**3**). Remove the forward propeller from the propeller shaft.



P0003974

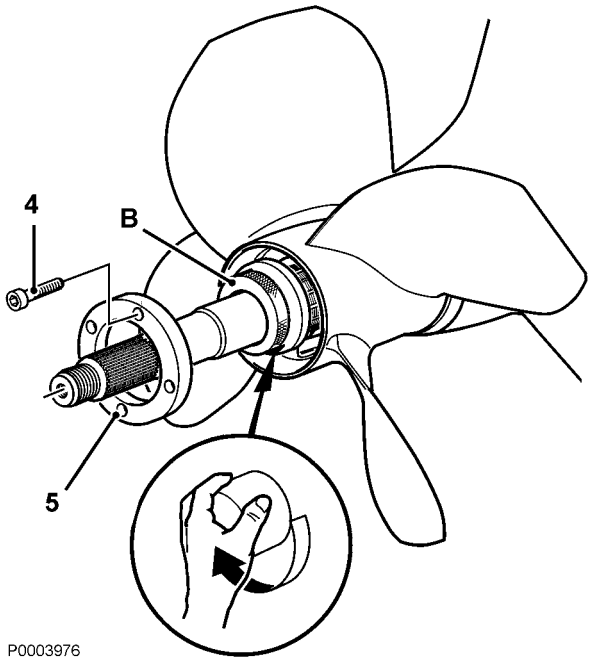
4 Undo the locking ring for the aft propeller with the accompanying special tool by unscrew the four socket cap screws (**4**). Remove nut (**C**) and locking ring (**5**). Remove the aft propeller from the propeller shaft.

5 Wipe the propeller shafts clean.


P0003972

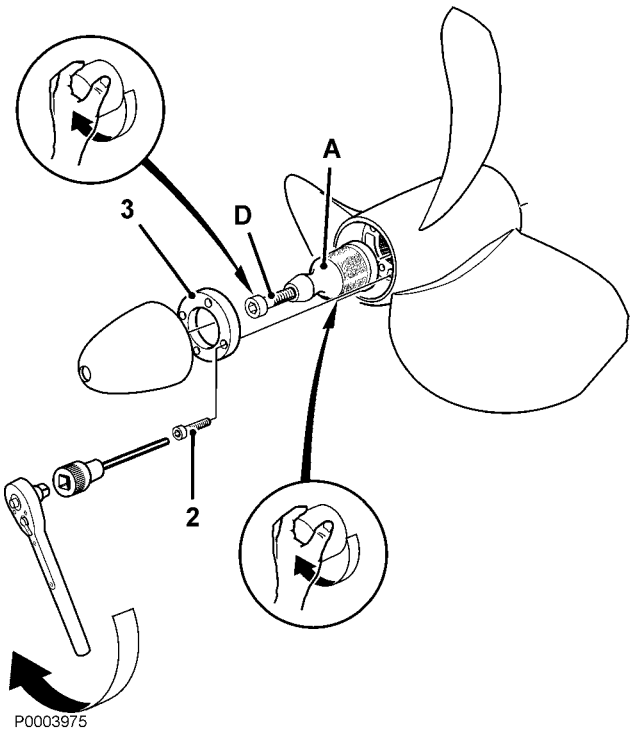
**Assemble propellers**

1 Apply water-resistant grease, P/N 828250 to the splines and threads on both propeller shafts.



P0003976

2 Install the aft propeller. Then install the aft nut (**C**) and tighten it by hand until it bottoms. Install locking ring (**5**). Tighten the locking ring with the accompanying special tool and four socket cap screws (**4**). **Torque 24-28 Nm (17.7-20.7 ft. lb.).**




3 Install the forward propeller on the propeller shaft. Tighten nut (**A**) by hand and install locking ring (**3**). Tighten the locking ring with the accompanying special tool and four socket cap screws (**2**). **Torque 24-28 Nm (17.7-20.7 ft. lb.).**

4 **IMPORTANT!**
Tighten the screw (**D**) until it bottoms. Otherwise it will not be possible to change the propeller without damaging the spinner.

5 Push the spinner into place by hand.

# Storage

## Short Term Storage

If the boat is not going to be used for a shorter period, the engines must be run up to normal operating temperature at least once every 14 days. This prevents corrosion in the engines.

### WARNING!

If the engines must be run up to normal operating temperature with the boat kept up on land, make sure to provide the seawater system with water during the operation or make sure that the pump housing is lubricated with glycerin. If the seawater pump is run dry the impeller could be damaged. Always check the impeller after dry runs. Please refer to *Maintenance page 76*.

If the boat is kept up on land the sacrificial anodes on the propulsion unit and on the transom must be cleaned to remove any oxidation before launching the boat. Please refer to *Corrosion protection, checking and changing page 88*.

To avoid fault codes in the ACP function, select inactive mode (see *EVC-menu*) before lifting the boat out of the water. In this mode the ACP no longer monitors the corrosion condition.

## Long Term Storage

If the boat is not going to be used for a longer period than two months, either left in the water or layed up on land, a long-term preservation of the engine and propulsion unit should be carried out. This ensures that the engine and propulsion unit are kept in good condition and that no damage arises. It is important that this is done properly and that nothing is forgotten.

We have provided a checklist covering the most important points.

### Long-term storage checklist

### ⚠ CAUTION!

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

**The following should be carried out on each engine when the boat is in the water:**

- Change the engine oil and replace the oil filter.
- Replace the fuel filter. Replace the fuel pre-filter if installed.
- Run the engine to normal operating temperature.

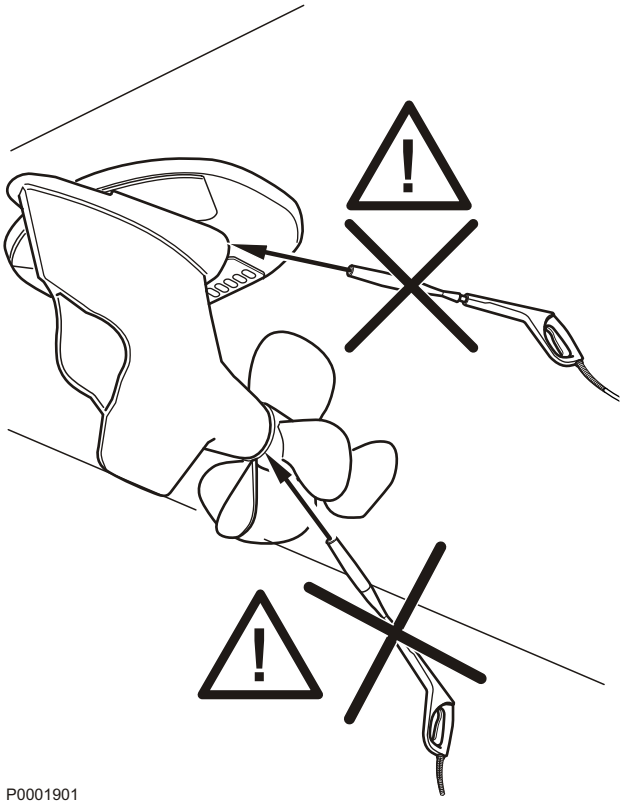
**The following are carried out on each engine when the boat is either in or out of the water:**

- Clean the seawater filter.
- Clean and preserve the seawater system with antifreeze mixture (50/50 freshwater and antifreeze).
- 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 antifreeze. Change it or top it up if required.
- Drain any water and contaminants from the fuel tank. Fill the tank completely with fuel to avoid condensation.
- Clean the outside of the engine. Touch up any damaged areas of paintwork with Volvo Penta original paint.
  **IMPORTANT!**
  Never use a high-pressure washer when washing the engine and never point highpressure water jets directly at seals, rubber hoses or electrical components, as this could cause serious damage.
- Disconnect the battery leads. Clean and charge the batteries.
  A poorly charged battery may burst as a result of freezing.
- Spray the electrical system components with moisture repellent spray.
- Check the anodes on the engine and transom. Replace an anode when approximately 1/3 of the anode has been eroded. Tighten the new anode so that there is a good electrical contact.

**The following are carried out on each propulsion unit when the boat is out of the water:**

If the boat is left in the water during the longterm preservation the boat must still be taken out of the water to performe these points shortly before starting to use the boat again:

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




P0001901

- Clean the outside of the propulsion unit 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 propeller shaft seal, etc., as this could damage these parts.
- Repair any damaged areas of the propulsion unit paintwork.
- Remove propeller (for storage). Grease the propeller shaft using water repellent grease Volvo Penta P/N 828250.
- Check the anode on the propulsion unit. Replace with a new anode when approximately 1/3 of the anode has been eroded. Tighten the new anode so that there is a good electrical contact.
  **IMPORTANT!**
  Use emery paper. Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.
- Change the oil and replace the oil filter the in propulsion unit.

## Bringing out of long-term storage checklist

**The following should be carried out on each propulsion unit with the boat out of the water:**

- Paint the hull.
- Check the sacrificial anodes on the propulsion unit 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!**
  Use emery paper. Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.
- Check the oil level in the propulsion unit. Top up if necessary. If there is preservation oil in the system drain and fill with new oil and change the oil filter.
- Install the propellers.

**The following should be carried out on each engine with the boat either in or out of the water:**

- Check the oil level in the engine. Top up if necessary. If there is preservation oil in the system drain and fill with new oil and change the oil filter.
- Drain the antifreeze from the seawater system.
- Install the impeller in the seawater pump. Replace if the old one looks worn.
- Close/tighten the drain cocks/plugs.
- Check the tension and condition of the drive belts.
- Check the condition of rubber hoses and tighten the hose clamps.
- Check the engine coolant level. Top up if necessary.
- Connect the fully charged batteries.
- Check the sacrificial anodes on engine and transom. If there is less than 2/3 of an anode left, it must be replaced. Clean with emery cloth just before the boat is launched.
  **IMPORTANT!**
  Use emery paper. Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.

**The following should be carried out with the boat in the water:**

- Check for leaks.
- Start all the engines. Check that there are no fuel, engine coolant or exhaust gas leaks and that all control functions are operating.

# Calibration and Settings

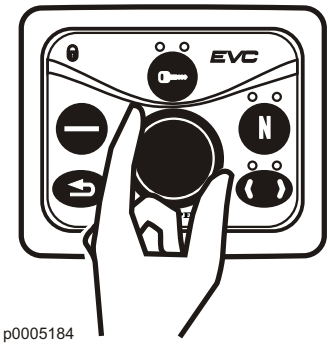
## Settnings menu

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

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

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

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



p0005184

P0001015

1 Turn clockwise until **Settings** is shown on the display.

2 Press the wheel to access the settings menu.

3 Navigate by turning the wheel.

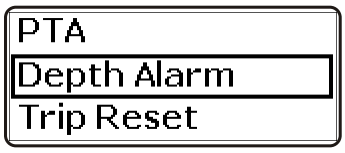
## Depth Alarm

Setting the depth alarm for the Volvo Penta echo sounder.

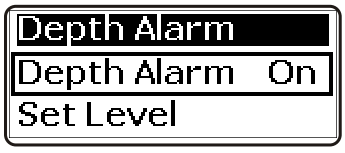
The setting need only be entered at one display, at one station.

1 Activate the station.

2 Turn until **Depth Alarm** is shown in the settings menu. Press the wheel to reach the submenu.

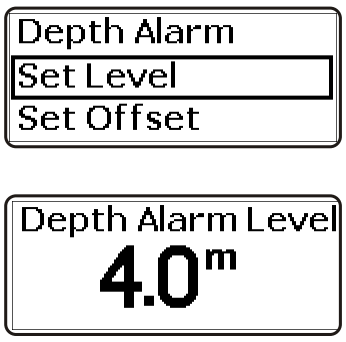


P0001028



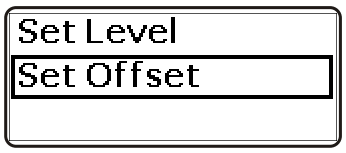
P0001027

3 **Depth Alarm**, press the wheel to switch the function on or off.



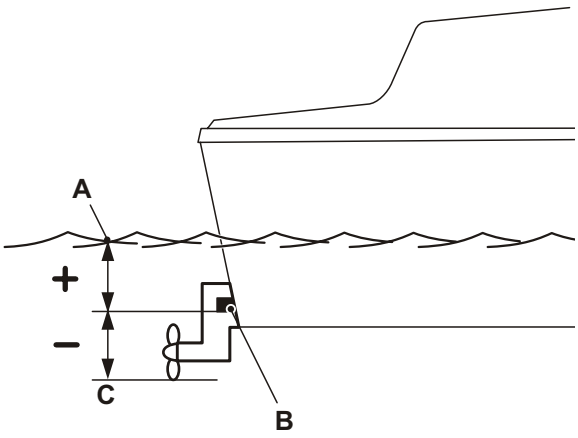

P0001033

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




P0001024

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

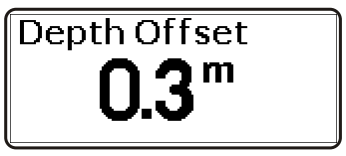



P0001201

A Waterline

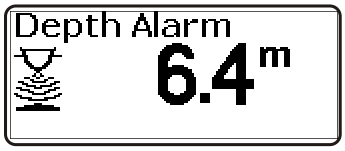
B Echo-sounder

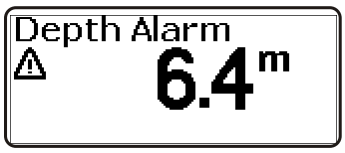
C Lowest point




P0001023

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

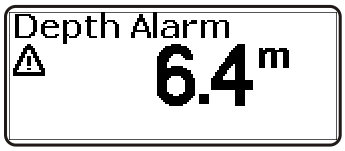



P0005853

**Depth alarm popup window**

When the depth is less than the alarm level, the popup window will display intermittently, followed by the alarm signal.
The pop-up window will be displayed every 30 seconds until the depth is greater than the alarm level.
Confirm the selection by depressing the navigation wheel.




P0005854


P0005855

**Lost depth alarm signal**

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

## Trip reset

Zeroing trip information

1 Activate the station.

2 Turn to **Trip reset** in the settings menu.

3 Press the wheel twice to zero the trip information.

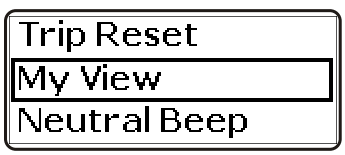

P0001032

## My View

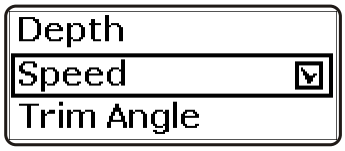
In My view it is possible to select the operating information to be displayed in the main menu.

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

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




P0001016




P0001014

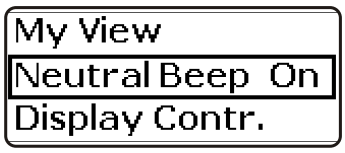
2 Turn to navigate through the menu with available operating information.

3 Press the wheel to check and uncheck the information to be displayed in the main menu.

## Neutral Beep

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

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



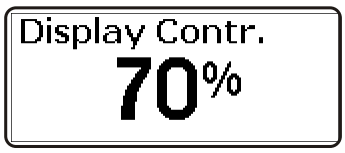

P0001031

1 Turn until **Neutral Beep** is shown in the settings menu.

2 Press the wheel to select **On** or **Off**.

## Display Contrast

Adjusting the tachometer display contrast


P0001030

1 Turn to **Display Contrast** in the settings menu. Press to reach the submenu.

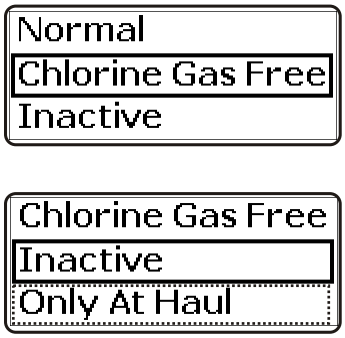
2 Turn to adjust the contrast. Press the wheel to confirm the selection.

## ACP

Setting the ACP protection position.


P0001022

1 Turn until **ACP** is shown in the settings menu. Press to reach the submenu.




P0001021

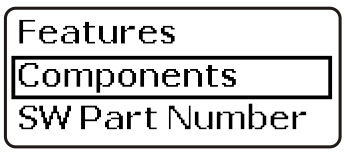
2 Turn to the desired position **Normal**, **Chlorine Gas Free** or **Inactive**.
Press the wheel to confirm the selection.

## EVC Info

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


P0001020

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




P0001019

2 **Features** shows what accessories are installed. Press the wheel to access the submenu.

3 **Components** shows what hardware components are installed. Press the wheel to access the submenu.

4 **Software** shows what software is installed. Press the wheel to access the submenu.

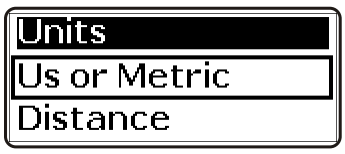
## Units

Setting operating information and trip data units.

1 Activate the station.


P0001035

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




P0001036

3 Turn to **US or Metric**; press the wheel and select US or Metric.
Press the wheel to confirm the selection.

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

## Language

It is possible to select between 10 languages.

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

1 Activate the station.

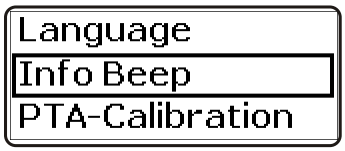
2 Turn until **Language** is shown in the settings menu. Press to reach the language menu.

3 Turn to the desired language and press to confirm the selection. The display will return to the settings menu.

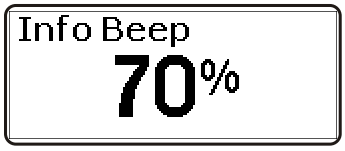

P0001037

## Information Beep

Adjusting the volume of the integral tachometer alarm.




1 Turn until **Info Beep** is shown in the settings menu. Press to access adjustment.




P0001039

2 Turn to the desired volume. Press to confirm the selection; the setting will be confirmed by a beep at the set volume. The display will return to the settings menu.

## Fuel Tank

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

### Fuel Multipoint Calibration

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

**Calibration is carried out in 5 steps.**

POS 1, 20% full tank

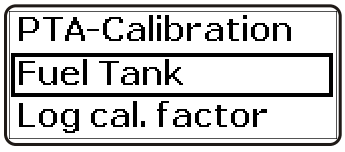
POS 2, 40% full tank

POS 3, 60% full tank

POS 4, 80% full tank

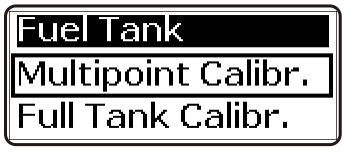
POS 5, 100% full tank

1 Activate the station.




P0001012

2 Turn to **Fuel Tank** in the settings menu and press to access the calibration menu.




P0001011

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


P0001010

4 Fill the tank with the quantity shown in the display, POS 1.

5 Fill the tank up to the level shown in the display, POS 2.
Press the wheel to confirm that the tank has been filled to the indicated level.

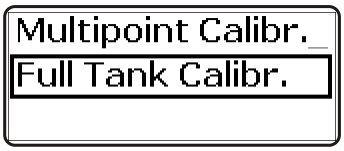
6 Repeat the procedure for POS 3 , POS 4 and POS 5. Confirm by pressing the wheel at each position.

### Full Fuel Tank Calibration

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


P0001012

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




P0001009

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


P0001034

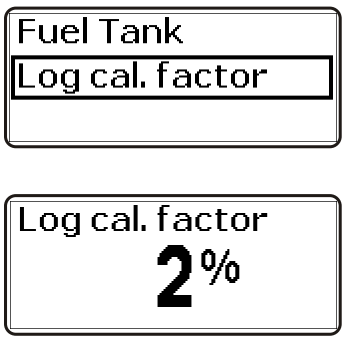
3 Fill the fuel tank. Confirm that the fuel tank is full by depressing the wheel.

## Speed Factor

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

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

1 Activate the station.

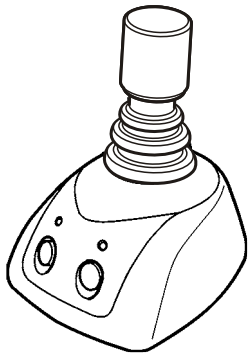



P0001230

2 Turn to **Log cal. factor** in the settings menu and press to reach adjustment,

3 Turn the wheel to set the level. Press to confirm the selection.

## Joystick



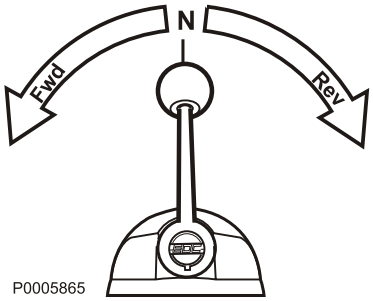
P0002903

Joystick calibration need only be carried out if boat movements do not correspond to joystick movements.

When calibrating the joystick the boat must be driven on open waters in safe conditions. Avoid calibrating in high winds or currents that can influence the result of the calibration.

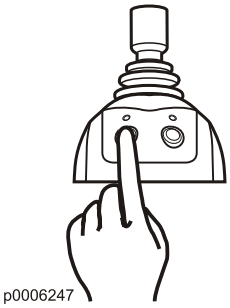
Allow the boat to run for a fairly long distance during the calibration. Hold the joystick firmly in position.

Calibration can only be carried out at a helm station that is equipped with both a joystick and a control panel.
Calibration need only be done in one direction, port or starboard.



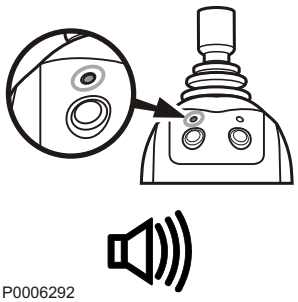

P0005865

1 Move the control lever(s) to neutral.



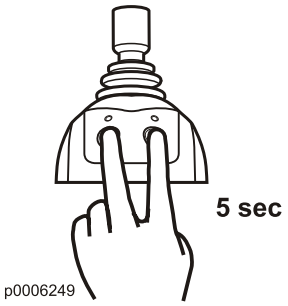
p0006247

2 Activate docking mode by depressing the docking button.



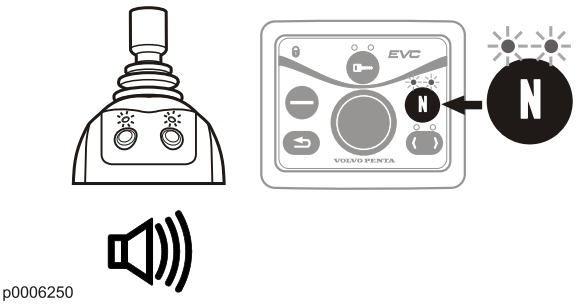
P0006292

3 An audible signal will confirm that docking mode is activated and the docking button lamp will light up.



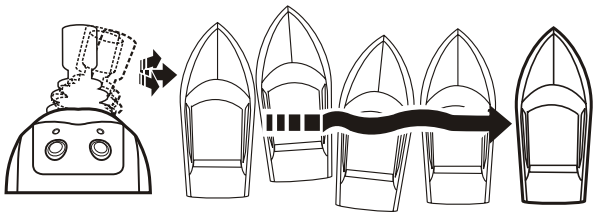
p0006249

4 Simultaneously press both buttons on the joystick for 5 sec. to reach calibration mode.

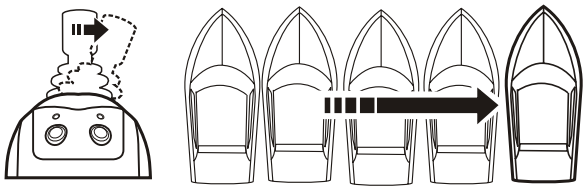


p0006250

5 Calibration mode is confirmed by an audible signal and by both lamps on the joystick and the neutral button lamps on the control panel flashing.

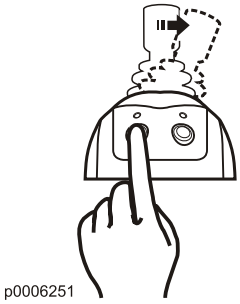

p0005194

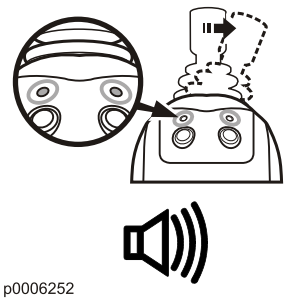
6 Move the joystick sideways as far as it will go in one direction.
Correct boat movements by moving the joystick up and down, and by turning it.


p0006064

7 When the boat is moving straight abeam, depress the docking button.

P0001202


p0006251

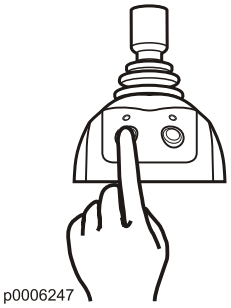


p0006252

8 An audible signal and both lamps on the joystick and the neutral button lamps on the control panel will light up to confirm that calibration is complete and stored. The system is now in docking mode.

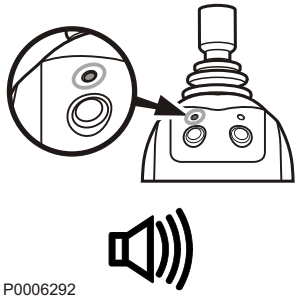
9 When the joystick is returned to the central position the lamps stop flashing; the lamps by the docking button and the neutral button shine continuously instead.

**Resetting the calibration**



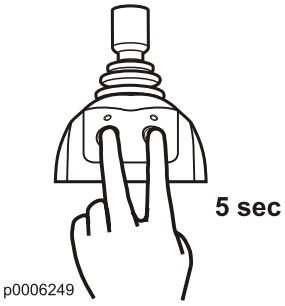
p0006247

1 Activate docking mode by depressing the docking button.



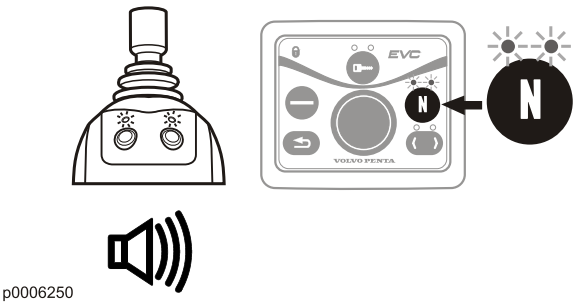
P0006292

2 An audible signal will confirm that docking mode is activated and the docking button lamp will light up.



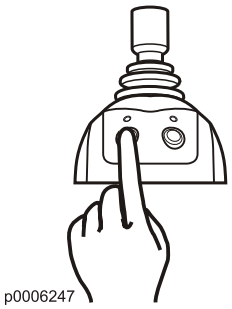

p0006249

3 Simultaneously press both buttons on the joystick for 5 seconds.




p0006250

4 Calibration mode is confirmed by an audible signal and by both lamps on the joystick and the neutral button lamps on the control panel flashing.



p0006247

5 Press the docking button. Calibration is now reset, which is confirmed by an audible signal. The system is now in docking mode.

# Technical Data

## Engines

| Volvo Penta IPS system designation | IPS 500 | IPS 600 |
|---|---|---|
| Engine model/after market designation | D6-370 D-B | D6-435 D-A |
| Crankshaft power** | 272 kW (370 hp) | 320 kW (435 hp) |
| Propellershaft power** | 259 kW (352 hp) | 307 kW (418 hp) |
| Idling speed* | 600 rpm | 600 rpm |
| Injection sequence | 1-5-3-6-2-4 | 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° |
| No. of cylinders | 6 | 6 |
| Bore | 103 mm (4.06") | 103 mm (4.06") |
| Stroke | 110 mm (4.33") | 110 mm (4.33") |
| Displacement | 5.5 $dm^3$ (335.6 $in^3$) | 5.5 $dm^3$ (335.6 $in^3$) |
| Dry weight with drive IPS | 887 kg (1956 lb) | - |
| Dry weight with drive IPS-B | - | 901 kg (1986 lb) |
| Compression ratio | 17.5:1 | 17.5:1 |

* At delivery, the idling speed is adjusted to 600 rpm. If needed, the speed can be adjusted within the range 600–750 rpm for IPS 500 and 600–650 rpm for IPS 600.
** According to ISO 8665.

# Lubrication System

| | |
|---|---|
| **Oil capacity including oil filters, approx.,** | |
| for all allowed installation inclinations | 20 liters (5.3 US gals) |
| volume difference MIN – MAX | 3.5 liters (0.9 US gals) |
| | |
| **Oil pressure, hot engine,** | |
| idling | 125 kPa (18.1 PSI) |
| at full speed | 450 kPa (65.3 PSI) |
| | |
| **Oil, viscosity** | SAE 15W/40 (See table) |

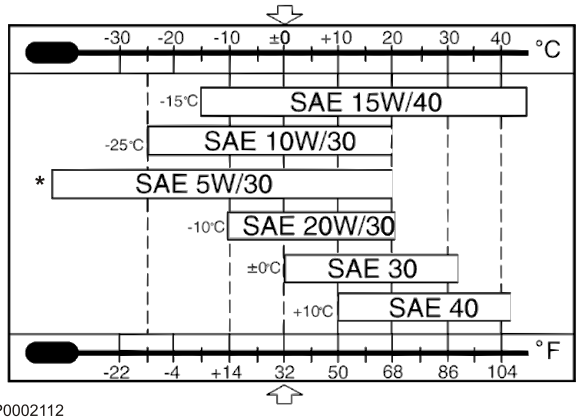
| | |
|---|---|
| **Compressor, oil** | |
| Oil volume | 0.1 liters (0.2 US pint) |
| Oil grade | Volvo Penta, part no. 1141641 |

| **Oil grade** [1] | **Sulphur content in fuel, by weight** | |
|---|---|---|
| | **< 0.5 – 1.0%** | **more than 1.0%** [2] |
| | **Oil change interval: Reached first in operation:** | |
| **All engines:**<br>VDS-2 **and** ACEA E7 [3), 4)]<br>or VDS-2 **and** Global DHD-1 [3)]<br>or VDS-2 **and** API CH-4 [3)]<br>or VDS-2 **and** API CI-4 [3)] | **200** hr. or 12 months | **100** hr. or 12 months |

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

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

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



P0002112

## Viscosity

Select the viscosity according to the table.

The temperature values refer to stable ambient temperatures.

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

# Fuel System

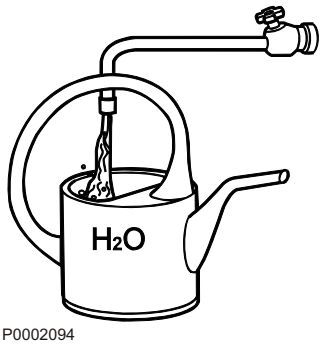
### Fuel specification

The fuel must comply with national and international standards for commercially supplied fuels, such as:
**EN 590** (with national environment and cold requirements)
**ASTM D 975 No 1-D and 2-D**
**JIS KK 2204**
**Sulfur content:** Complying with legal requirements in each country.

Low density fuel (urban diesel in Sweden and city diesel in Finland) can cause a loss of up to 5% of power and an increase in fuel consumption of about 2–3%.

# Cooling System

## Water Quality



P0002094

**ASTM D4985:**

| | |
|---|---|
| Total solid particles | <340 ppm |
| Total hardness | <9,5° dH |
| Chloride | <40 ppm |
| Sulfate | <100 ppm |
| pH value | 5,5–9 |
| Silica (acc. ASTM D859) | <20 mg $SiO_2$/l |
| Iron (acc. ASTM D1068) | <0,10 ppm |
| Manganese (acc. ASTM D858) | <0,05 ppm |
| Conductivity (acc. ASTM D1125) | <500 µS/cm |
| Organic content, $COD_{Mn}$ (acc. ISO8467) | <15 mg $KMnO_4$/l |

# Electrical System

| | | |
|---|---|---|
| **System voltage** | 12V | 24V |
| | | |
| **Alternator, rated power, max** | | |
| voltage/max. amperage | 14V/115A | 28V/80A |
| output, approx. | 1610W | 2240W |
| | | |
| **Battery capacity** | 2 connected parallelly 12V, max. 88Ah | 2 connected in series 12V, max. 88Ah |
| | | |
| **Battery electrolyte density at +25°C (77°F):** | | |
| fully charged battery | 1.28 g/cm$^3$ = 0.0462 lb/in$^3$ (1.24 g/cm$^3$ = 0.0448 lb/in$^3$)* | 1.28 g/cm$^3$ = 0.0462 lb/in$^3$ (1.24 g/cm$^3$ = 0.0448 lb/in$^3$)* |
| battery recharged at | 1.24 g/cm$^3$ = 0.0448 lb/in$^3$ (1.20 g/cm$^3$ = 0.0434 lb/in$^3$)* | 1.24 g/cm$^3$ = 0.0448 lb/in$^3$ (1.20 g/cm$^3$ = 0.0434 lb/in$^3$)* |

**NOTICE!** * Applies to batteries with tropical acid.

# Sterndrive

## Propulsion Unit

| **Volvo Penta IPS system designation** | **IPS 500** | **IPS 600** |
|---|---|---|
| Oil volume, approx. | 14 liters (3.7 US gals) | 14 liters (3.7 US gals) |
| Oil volume difference MIN – MAX | 0.5 liters (0.13 US gals) | 0.5 liters (0.13 US gals) |
| Oil grade and viscosity | VP 1141634 (API GL5 SAE 75W/90) Synthetic | |
| Gear ratio | 1.94:1 | 1.82:1 |

# Identification Numbers

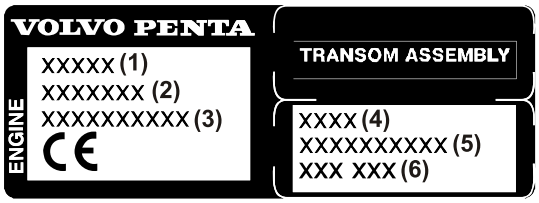
There are type plates on the engine and transmission, marked with identification numbers. This information must always be used as reference when service and spare parts are ordered. You will probably find similar plates on your boat and its equipment. Note this information below, make a copy of the page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

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

**Engine**

Product designation (**1***) .....
Product number (**2***) .....
Serial number (**3***) .....

**A**



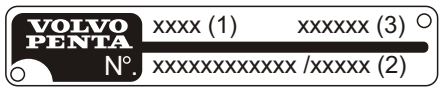

P0004534

**Propulsion Unit**

Product designation (**4***) .....
Gear ratio (**5***) .....
Serial number (**6***) .....
Product number (**7***) .....

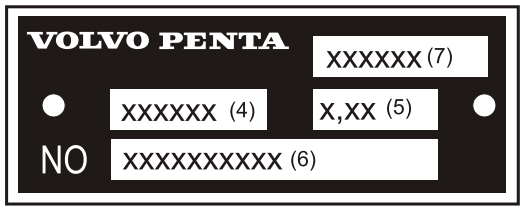
* The numbers refer to the position of the identification numbers on the information decal/plate.

**B**




P0006167

**C**

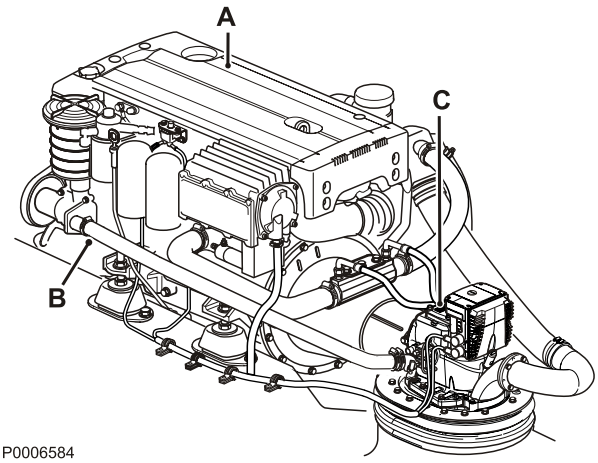



P0002669

A **Warranty decal (Engine/Propulsion Unit)**
Warranty decal, IMO decal, Exhaust Emission certificate and EPA decal.

B **Engine plate**

C **Propulsion unit plate**




P0006584

# Alphabetical index

# VOLVO PENTA

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

# VOLVO PENTA IPS

**Engine manufacturer**
AB Volvo Penta
Gropegårdsgatan
405 08 Göteborg
Sweden

**Body for sound and exhaust emission assessment**
International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
**ID Number:** 0609

**Module used for sound emission assessment** .....Aa
International production control
Test according to Annex VI

**Modules used for exhaust emission assessment** B+C

**Other Community Directives applied** .....EMC 89/336/EEC

**Description of engine(s) and essential requirements**
Engine type.....4 stroke diesel engine with propulsion unit with integral exhaust

| **Engine(s) models covered by this declaration** | **EC Type certificate number** |
|---|---|
| Volvo Penta IPS 350 | SDVOLV005 (noise)<br>EXVOLV001 (exhaust) |
| Volvo Penta IPS 400 | SDVOLV004 (noise)<br>EXVOLV001 (exhaust) |
| Volvo Penta IPS 500 | SDVOLV004 (noise)<br>EXVOLV001 (exhaust) |
| Volvo Penta IPS 600 | SDVOLV004 (noise)<br>EXVOLV001 (exhaust) |

| **Essential requirements** | **Standards Used** | **Other normative document used** |
|---|---|---|
| **Annex I.B – Exhaust Emissions** | | |
| Engine identification | Volvo Penta std | Annex I.B.1 |
| Exhaust emission requirements | EN ISO 8178-1:1996 | Annex I.B.2 |
| Durability | Volvo Penta std | Annex I.B.3 |
| Operator's manual | ISO 10240:2004 | Annex I.B.4 |
| **Annex I.C – Noise Emissions** | | |
| Sound emission levels | EN ISO 14509:2000/prA1:2004 | Annex I.C.1 |
| Operator's manual | ISO 10240:2004 | Annex I.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 complie(s) 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, Product Liability**

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

**Signature and title:**

(or an equivalent marking)

Date and place of issue: (yr/month/day) 2006/04/20 Göteborg

PL-84/06

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