

OPERATOR'S MANUAL

Volvo Penta IPS

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If internet access isn't possible, please contact your Volvo Penta dealer.

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JPN このオペレーターズ マニュアルの他言語版が、発行後最高12か月間、インターネットより無料で発注可能です。

<http:// manual.volvopenta.com/coupon/>

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Jos sinulla ei ole Internet-yhteyttä, ota yhteys lähimpään Volvo Penta jälleenmyyjään.

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GRC Το παρόν Βιβλίο Χρήσης μπορεί να παραγγελθεί δωρεάν σε άλλη γλώσσα μέχρι 12 μήνες μετά την παράδοση, μέσω διαδικτύου.

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Εάν δεν είναι δυνατή η πρόσβαση στο ιαδίκτυο, παρακαλούμε επικοινωνήστε με το δικό σας αντιπρόσωπο της Volvo Penta.

RUS Данное руководство по эксплуатации можно бесплатно заказать на другом языке по Интернету в течение 12 месяцев после доставки.

<http:// manual.volvopenta.com/coupon/>

Если доступ к Интернету отсутствует, обратитесь к своему дилеру компании Volvo Penta.

TUR Bu Kullanım Kılavuzu, teslimden 12 ay sonrasına kadar internet yoluyla ücretsiz olarak farklı bir dilde sipariş edilebilir.

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İnternet mümkün değilse, lütfen Volvo Penta yetkili satıcınızla temas geçin.

CHI 本操作手册可通过互联网以不同的言进行订购，交付后可免费使用达12个月。

<http:// manual.volvopenta.com/coupon/>

如果无法访问互联网，请与沃尔沃遍达经销商联系。

DUT Dit instructieboek kan gratis via internet in een a dere taal worden besteld tot 12 maanden na aflevering.

<http:// manual.volvopenta.com/coupon/>

Als toegang tot het internet niet mogelijk is, neem dan contact op met uw Volvo Penta dealer.

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Caso o acesso à internet não for possível, contatar seu distribuidor Volvo Penta.

ARA

من الممكن طلب دليل المشغل بلغة أخرى مجاناً عبر الإنترنت لفترة تصل إلى ١٢ شهراً من بعد التسليم.

[/http:// manual.volvopenta.com/coupon/](http:// manual.volvopenta.com/coupon/)

إذا كان الوصول إلى الإنترنت غير متاح، فالرجاء الاتصال بوكيل Volvo Penta.

CALIFORNIA PROPOSITION 65 WARNING

Engine exhaust, some of its constituents, and a broad range of engine parts are known to the State of California to cause cancer, birth defects, and other reproductive harm. Additionally, lubricants, fuels, and other fluids used in engines – including any waste created through the wearing of engine parts – contain or produce chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Battery posts, terminals, and related accessories contain lead and lead compounds. Wash your hands after handling. Used engine oil contains chemicals that have caused cancer in laboratory animals. Always protect your skin by washing thoroughly with soap and water.

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Foreword

Welcome!

Congratulations on your new boat equipped with a Volvo Penta marine engine. Volvo Penta engines are designed to fulfill Volvo's core values; quality, safety and environmental care. And after more than 100 years as an engine manufacturer, the Volvo Penta brand has also become a symbol of reliability, technical innovation, top-of-the-range performance and long service life. Volvo Penta marine engines are used all over the world, in all possible operating conditions for professional as well as leisure purposes.

Make sure to thoroughly read through this Operator's Manual and take necessary actions regarding running and maintenance before your maiden voyage. It contains the information you need to be able to operate and maintain the engine safely and correctly. Pay careful attention to the safety instructions included in the manual.

As the owner of a Volvo Penta marine engine, you become part of a worldwide network of dealers and service workshops that assist you with technical advice, service requirements and replacement parts. Contact your nearest authorized Volvo Penta dealer for assistance.

Information about your closest Volvo Penta dealer and other useful information can be found at www.volvopenta.com.

Safety Information

Read this chapter very carefully. It concerns your safety. This chapter describes how safety information is presented in the operator's manual and on the product. It also provides you with an introduction to the basic safety rules for using and looking after the engine.



This symbol is used in the operator's manual 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 operator's manual 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.



In some cases, this symbol is used on our products and refers to important information in the operator's manual. Make sure that warning and information symbols on the engine are clearly visible and legible. Replace symbols that have been damaged or have been painted over.

Daily Checks

Make a habit of giving the engine and engine bay a visual check before driving (before starting the engine) and after operation (when you have stopped the engine). This will help you to quickly discover whether there is any leakage of fuel, coolant, oil or any other abnormal event has occurred, or is about to occur.

WARNING!

Do not start the engine if there is reason to suspect fuel and/or propane leaks, or if there is explosive material nearby.

Maneuvering

To avoid passengers falling overboard, refrain from extreme and sudden rudder movements and ahead/astern movements.

A rotating propeller can cause severe injuries. Make sure that there is nobody in the water before engaging ahead/astern drive. Never drive close to bathers or in areas where it can be expected that people are in the water.

Lanyard Switch

We recommend installing and using a lanyard switch (optional), especially if the boat is capable of high speeds. The lanyard switch stops the engine if the driver loses control of the boat.

Fuel Filling

There is always a risk of fire and explosion during fueling. Smoking is forbidden and the engine must be stopped during fueling.

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

Only use fuel recommended in the *Technical Data*, page 125. The wrong grade of fuel can cause serious malfunctions, power loss or stop the engine. In diesel engines, fuel of poor quality can cause damage to the fuel system or cause the engine to over-speed, with risk of personal injury.

Accidents at Sea

Maritime rescue statistics show that a large number of boat accidents are caused by inadequate engine and boat maintenance and the lack of safety equipment.

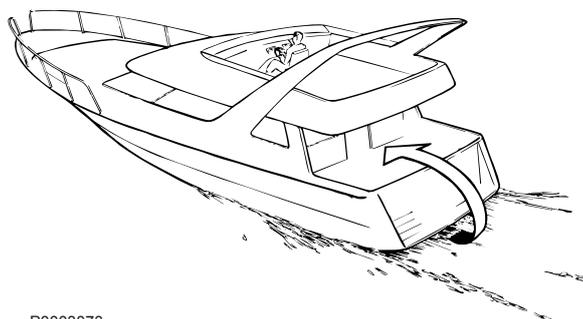
Make sure that the boat engine is properly maintained by making sure that the recommended service is performed, and that necessary safety equipment is available and functional.

Carbon Monoxide Poisoning

When the boat moves forward, an area of lower pressure air is formed behind the boat — so-called turbulence. In certain conditions, this turbulence can be powerful enough to draw the exhaust fumes into the cockpit or cabin, creating a risk of carbon monoxide poisoning to people on board.

The turbulence problem is most pronounced on tall, broad-beamed boats with a transom stern. But even for other boat types, low-pressure suction can be a problem in certain conditions, such as driving with cockpit awnings rigged. Other factors that can increase the effect of turbulence are wind conditions, load distribution, swell, trim, open hatches and ventilators etc.

Most modern boats are, however, designed so that the problem of low-pressure suction is very rare. Should turbulence nevertheless occur, hatches or ventilators must not be opened since this might exacerbate the problem. Instead, try to change the speed, trim or load distribution. If possible, take down or open the cockpit awning. Contact your boat dealer for the best solution for your boat.



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Remember

The list below includes some tips on what to remember to bring on any boat trip. The list can be extended since the need for safety equipment varies with the boat type and where or how it is used etc. We recommend you ask a regional boat or sea safety organization for more detailed maritime safety information.

Safety Equipment:

- life jackets
- communication equipment
- emergency rockets
- approved fire extinguisher
- first aid kit
- life buoy
- anchor
- paddle
- flashlights

Spare Parts and Tools:

- impeller
- fuel filters
- fuses
- tape
- hose clamps
- engine oil
- other tools that may be required

- 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.

Introduction

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

For engine designations, refer to *Technical Data, page 123*. The designation is stated on the engine plate, refer to *Technical Data, page 129*.

About this manual

This Operator's Manual has been prepared to give you the greatest possible benefit from your Volvo Penta marine engine. It contains necessary information regarding safe and correct engine operation and maintenance. 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 may cover several product types, which means that there may be slight differences between the illustrations and the purchased product. This does, however, not affect the validity of the information and/or instructions in the manual. Volvo Penta reserves the right to make alterations to specifications, design features, and illustrations without prior notice.

Your New Boat

Carefully read through the instructions and other information that is delivered with the new boat. Learn to handle the engine, controls and other equipment in a safe and proper manner. If this is your first boat or if the boat type is unfamiliar to you, we recommend that you practice maneuvering the boat before casting off on the maiden voyage. Make yourself familiar with the boat's seakeeping and maneuvering qualities at different speeds, sea states and load conditions.

Bear in mind that a person in charge of a boat under way bears the legal responsibility of knowing and following the regulations for passage and safety afloat. Learn which regulations apply to you and your waters by contacting the relevant authorities or maritime safety organization. We recommend that you complete a boat driver's course.

Warranty

Your new Volvo Penta marine engine is covered by a limited warranty, subject to the conditions compiled in the Warranty Information. Note that AB Volvo Penta's liability is limited to the specification in the Warranty Information (included CD) and Emission Control System Warranty Statement.

Read the information carefully, as soon as possible after delivery. It includes important information about service and maintenance; the owner is responsible for being familiar with, checking and implementing these. Otherwise AB Volvo Penta may deny its warranty obligations in part or in full.

Contact your Volvo Penta dealer if you have not received the Warranty Information or Service Book.

Environmental Care

Volvo Penta has special responsibility as an engine manufacturer, and for this reason environmental care is a natural cornerstone of our product development. Volvo Penta currently has a broad engine program in which great advances have been made in reducing exhaust emissions, fuel consumption and engine noise etc.

We hope that you will be keen to preserve these qualities. Always follow the directions in the Operator's Manual regarding fuel grades, operation and maintenance to avoid unnecessary environmental impact. Contact your Volvo Penta dealer if you notice any changes such as increased fuel consumption or increased exhaust smoke.

Remember always to hand in environmentally hazardous waste such as drained oil, coolant, old batteries, etc. for treatment at a recycling facility.

Our united efforts can make a valuable contribution to the environment.

Running In

The engine must be run in during the first 10 hours of operation. Do this by using the engine in normal operation, where full load is only applied for short periods of time. Never run the engine at constant speed for any longer periods of time.

Since oil consumption is higher during the running in period, be sure to control the oil level more frequently than normally recommended.

Refer to *Maintenance, page 77* for more information.

Fuel, Oils and Coolant

Only use the fuels and oils recommended in the *Technical Data, page 124*, since other grades may cause malfunctions, increased fuel consumption, and possibly shorten the life of the engine.

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

Make sure to always use suitable and correctly mixed coolant.

Future warranty claims related to engine and accessories may be denied if an unsuitable coolant has been used, or if the instructions for coolant mixture have not been followed.

Maintenance and replacement parts

Volvo Penta engines are designed for maximum reliability and long life. They are not only built to withstand a demanding environment, but also to have the smallest possible environmental impact. These qualities will be maintained through regular servicing and the use of spare parts with the same quality as Volvo Penta original spare parts. If reliable and purpose-built parts are not used, your safety, health, and the machine's function may be compromised. Volvo Penta has a world-wide network of authorized dealers.

They are Volvo Penta product specialists, and have the accessories, genuine parts, test equipment and special tools needed for high quality service and repair work. Always observe the maintenance intervals in the manual, the complete Service Protocol can be found at volvopenta.com. Remember to note the engine / transmission identification number when you **order service and spare parts**.

Excessive Strain On a Product and Components

Volvo Penta products and their components are not dimensioned for external loads. Never stand or step onto an engine, transmission or its components. Loads can bring about damage and the malfunction of a product or property.

Volvo Penta EVC System, Integrity and Modification

The Electronic Vessel Control (EVC) system is a complete vessel control system for engine, gear, and vessel steering control. Modifying the EVC system or connecting spare parts or systems that do not comply with the quality of Volvo Penta original parts may adversely affect the system performance, safety, and warranty coverage.

We recommend you only use electronic systems and spare parts approved by Volvo Penta. Contact your local Volvo Penta dealer for detailed information and advice.

Recording engine data

One or more computers in your Volvo Penta engine can record detailed information. It can include data such as usage and information of other systems and modules on the engine. This data can include information such as boat position and usage. Only a limited amount of data can be stored.

AB Volvo Penta will not distribute this stored information without permission. AB Volvo Penta may, however, be forced to provide this information if required by national legislation. In general, AB Volvo Penta and authorised workshops may read and use the information.

Certified Engines

The engine is emission-certified and if you use it in areas where exhaust emissions are regulated by law, there are special demands regarding the care and maintenance you provide to your engine.

NOTICE! Neglect or failure to follow the points listed here may invalidate the engine emission certificate. This means that AB Volvo Penta will no longer be able to guarantee engine conformity with the certified model. Volvo Penta is not responsible for damages or costs arising as a result of this.

- Certification means that an engine type has been checked and approved by the relevant authority. The engine manufacturer guarantees that all engines of the same type are equivalent to the certified engine.
- It is the responsibility of the operator to ensure that no deliberate misuse of the engine takes place.
- Volvo Penta maintenance and service intervals must be complied with.
- Any case of malfunction must be rectified without delay.
- Only use Volvo Penta original spare parts or spare parts with the same quality as Volvo Penta original parts.
- Service to injection pumps, pump settings and injectors must always be carried out by an authorized Volvo Penta workshop.
- The engine must not be converted or modified, except with accessories and service kits that Volvo Penta has developed for the engine.
- No installation changes to the exhaust pipe and engine air inlet ducts may be made.
- No warranty seals (where present on the product) may be broken by unauthorized persons.
- The general instructions in the Operator's Manual concerning operation, service and maintenance apply.

Volvo Penta Dealer Network

The Volvo Penta global network of authorized dealers is at your service. We strongly recommend that you take your product to an authorized Volvo Penta dealer for service and repair. They are specialists in Volvo Penta products and have the accessories, genuine Volvo Penta parts, the special tools and the latest service information for high quality service and repair work.

Dealer Locator Services

Locate the nearest Volvo Penta dealer through our dealer locator on www.volvopenta.com or download the dealer locator app to your smartphone.

Volvo Penta Action Service

Our global dealer network, your first line of contact, is backed up by Volvo Penta Action Service, a phone based breakdown and support service providing assistance 24 hours a day, every day of the year.

How it works

A dedicated operator will support you all the way through your case and keep you updated on status and progress.

Whenever on-site assistance or technical support is needed, the operator will put you in contact with the closest Volvo Penta dealer that can support your product.

Phone numbers

Find your Volvo Penta Action Service phone number and more information on www.volvopenta.com.



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.

Ignition Lock

There is always a helm station with an e-Key panel on a boat. The ignition must be switched on here in order to use other helm stations.

Read the starting instructions in *Starting, page 50* to make sure you use the correct start procedure.

e-Key panel

The Volvo Penta e-Key consists of a panel and a key fob.

Hold the key fob in front of the  symbol on the panel to unlock the EVC system. A sound confirms the system is unlocked.

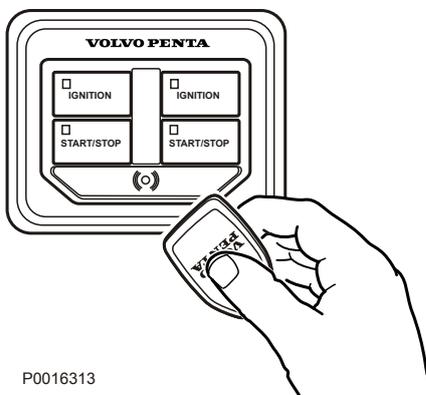
When the electrical system is locked, a red light will flash under the symbol. The lamp goes out to indicate the system is unlocked.

Key Management

Two key fobs are provided at the time of delivery. It is possible to add additional keys; the system allows up to four keys. With a key already registered to the system other keys can be added or removed, see *Key Management*.

Safety Lanyard

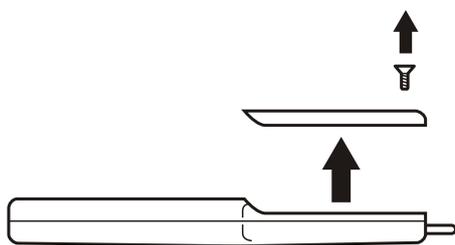
A safety lanyard (optional extra) can be connected to the panel. Should the safety lanyard be removed, the engines will stop, the system alerts and a warning message will be displayed in the Information Panel.



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e-Key Remote

e-Key Remote Sender locks and unlocks the boat's electrical system and starts the engine's ignition via the e-Key Remote Receiver.

On the key there are also two buttons that control relays to optional functions such as deck light or anchor winches.

ON – turns on the start switch and other selected switches.

OFF – turns off the start switch and other selected switches.

1 and **2** – the buttons are used to turn optional boat functions off and on.

Battery replacement

Undo the screw on the battery cover and replace the battery. Battery types: CR2032.

Battery installation

Place the battery cover back fasteners and secure the gasket by pressing on the cover. Install the screw to secure the cover placement.

NOTICE! The e-Key remote can still be used as a regular key fob even if the battery is discharged, refer to *e-Key panel*, page 12.

Control Panels

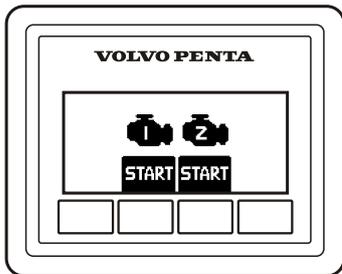
Volvo Penta control panels can be installed in different combinations. The panels all look the same but are configured to handle different functionality. The number of available panels and their function depend on the boat's functionality setup.

Start/Stop Panel

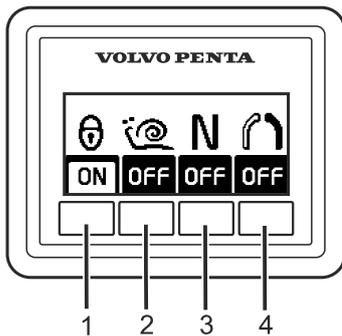
The **Start/Stop** panel is used for starting and stopping the engine.

To start the engine, the ignition must be switched on at the main helm station.

Read the starting instructions in the chapter *Starting*, page 50 to make sure the correct start procedure is used.



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Station Panel

Activation

Activate the helm station with a single press of the **ON** button (1).

Press the button (1) twice to lock the helm station. To set all helm stations to inactive mode, hold the button down for three seconds.



Inactive helm station



Active helm station



Locked helm station

Lowspeed

The Lowspeed function is engaged with the button (2).

Lowspeed

For further information about the function, refer to *Features*, page 28.

N Neutral Button

The gearshift function can be disconnected so that the control lever only operates the throttle. The **Neutral (N)** button (3) disengages the drive/reverse gear so that engine speed may be increased without driving the boat (warm-up mode).

 The drive is disengaged.

 The drive is engaged for movement ahead and astern.

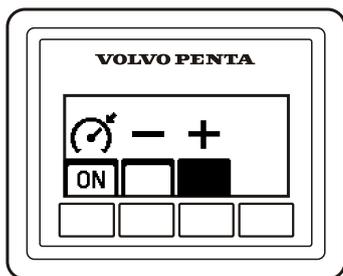
Single Lever Control

Single Lever Control is engaged by pressing the button marked (4) in the picture. When the single lever function is activated, the lever that is moved from its position first becomes the control lever for all engines. The other control lever has no function as long as the single lever function is activated.

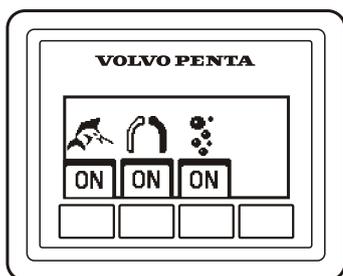
In order to activate the single lever function, the control levers must be in **Neutral (N)** position.

Cruise Control

Switch on cruise control by pressing the  button. Make fine adjustments to the locked engine speed by pressing the + or – buttons to increase or reduce the speed.



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Sport Fish Panel

-  Sport fishing
-  Single lever
-  Silent idle

For more information regarding these functions, refer to *Optional, page 35*.

Docking Panel

When the boat is operated from a docking station, engines can be stopped and started and messages can be managed using the docking panel.

The joystick can be used for maneuvering when the docking station is activated; refer to the *Instruments and Controls*, page 22 section for further information.

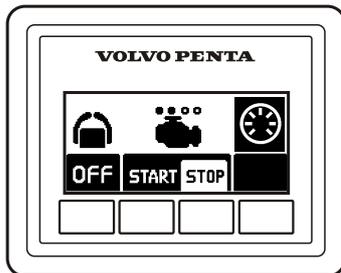
Activation

Activate the helm station by depressing the on/off button. Further pressure on the button locks the helm station.

To switch off the function, hold the button down for 3 seconds.

Twin installation

Both engines in a twin installation must be running before the docking station can be activated.



P0012493



The helm station is inactive.



The helm station is active and the docking function is switched on.

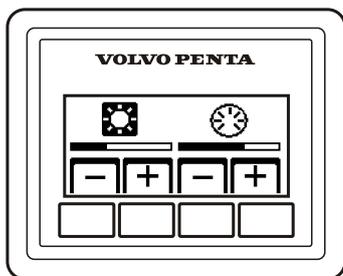


The helm station is locked.

Start/Stop

Press the STOP and START buttons to stop and start all engines.

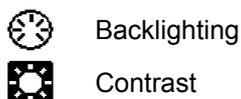
The circles above the engine symbols show which engines are running. An empty circle means an engine is running.



P0012494

Contrast and backlighting

The button on the far right is used to adjust contrast and panel backlighting. The button is also used to confirm fault messages.



Press the button to adjust the contrast and the backlighting.

Use + and – to increase or reduce the contrast or backlighting.

Adjustments affect all screens in the system.

Fault message

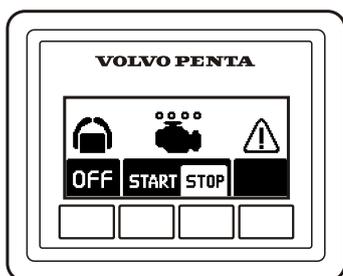
⚠ is displayed on the screen when the system discovers a fault.

All fault messages must be acknowledged.

Acknowledge by pressing the button; if the fault is accompanied by an audible signal, the signal will be silenced. Go to the information display to obtain information regarding the alarm.

Contact a Volvo Penta workshop for a complete readout of all fault messages.

For further information on how to handle fault messages and recommended actions, refer to the *Fault Handling, page 60* and *Fault Code Register, page 65* chapters.



P0001308



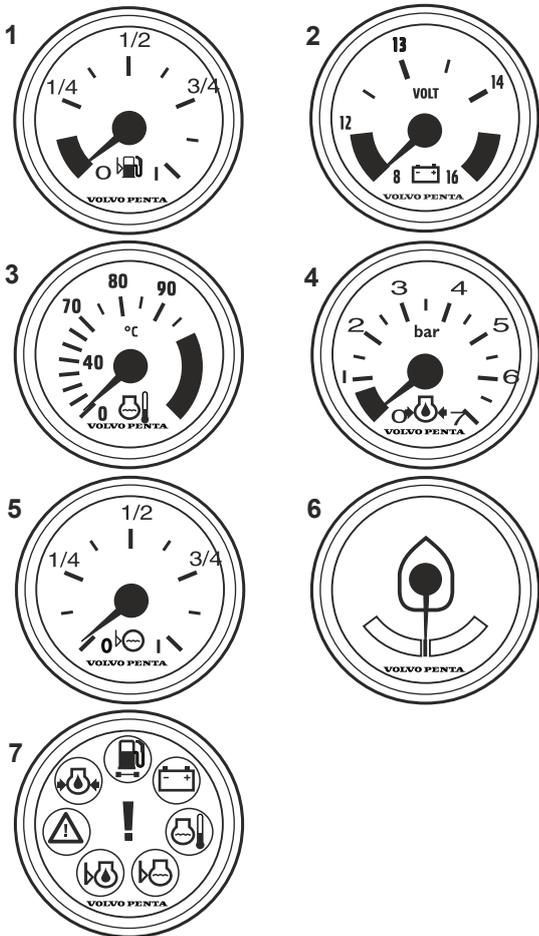
P0012490

Gauges

These instruments are sold as engine options by Volvo Penta.

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. Engine hours are displayed in the tachometer window. When a function is activated a symbol is shown briefly on the display.



P0021447

1 Fuel Level Gauge

The fuel level gauge shows the level of remaining fuel.

2 Voltmeter, Battery Charging

The voltmeter 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 approximately 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 and 95°C (167-203°F).

4 Oil Pressure Gauge

The oil pressure gauge displays engine oil pressure. During operations, the oil pressure is normally 3 to 5 bar. When idling, lower values are normal.

5 Fresh Water Level Sensor

The dial shows the level of fresh water in the fresh water tank.

6 Rudder Position Indicator

The instrument shows rudder position.

7 Alarm Monitor

The alarm monitor provides a visual warning for any active alarm.

Displays

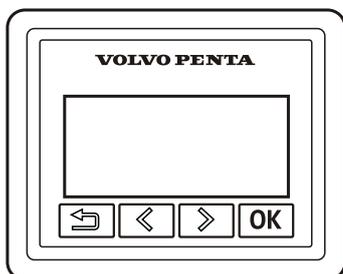
Information Display

The information display shows engine and operational information, messages and alarms.

There is one information display per driveline and helm station if no 7" or larger screen is installed.

The information shown can be set up according to personal preferences. The basic settings show:

- Engine speed
- Oil pressure
- Coolant temp
- Battery voltage



P0001306



Press this button to return to the previous menu. To navigate back to the main menu, hold the button down for more than three seconds or press the button repeatedly.

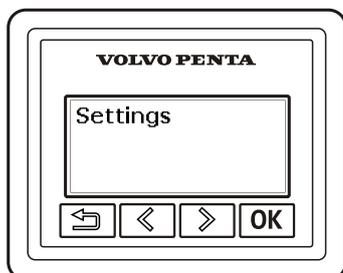


Press these buttons to navigate backwards and forwards in the menus.

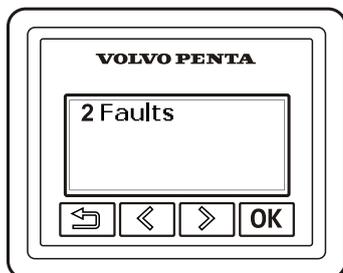
Hold down a button to scroll through a menu.



Press this button to confirm a selection.



P0012801



P0012800

Settings

Browse to the settings menu and press the **OK** button to proceed to the submenu.

For further information about settings, refer to *Calibration and Settings*.

Fault Messages

If the system discovers a fault, the word **Fault** and the number of discovered faults, are shown on the display. To see the what faults have been detected, press the **OK** button.

For further information on how to handle fault messages and recommended actions, refer to *Fault Handling, page 60*.

Backlighting

Display backlighting can be adjusted by pressing the



buttons simultaneously.

Glass Cockpit Display

The Glass Cockpit Display is switched on and off by pressing .

NOTICE!

For information on how to navigate and customize the Glass Cockpit display, refer to the integrated Glass Cockpit Manual. Go to **Info > Owner's Manual** to see the manual in the display or download the latest manual on www.garmin.com.

Warning Manager

Select **Info > Warning Manager** to navigate to Warning Manager.

If the system discovers a fault, the helmsman is alerted by a message on the display. Acknowledge the message by selecting OK.

All faults are stored in Warnings Manager.

The fault message describes the fault and suggests suitable actions.

For further information see *Fault Handling, page 60* and Volvo Penta Glass Cockpit manual.



P0022469

Gauge View

Select **A/V, Gauges, Controls > Choose one of the available gauges views**.

Navigate between the different gauge views by selecting ◀ or ▶ in the gauges menu.



P0022479

This is an example of gauges that can be displayed in the different views:



Engine View

- Engine speed
- Engine hours
- Exhaust temperature, dry
- Coolant temperature
- Coolant pressure
- Voltage
- Oil pressure
- Turbo pressure (diesel)
- Transmission, oil pressure
- Transmission, oil temperature
- Percent load
- Oil Filter Diff Pressure



Vessel View

- Active Corrosion Protection info
- Depth with alarm
- Fuel level
- Fresh water
- Boat Speed
- Power trim angle
- Rudder angle
- Water temp



Battery View

NOTICE! The Battery View shows battery status. The system requires a battery sensor to be able to show the status of the battery.

For installation without Battery Management System, *Voltage* is the only gauge displayed in this view.

- SOC (State Of Charge)
- Time to Empty / Time to Full
- Voltage
- Current
- Battery Health



Fuel Economy View

- Instant fuel rate
- Average fuel rate
- Time to empty
- Instant fuel economy
- Average fuel economy
- Trip fuel economy
- Distance to empty
- Fuel level
- Fuel remaining

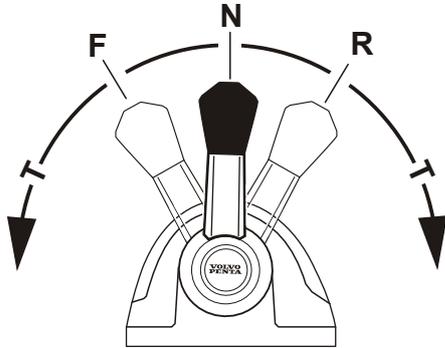


My View

- Boat speed
- Fuel level
- Fuel feed pressure
- Fresh water level
- Seawater temperature
- Seawater pressure
- Rudder angle
- Interceptor position
- Lowspeed mode, slip rate
- Propulsion speed
- Trip fuel
- Total fuel rate
- Trip distance
- Trip hours
- Total fuel economy

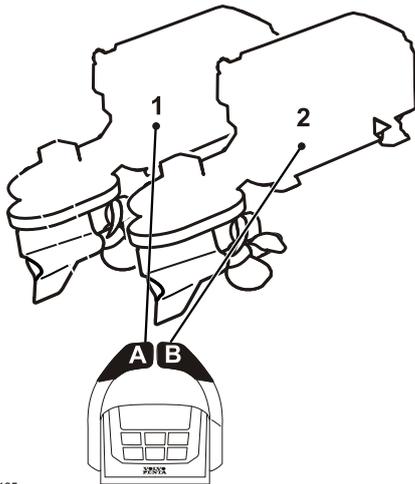
Controls

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



P0012501

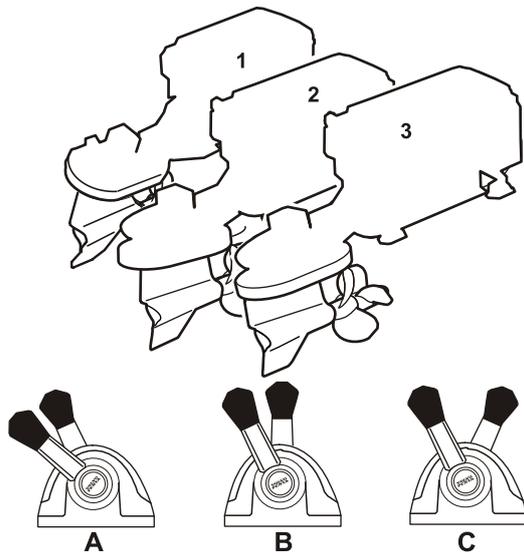
- N** = Neutral position. Reverse gear/drive disengaged and engine at idle.
- F** = Reverse gear/drive engaged for forward motion.
- R** = Reverse gear/drive engaged for rearward motion.
- T** = Engine rpm control (throttle).



P0022185

Twin Installation

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 engine and propulsion unit (**1**). The starboard control lever (**B**) controls the starboard engine and propulsion unit (**2**).

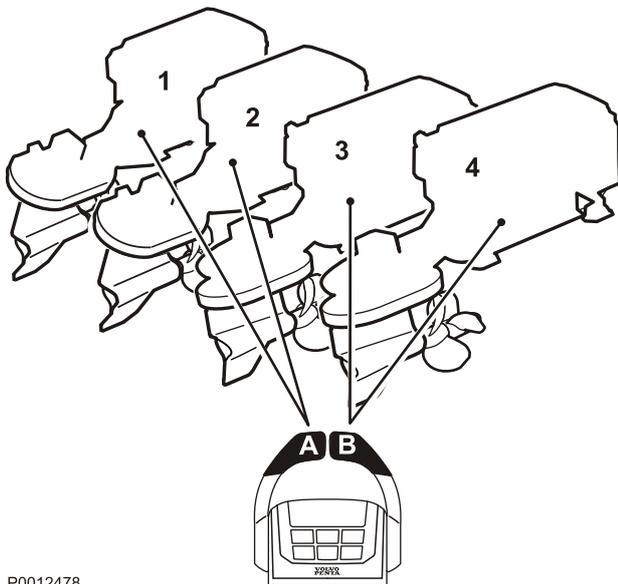


P0012476

Triple Installation

Both the adjustment of engine speed and the gear shift function are controlled using the control levers. The two control levers control all engines and propulsion units.

- A If the control levers are in different positions the centre engine (2) will operate in this range of revolutions.
- B If one of the control levers is in neutral propulsion the centre propulsion unit (2) is also in neutral.
- C If the control levers are in different positions, one engaged for forward motion and the other for reward motion, the centre propulsion unit will be in neutral.



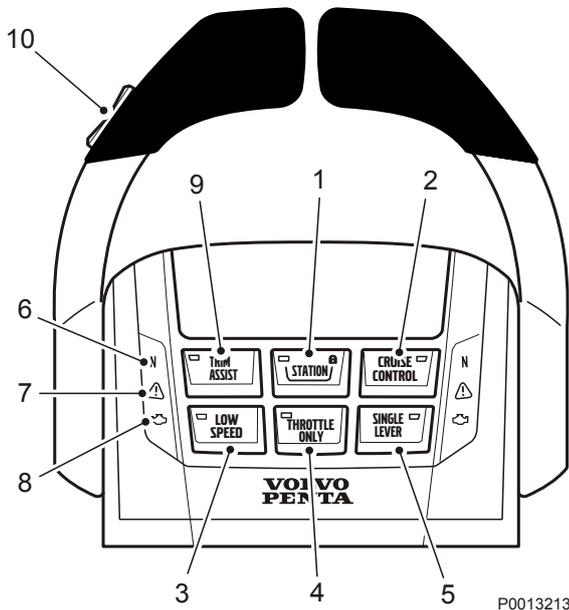
P0012478

Quadruple Installation

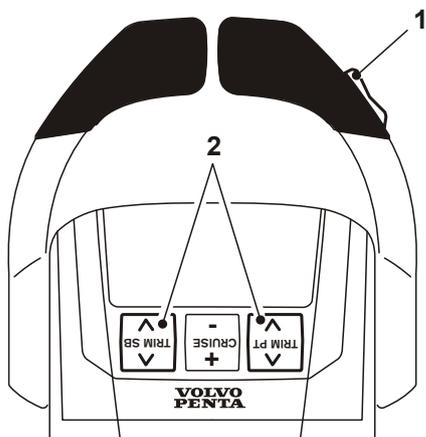
Both the adjustment of engine speed and the gear shift function are controlled using the control levers. The port side control lever (A) controls the port side engines and propulsion units (1) and (2). The starboard control lever (B) controls the starboard engines and propulsion units (3) and (4).

Electronic controls

Engine and drive features are controlled with push buttons on the control. The buttons and functions available depend on the installation.



- 1 **STATION**
The button lamp is lit if the helm station is active. Refer to *Operation*, page 55 for further information.
- 2 **CRUISE CONTROL**
Switch on cruise control by pressing the button (2). Fine tune the locked engine speed by increasing (+) or reducing (-) engine rpm with the button at the back of the control.
- 3 **LOW SPEED**
Refer to *Features*, page 28 for information about the **Lowspeed** function.
- 4 **THROTTLE ONLY**
By activating **THROTTLE ONLY**, the shift function is disconnected and the control lever only affects the engine speed.
- 5 **SINGLE LEVER**
Switch on the single lever function by pressing the button. The lever that is moved from its position first becomes the control lever for both engines. The other control lever has no function as long as the single lever function is activated. The button lamp lights up to show that the function is active. Exit the single lever function by pressing the button again.
- 6 **N**
Neutral position. The symbol shows that the drive/reverse gear is disengaged.
- 7 
The warning triangle lights up if the system discovers a fault. Refer to *Fault Handling*, page 60 for more information about system faults. The warning triangle lights up on the same side as the drive line with the indicated fault.
- 8 For gasoline engines only
- 9 **TRIM ASSIST (Optional)**
Switch on the automatic interceptor control functionality by pressing the button (9). The interceptors are then automatically adjusted when needed. Refer to *Optional*, page 47 for more information.
- 10 **TRIM (Optional)**
Manually adjust the interceptors. Manual adjustment using the **TRIM** button (10) will override the automatic function, if enabled. For twin engine installations, the adjustment of the drives are synchronized.



P0013214

The picture alongside shows the other side of the control.

1 TRIM (Optional)

Manually adjust the interceptors. Manual adjustment using the **TRIM** button (1) will override the automatic function, if enabled.

For twin engine installations, the adjustment of the drives are synchronized.

2 TRIM PT and TRIM SB (Optional)

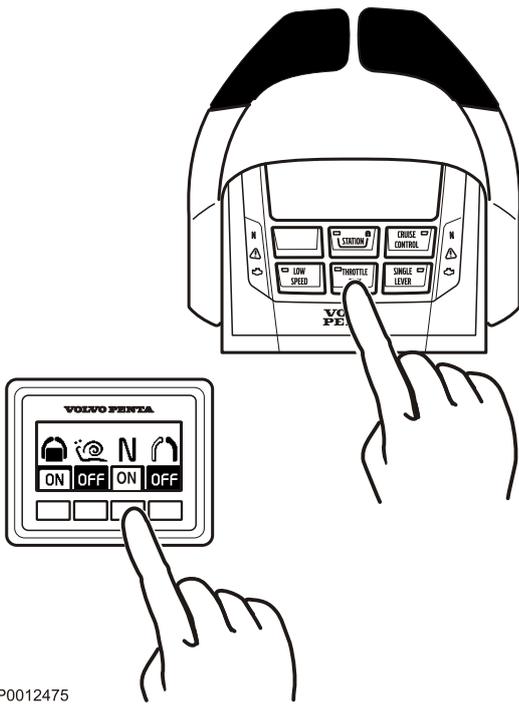
Manually adjust the interceptors individually by using the **TRIM PT** button (2) for portside interceptor adjustment, and the **TRIM SB** button (2) for starboard interceptor adjustment.

Disengaging the Shift Function

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

- 1 Put the control levers in neutral.
- 2 Press the control's "Throttle Only" button or the neutral button (N) on the helm station panel.
- 3 Release the button. The N symbol on the control will light up as confirmation that the gearshift function is disengaged and that the lever will only affect engine revolutions.

To exit neutral mode, press the button again.

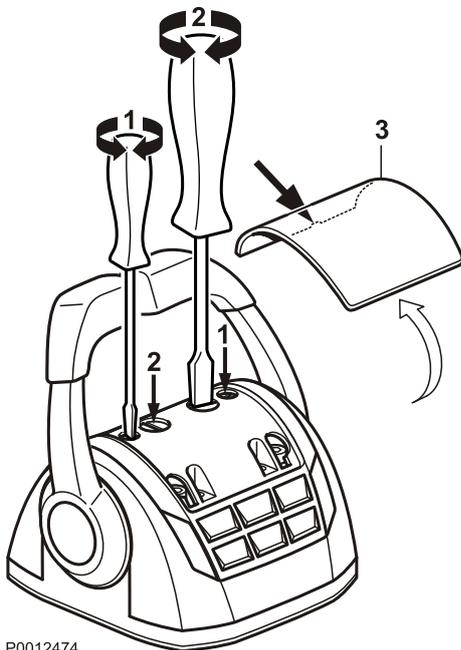


P0012475

Adjusting the friction brake

The control lever has a friction brake that can be adjusted for lighter or stiffer lever movement. Resistance in click mode can also be adjusted.

- 1 Switch off the engine.
- 2 Remove the cover (3).
- 3 Adjust the friction brake (1) and/or click mode (2) by turning the screw clockwise for stiffer lever movement, and counterclockwise for lighter lever movement.
- 4 Replace the cover.

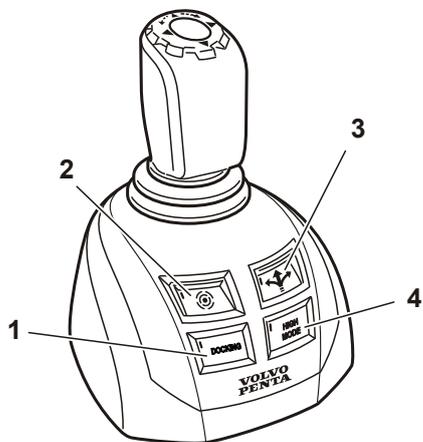


P0012474

Joystick

Volvo Penta Joystick is a control used for docking and maneuvering. Practise using the joystick and its functions in a safe and proper manner. Practise how to operate the boat with both joystick docking and steering functions.

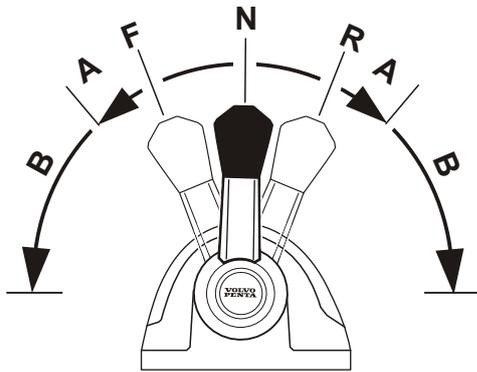
The features are controlled with push buttons on the control. The buttons and functions available depend on the installation.



P0016686

- 1 Docking
For operation and further function information, refer to *Features, page 30*.
- 2 Dynamic Positioning System
For operation and further function information, refer to *Optional, page 37*.
- 3 Joystick Driving
For operation and further function information, refer to *Joystick Driving*.
- 4 High Mode
For operation and further function information, refer to *Features, page 33*.

Features



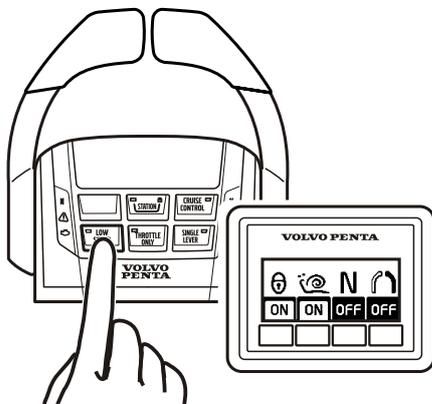
P0012499

Lowspeed

The Volvo Penta Lowspeed function is available for engines with hydraulic transmissions.

Boats with powerful engines can have high speeds even at low revolutions; the low speed function reduces speed.

- N** = Neutral position.
Transmission is disengaged and engine revolutions are at idle.
- F** = Forward at idle.
The transmission is engaged for operations ahead and the engine is at idle; this involves maximum trolling in the transmission.
- R** = Reverse at idle.
The transmission is engaged for operations astern and the engine is at idle; this involves maximum trolling in the transmission.
- A** = Low speed engaged.
The transmission affects propeller revolutions. The engine is not affected.
- B** = Low speed disengaged.
The control affects engine speed and propeller revolutions.



- A** Lowspeed Activated
- B** Coolant Temp 89°C
- C** Lowspeed Deactivated

P0012978

Engaging the lowspeed function

- 1 Move the lever to the neutral position.
- 2 Press the Lowspeed button on the control or  on the helm station panel to activate the lowspeed function.
An audible signal and the “Lowspeed activated” message (**A**) will be displayed on screen to confirm that the function is on.

 is shown on the screen if the low speed function is active (**B**).

When the low speed function is engaged, a delay may occur when shifting.

Disengage the lowspeed function

- 1 Move the lever to the neutral position.
- 2 Press the Lowspeed button on the control or  on the helm station panel to disengage the low speed function.
Two audible signals confirm that the function is switched off and the “Lowspeed deactivated” (**C**) message is displayed on the screen.

Autopilot

For information about Autopilot in glass cockpit displays, refer to the Glass Cockpit Manual. Go to **Info > Owner's Manual** to see the manual in the display or download the latest manual on www.garmin.com

Volvo Penta **Autopilot** consists of a compass unit and the Glass Cockpit Display. The autopilot adjusts boat steering to hold the boat on a straight course. Several different steering patterns can be set and the autopilot also permits manual steering.

Read the instructions carefully and learn to maneuver the boat with the aid of the autopilot in calm, open waters.

NOTICE! The helmsman is responsible for piloting the boat in a safe, reliable manner, even when the autopilot is enabled. Avoid navigational hazards and never leave the helm unattended. Always be prepared to quickly take over the helm.

The autopilot is automatically in standby mode when the boat's electrical systems are switched on. The display will show the main menu or the last menu used.

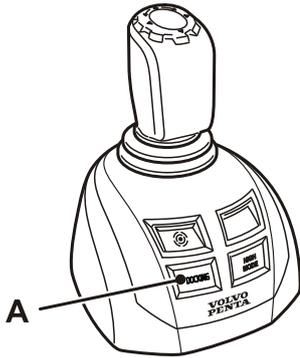
When the autopilot is active, the helm steering unit is locked but may be used for e.g. changing course or giving way to obstacles. If the helm steering unit is used, the autopilot will automatically enter standby mode and must be reactivated again to function.

Joystick for Docking

When the docking function is activated, engine revolutions are limited and the boat can only be steered by the joystick.

In order to activate the docking function, the following must be fulfilled:

- engines running
- control levers in neutral
- helm station active
- joystick in center position



P0012509

Activating the docking function

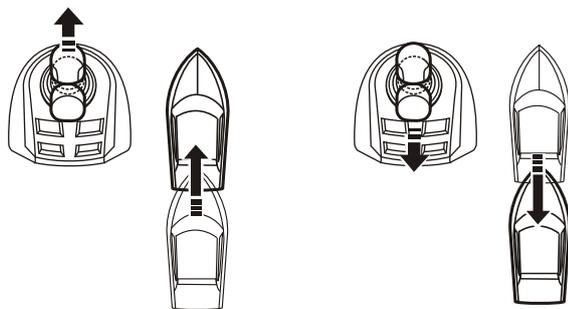
Activate docking mode by depressing the docking button (A) on the joystick.

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

Exiting the docking function

To exit the function, press the joystick docking button (A). An audible signal will sound twice to confirm that docking mode is deactivated, and the docking light will go out.

The docking function is also deactivated if the controls are moved from the neutral position.

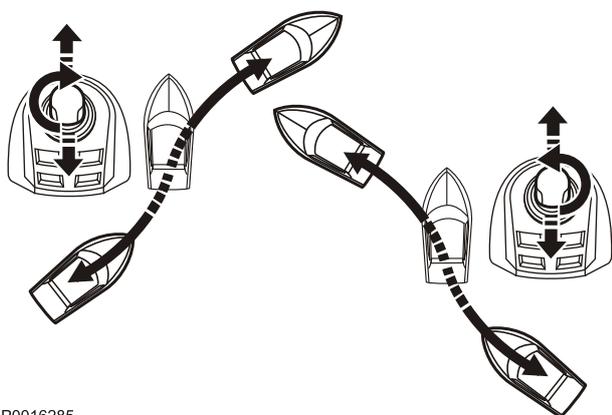
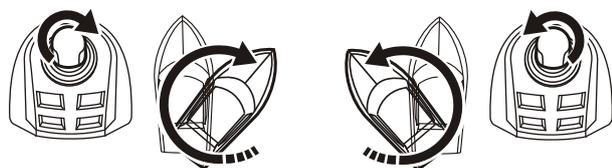


CAUTION!

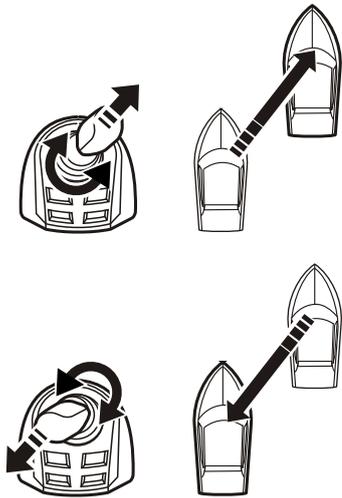
The boat will continue to move in the selected direction even when the joystick has been released. To slow the boat or reverse its direction, move the joystick in the opposite direction.

The docking function is designed to be used when docking or maneuvering in close quarters. Use the steering wheel and throttle control levers in all other situations.

The boat is maneuvered by moving the joystick forward, aft, abeam, twisting the top of the joystick and combinations of the movements.



P0016285



In order to achieve a diagonal movement, move the joystick diagonally and use the joystick knob to adjust the boat's direction accordingly.

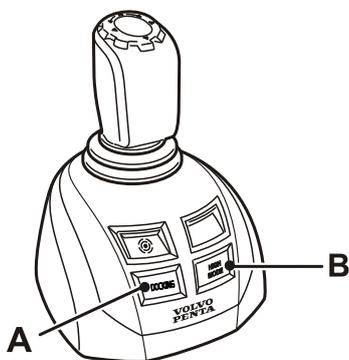
P0016286

High Mode

If extra power, e.g. when there is a strong wind or strong current, the High Mode function may be engaged.

Activate High Mode

- 1 Activate the joystick by depressing the docking button (A). An audible signal confirms that the joystick is activated and the docking button lights up.
- 2 Activate the High Mode function by depressing button (B) on the joystick.
- 3 An audible signal confirms that the function is activated and the high Mode button lights up.



P0012510

Disengage High Model

Disengage the function by pressing the button again. An audible signal will sound twice to confirm that docking mode is deactivated, and the light will go out. The system is now in normal docking mode.

Joystick Driving

NOTICE! Function Joystick Driving only works together with Volvo Penta autopilot.

The Joystick Driving function allows the joystick to be used during passage to adjust the boat's heading and maneuver the boat in the same way as with the autopilot and helm steering unit.

Throttle and gear shift controls work in the normal manner.

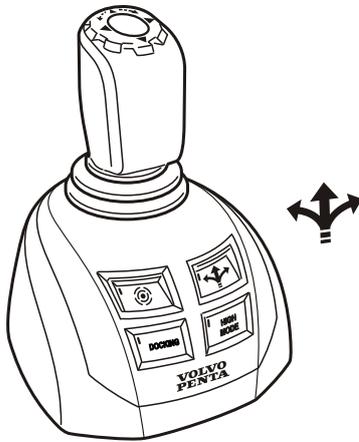
Learn to maneuver the boat with the joystick in calm, open waters.

Joystick Driving is activated and de-activated by pressing the  button on the joystick.

When Joystick Driving is activated the autopilot is also started. While the boat is under joystick control the autopilot is in standby mode; when the joystick is released to its central position the autopilot is activated and locks in on the new heading after a few seconds.

Like the autopilot, the helm steering unit is locked when the function is active but it may always be used for e.g. changing course or giving way for an obstacle. Twist the top of the joystick or move it sideways to reengage Joystick Driving.

If the autopilot is put in standby mode manually by means of the STBY button, Joystick Driving switched off and must be reengaged using the button on the joystick.



P0016372

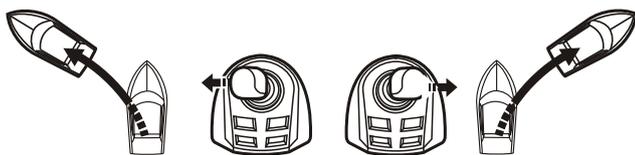


P0016293

Heading adjustments

Twist the top of the joystick to change heading incrementally. A short twist changes the heading by a fixed increment while a twist held firm will change the heading through several increments.

The autopilot shows the heading with a digital value and an indicator in shape of a blue triangle, a yellow arrow shows the new heading that the boat will be set to.



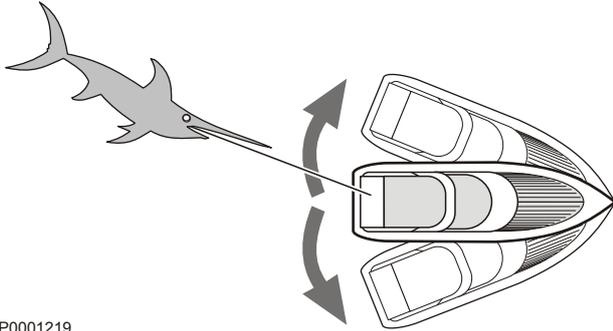
P0004011

Maneuvering

The joystick can also be used to maneuver the boat in the same manner as with a helm steering unit. Move the joystick sideways to steer the boat in the same direction. When the joystick is released the autopilot will set a new heading that corresponds to boat heading.

NOTICE! Full joystick movement to one side corresponds to full helm. Maneuvering abeam provides a faster response than adjusting the heading by twisting the top of the joystick.

Optional



P0001219

Sport Fishing Mode

The Volvo Penta sport fish function was developed for deep-sea fishing. When the function is activated, the IPS units are angled outwards and the helmsman can quickly rotate and maneuver forward/backwards to follow the movement of the fish. When activated, the wheel is disconnected and the boat is maneuvered solely via the control levers.

When the function is activated, the wheel is disconnected and the boat is steered with the control levers.

▲ WARNING!

There is a risk that the boat may take in water if the movements are too violent.

The single-lever function used together with the sport fish function makes it possible to control both engines using just one of the control levers.

Sport fishing

Switching on the sport fishing function

- 1 Move both control levers to neutral.
- 2 Press the sport fishing  button on the panel.

An audible signal and the message "Sport fishing activated" will be displayed on screen for 5 seconds to confirm that the function is activated.

If it is not possible to switch on the function, check that the controls are in neutral.

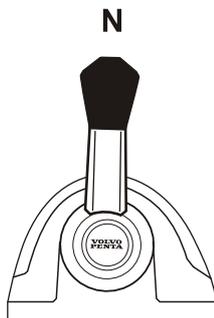
Switching off the sport fishing function

When the function is switched off, both IPS units are set to dead ahead.

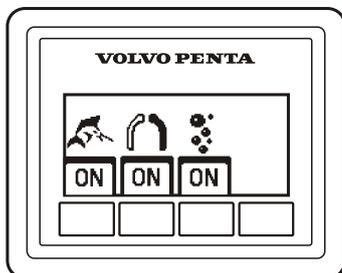
IMPORTANT:

If the controls are at full throttle when the function is switched off the boat will accelerate forward.

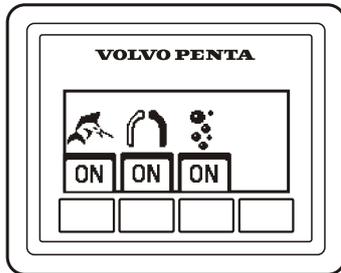
- 1 Exit the function by pressing the sport fish button on the panel. An audible signal and the message "Sport fish deactivated" will be displayed on screen to confirm that the function is on.
- 2 It is also possible to exit the function by turning the wheel more than 30 degrees.



P0012457



P0002114



P0002114

Single lever

Switching on the single-lever function

- 1 In order to activate the single-lever function, put the control levers in neutral.
- 2 Press the  button to switch on the single-lever function.
An audible signal and the message "Single lever activated" will be displayed on screen to confirm that the function is on.
- 3 When the single-lever function is activated, the lever that is moved from its position first becomes the control lever for both engines.
The other control lever has no function as long as the single-lever function is activated.

Switching off the single-lever function

- 1 Move the levers to neutral.
- 2 Press the single lever button. A double audible signal and the message "Single lever deactivated" will be displayed on screen to confirm that the function is off.

Clear Wake Exhaust System

When running at idle it is possible to select exhaust discharge above the waterline, which provides improved comfort, lower noise and reduced vibrations in the boat.

- 1 Press the  button to switch the function on and off.

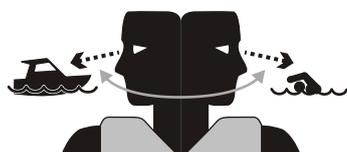
Dynamic Positioning System

Volvo Penta IPS Dynamic Positioning system (DPS) is a function that aids holding a selected position and compass heading by means of a GPS signal. The function is intended as an aid e.g. while waiting for a berth or for a bridge to open.

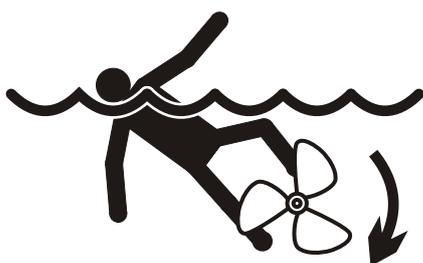
From a legal standpoint, the boat is under way when the DPS is activated. The operator has the same responsibility regarding supervision and maneuvering as when making way through water. The helm station must remain attended.

It is the operator's responsibility to inform passengers of the risks and make sure no persons or any other boat or object that can be affected by the operation of the DPS function are in the water near the boat. When DPS is active, precision is affected by wind, waves, current, and GPS signal strength. Keep away from swimmers or any other boat or object when DPS is active. The dynamic positioning system can be affected by strong electromagnetic signals as created by radar and radio transmitters. Maintain a safe distance, with a minimum of 2 boat lengths to any object.

Show consideration! When the DPS is active, it gives rise to noise and heavy propeller wash that may annoy those around. You are responsible for the wake from your boat.



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⚠ WARNING!

Check that nobody is in the water before engaging DPS. Maintain a safe distance, with a minimum of two boat lengths to any object.

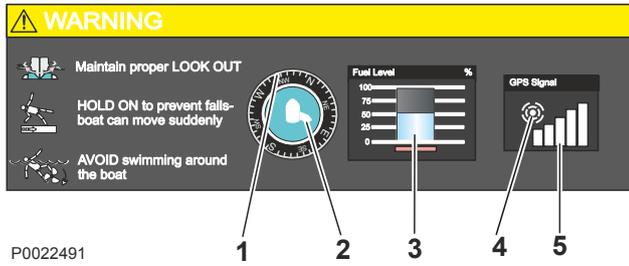
Never use it in, or near, areas where people could be in the water. Personal injury could result from contact with propellers.

⚠ WARNING!

With DPS active, the propellers are spinning to keep the boat in position, creating a slipstream. Keep away from people in the water. Personal injury could result from contact with propellers.

⚠ CAUTION!

When DPS is in use, the boat may move unexpectedly. The operator should inform passengers of the possibility of abrupt movement and to hold on to prevent falls.



Overview

The DPS view is shown when the DPS function is activated.

- 1 Bearing
- 2 Direction of movement
- 3 Fuel level
- 4 DPS symbol
- 5 GPS signal strength

Activating the DPS

The DPS can only be activated when boat speed is below 3 knots.

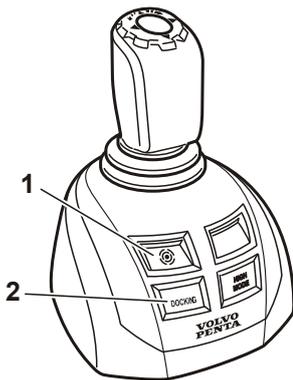
The function remains active for a maximum of 12 hours.

Activating the DPS at the Main Helm Station

- 1 Make sure that swimmers and boats or other objects are more than two boat lengths away.
- 2 Move the control levers to neutral.
- 3 Press the DPS button (1). An audible signal confirms that the DPS is active and the button light is lit. The screen shows the DPS view.

Activating the DPS at the Docking Station

- 1 Make sure that swimmers and boats or other objects are more than two boat lengths away.
- 2 Press the DPS button (1). An audible signal confirms that the DPS is active and the button light is lit.



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Deactivating the DPS

The DPS can be switched off in one of the following ways:

- Moving the control levers out of the neutral position.
- Pressing the DPS button (1).
- Activating the joystick with button (2).

Two audible signals confirm that the DPS function is switched off and the DPS button (1) light goes out.

DPS messages

Messages When Active

Should a disturbance occur, the operator is warned by an audible alarm and a message is displayed on the screen. The message describes what has occurred and DPS function status.

Acknowledge the message by pressing OK on the panel or the knob on the control panel, the audible alarm will stop.

Following is a list of messages resulting from potential disturbances:

- **The boat has lost the selected position. The DPS is working to find the selected position.**
- **The boat has lost the selected heading. The DPS is working to find the selected heading.**
- **The DPS function has switched off. The slip function is no longer accessible.**
- **Unreliable GPS signal. The DPS function may be switched off.**

Messages When Activating

Should a disturbance occur that prevents activating DPS, a message is displayed on the screen. The message describes why the DPS cannot be activated.

- **GPS signal too weak. DPS will not be activated.**
If the GPS signal is too weak it may help to wait a moment since the signal might be temporarily weak. Alternatively move the boat to a new position. Bridges, cranes and tall buildings might obscure the GPS signal and disturb the function. Check that the antenna has free range.
- **DPS cannot be activated. Too few drivetrains accessible. Check that all engines are running. Take action on possible faults.**
All engines must be running in order to engage the DPS. Make sure all engines are running. Make sure there are no messages that needs to be acknowledged and attended to.
- **DPS cannot be activated. Control lever(s) not in neutral. Move lever(s) to neutral and activate the DPS.**
The control lever(s) must be in neutral position in order to engage the DPS.
- **DPS cannot be activated. The boat speed is too high. Reduce speed to 3 knots and start the DPS.**
- **DPS cannot be activated. The slip function is no longer accessible. Take action on possible faults.**
The slip function needs to be functioning in order to engage the DPS. If the slip function isn't calibrated or if a malfunction has occurred it will not be possible to engage the DPS. Make sure there are no messages that needs to be acknowledged and attended to.
- **DPS antenna failure. DPS will not be activated.**

Battery Management System

The Battery Management system helps to ensure availability and robustness in power supply to the starter and other power consumers on board.

Depending on installation, the local controls on the Battery Management unit(s) or both the local controls and the Battery Management Display can be used to control the system.

Local Control

The keypad on the BCM has four buttons, 3 for switches and one to disable remote control of the BCM. The switches not only switch power supply on and off but are also able when necessary to cross connect the service battery to the starter motor circuit when the start battery does not provide sufficient power to the starter motor.

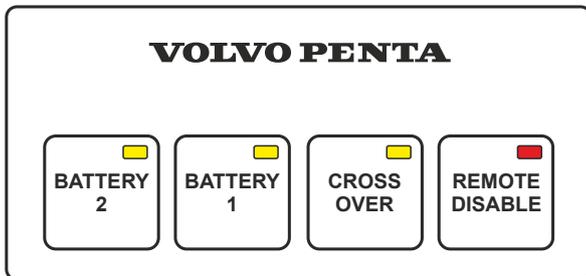
- BATTERY 1: Turns off/on the power supply for start motor and any power-user.
- BATTERY 2: Turns off/on the power supply for selected accessories.
- CROSSOVER: Crossover function. Activates cross over function between the batteries connected to the BCM. To secure power-supply.

Remote disable

In order to prevent inadvertent activation of the breakers (via the Battery Management display or external wired switches) when working on the boat's electrical system, remote control of the breakers can be deactivated.

Press REMOTE DISABLE (red LED on the button lights up) for deactivation of remote control. The breakers can still be controlled locally on the BCM.

Deactivation/activation is synchronized between all BCMs in the network.



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Remote disable.

Battery Management display

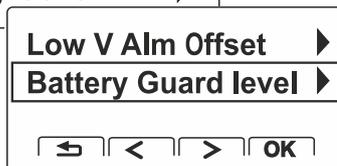
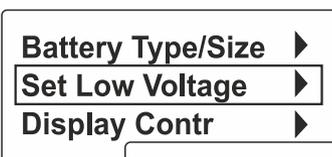
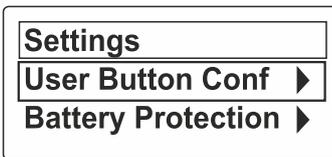
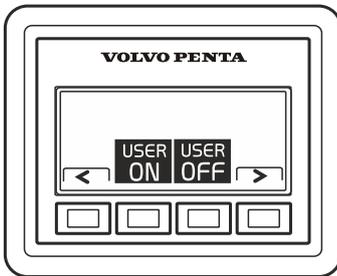
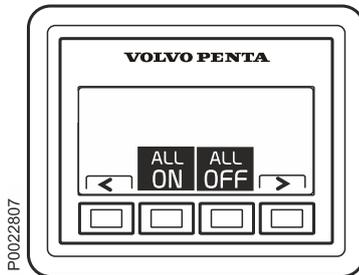
The menus are dynamic depending on the installation. Information about the battery's voltage as well as menus for battery control and settings are shown as standard.

Warning messages and other pop-up messages are also shown here. At start or during standby mode the display reverts to the view last shown.

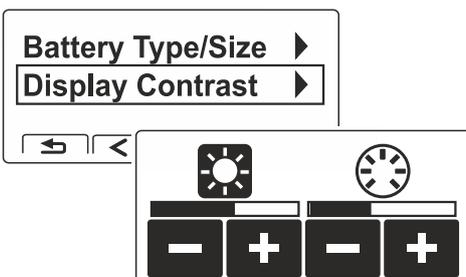
    Scroll through the menus.

 Return to the previous menu.

 Proceed through the menus/confirm selection(s).



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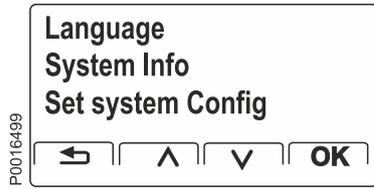
Settings

Manage and set viewing of drivelines, groups, batteries and alarm levels in the Battery Management display.

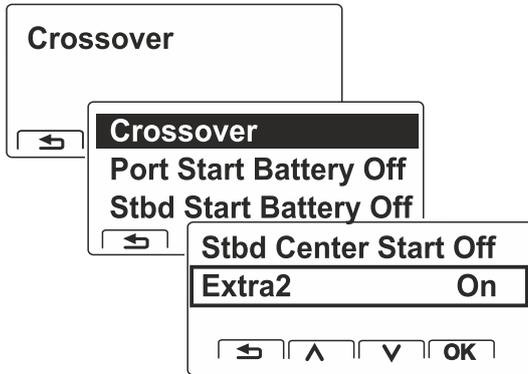
User Button Configuration. Battery and Accessory Groups. Set selection of groups to be affected by User ON and User OFF. The selected groups will then be handled simultaneously by: All ON respective All OFF.

Battery protection. Set alarm limits and levels for each battery. The values form the basis for when specified levels will alert/switch off to prevent total power loss or battery getting damaged or drained. The menu includes settings for Start Aid and Start Aid Level .

Display Contrast. Adjustment of contrast and backlighting.

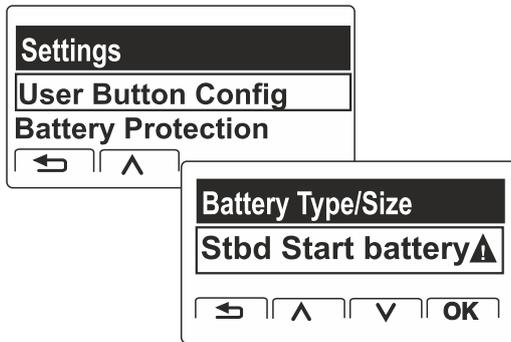


Stand-alone system, non EVC installations also have the menus Language, System Information and Set System Configuration.

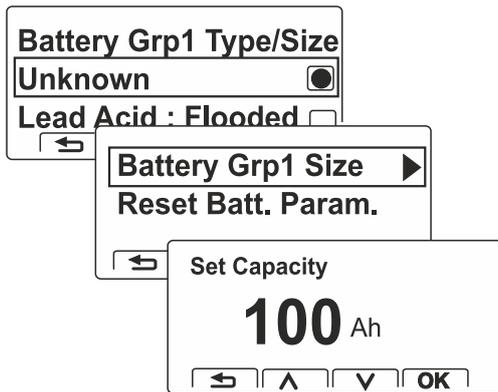


Crossover Activate/deactivate the function for each individual BCM.

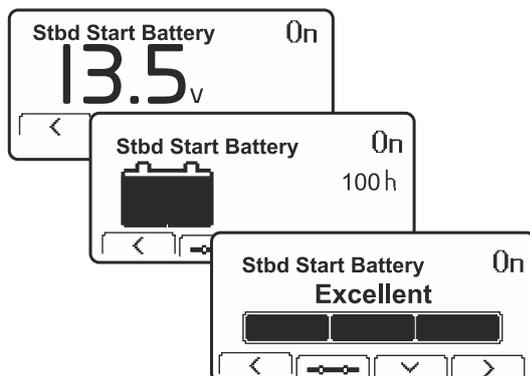
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Settings for Battery Sensor

▲ The symbol indicates that settings are required.

Battery type/size. State the values stated on the manufacturer's battery. These form the basis for the information shown in the display.

If a new battery or a battery sensor has been connected or removed, select **Reset** and set the current values.

NOTICE! Battery type/size is important so that the system is able to present accurate and correct information.

View Voltage/current

Relevant voltage and current in the battery.

Press to view:

Charging

Shows remaining capacity (%) (based on the battery's capacity when it was new) and hours remaining until battery is empty. During operations, the number of hours are shown until the battery is empty, and when the battery is charged, the number of hours are shown until a fully-charged battery.

Pressing again shows:

The battery's health status

The value shown is based on full capacity when the battery was new. The battery can have the following status:

- **Excellent** – no action required.
- **Good** – good status but the battery will not achieve its full capacity.
- **Poor** – replace the battery.

The batteries' status (On/Off) for the driveline is shown with a symbol at the bottom of the Battery Management display = Off.

Active Corrosion Protection

Active Corrosion Protection (ACP) is a system developed to provide optimum IPS unit corrosion protection in salt water and brackish water.

ACP has three levels of protection that can be monitored by the boat's electrical system. Presentation of protection status on boat displays can be selected in **Vessel View**.

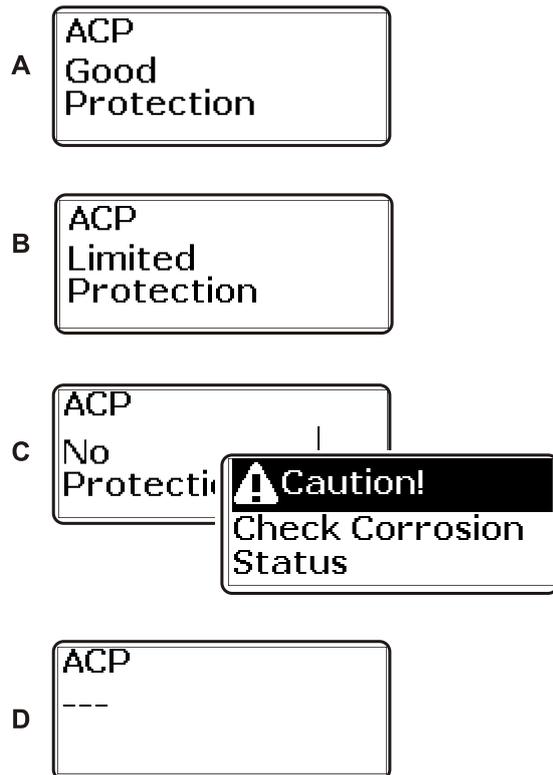
When the system is active a small amount of chlorine gas is given off. If the smell is disturbing, the ACP function can be temporarily switched off. For more information refer to *Setting Protection Level*. The system may be switched off for a maximum of 4 hours during which time the IPS unit is protected against corrosion by means of the secondary system, refer to *Protection Levels* for more information.

The ACP reverts automatically to normal mode after 4 hours. If you wish to leave chlorine-free mode earlier do so via the settings menu or by switching on the ignition.

When berthed, the boat should be connected to shore power where provided. If shore power is lacking the ACP uses the boat's batteries. If the batteries begin to run down, disconnect the ACP and switch to the secondary system.

NOTICE! To avoid false alarms from the system when running in freshwater environments where corrosion is not so aggressive the function should be rendered inactive. The IPS unit is protected by the secondary system even when ACP is inactive.

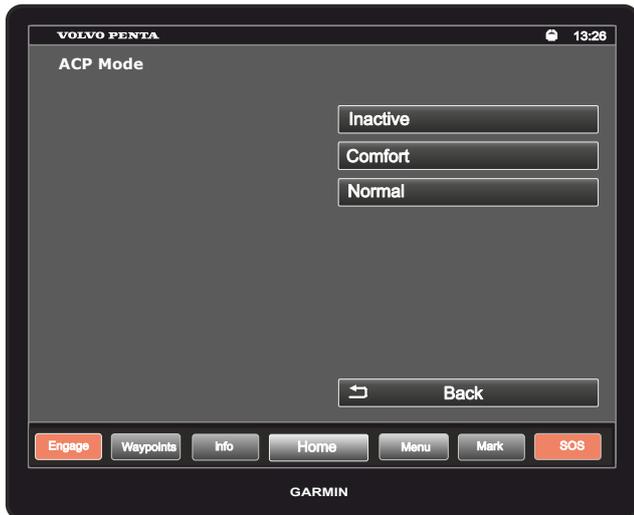
Set the ACP to normal mode if the boat is move to a more aggressive environment.



P0012970

Protection Levels

- A Good Protection (Good Protection)** – the IPS unit is optimally protected by the ACP function. The ACP adapts automatically to the corrosion environment the boat is in.
- B Limited Protection (Limited Protection)** – secondary protection. The IPS has full corrosion protection from the zinc anode installed in the ACP unit on the transom (secondary protection).
Check that the batteries are being charged by shore power; alternatively, start the engine so that the alternator charges the batteries.
When the boat is in saltwater or brackish water, and if the system remains in this mode for more than 1–2 weeks after shore power is connected or an adequate battery charge is achieved, a system check service should be sought.
- C No Protection (No Protection)** – risk of corrosion, system alarm.
Seek system check service.
- D** If the ACP is set to inactive the system cannot identify ACP status; three lines will be shown on the display. Should this occur when the system is not set to inactive, seek service for checks. The three lines are also shown for just under one minute when ignition is switched on before current protection level can be shown.



P0022480

Setting Protection Level

ACP has three levels of protection, which are selected in the settings menu.

- A Normal (Normal), means that protection is active and functioning in the best way for the conditions the boat is in.
- B Comfort (Chlorine Free); the system has switched over to protection from the zinc anode for 4 hours and no chlorine gas will be given off.
- C Inactive (Inactive Only at Haul) – this mode may only be used when the boat is taken out of the water, is on land or if it is to be run in freshwater. Select this mode before the boat is lifted out of the water to avoid false alarms. In this mode the IPS no longer monitors corrosion conditions, but the IPS is protected by the zinc anode.

When ignition is switched on the system is restarted and goes to Normal mode.

Settings Menu

Navigate to ACP Mode in the settings menu, **Settings** > **My Vessel** > **ACP Mode**. Select ACP level.

Volvo Penta Interceptor System

The Volvo Penta interceptor system is a trim system that uses interceptors installed on the transom to act on a boat's running characteristics and provide a safer, more comfortable passage regardless of weather conditions.

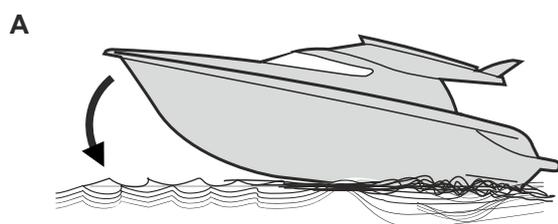
The IS system affects a boat's running characteristics at speeds of ≈ 10 knots and above.

Each interceptor has a blade that extends by varying amounts, depending on the preferred effect, and trims the boat in three axes. The IS system is available in two versions, manual and auto.

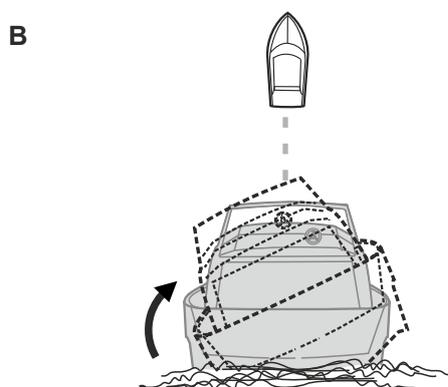
Manual means the helmsman controls the interceptor blades using control buttons.

Auto means the system is pre-calibrated and interceptor blade control is completely automatic to provide optimum safety and comfort.

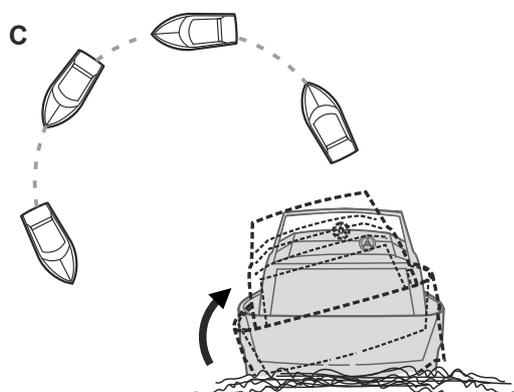
For further information refer to *Operation, page 48*:



- A Trimming angle of attack (the angle between the bow and the surface of the water). Improves the helmsman's visibility to provide safer passage.



- B Trimming roll angle when moving dead ahead. Compensates boat heel to improve comfort e.g. when the boat is unevenly laden or in a side wind.



- C Trimming roll angle in turns. Compensates boat heel, improves the helmsman's all-round visibility and provides for a more pleasant passage.

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Operation

⚠ CAUTION!

Learn to manage the system and how it affects your boat in a safe and proper manner at calm conditions.

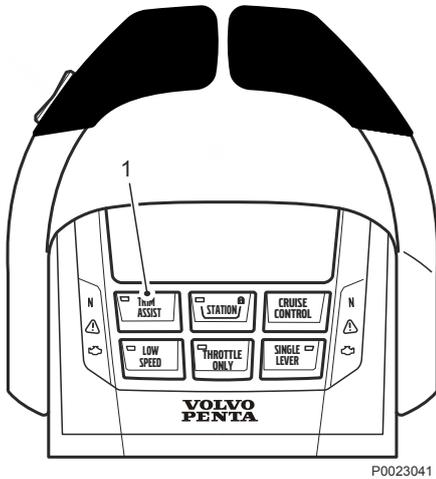
Auto

Press the TRIM ASSIST button (1) to switch on the Auto function; The button's green lamp indicates that the function is on. The system now controls the interceptors automatically.

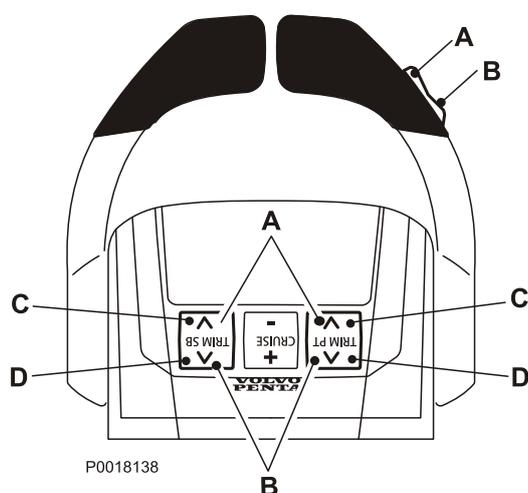
It is possible to switch between automatic and manual interceptor blade control in the Auto version. To take manual control, switch off the auto function by pressing the TRIM ASSIST button; when the button lamp is extinguished the function is off. The interceptor blades are now controlled entirely by the control buttons.

NOTICE! At start up, the system assumes the mode last selected, auto or manual.

The control buttons may be used to temporarily adjust boat trim even when the auto function is switched on. The auto function is still active but the system changes default mode. To revert to pre-calibrated auto mode, press the TRIM ASSIST button twice.



P0023041



Manual control using control buttons

Manual control of the interceptors is performed using the control lever buttons and the buttons at the back of the control.

- A All interceptors are trimmed **upward** simultaneously. The bow is raised.
- B All interceptors are trimmed **downward** simultaneously. The bow is lowered.
- C Port and starboard interceptors are trimmed **upward** individually. Used to correct heel.
- D Port and starboard interceptors are trimmed **downward** individually. Used to correct heel.

If both the port and starboard buttons at the back of the control are pressed at once all interceptors are trimmed in the same way as when using the control lever button.

In installations with four interceptors, the interceptors are trimmed in port and starboard pairs.

Screen Display

Interceptor blade position, i.e. how far the blades are extended, can be presented in one of the EVC system displays. The display will also indicate if the system is in auto or manual mode.

In installations with four interceptors, the interceptors are presented in port and starboard pairs.

Cleaning

The system automatically performs self cleaning by extending and retracting the blades once every 24 hours to prevent fouling of the interceptor blades. Self cleaning is performed whether or not the boat is in use.

During prolonged inactivity, e.g. winter lay-ups, self cleaning can be switched off by turning off the circuit breaker or disconnecting power.

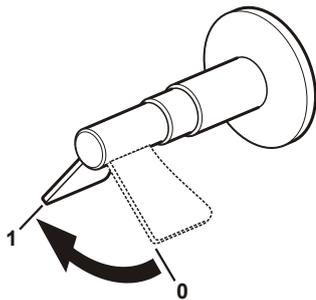
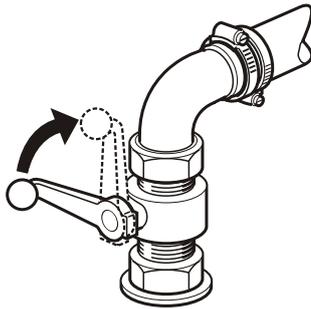
Starting

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 occurred, or is about to occur. Also check that instruments and warning displays show normal values when you have started the engine.

To minimize cold start smoke we recommend you install an engine heater or engine bay heater if temperatures below +5°C (41°F) are encountered.

⚠ WARNING!

Never use start spray or similar agents to start an engine. This may cause an explosion in the inlet manifold. Risk of personal injury.



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Before Starting

- Check the engine and drive units oil level.
- Check the coolant level.
- Open the sea cock.
- Open the fuel cock.
- Turn the main switches on.

IMPORTANT:

- Never disconnect the current using the main switches when the engine is running. The alternator and electronics could be damaged.
- Unlock the EVC system with the e-Key.
 - 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.

Starting the Engine

Shifting and adjusting speed is only possible at an active station. On a boat with one station, the station is always active.

The main station is automatically activated when the EVC-system is unlocked with the e- Key panel.

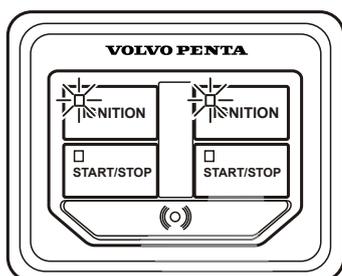
On a boat with two or more stations, the engine(s) can be started from another station with a start/stop panel – if the engine(s) are turned off. The station automatically becomes active when the engine(s) is/are started.

Put the Gear in Neutral

Put the drive/reverse gear in **Neutral** by moving the control lever(s) to **Neutral (N)** at all stations.



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Turn On the Ignition

A green light in the **IGNITION** button indicates that the ignition is on.

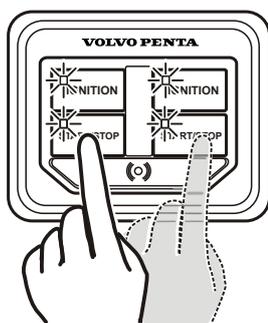
Press the **IGNITION** button to switch on the ignition if the green light is not shining.

Check the instruments

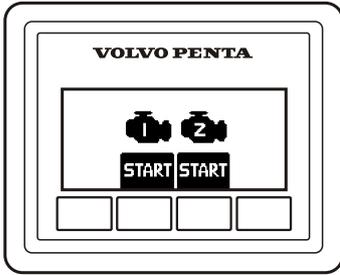
If a fault is registered, it will be shown in the display; please refer to *Fault Handling, page 60* for further information and recommended actions.

Starting Using the e-Key Panel

To start, press the **START/STOP** button once for each engine.



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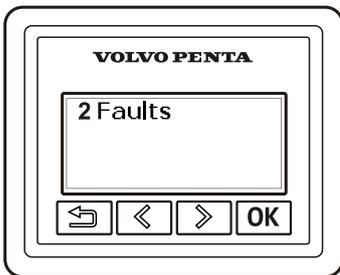
P0001087

Starting Using the Start/Stop Panel

Press the **START/STOP** button for each engine. Release the button as soon as the engine has started.

Overheating protection

If the starter motor is engaged for its maximum activation time (30 seconds), the starter motor circuit is automatically cut 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.



P0012800

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 messages are displayed and no warning signs are showing. If a fault is registered, please refer to section *Fault Handling, page 60* for further information and recommended actions. Warm the engine up at low speed and low load, so normal operating temperature is reached before full power is used.

IMPORTANT:

Never race the engine when it is cold. Racing the engine when it is cold may damage the engine components and decrease the engine lifetime.

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.

Alarms

All alarms and messages are shown in the information display. Some alarms also have an audible alarm and/or flashing light indication.

- 1 Read the message.
- 2 Acknowledge the alarm.
- 3 Perform any necessary action to remedy the fault, refer to *Fault Code Register, page 65*.

The fault will be stored in the system as long as it remains. It is possible to access the error code at an upcoming service.

Maneuvering

Shifting between forward and reverse is 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 a high engine speed, a safety function is automatically activated, and will delay shifting until engine speed has fallen to 1000 rpm.

Execute a Forward/Reverse Operation as Follows:

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

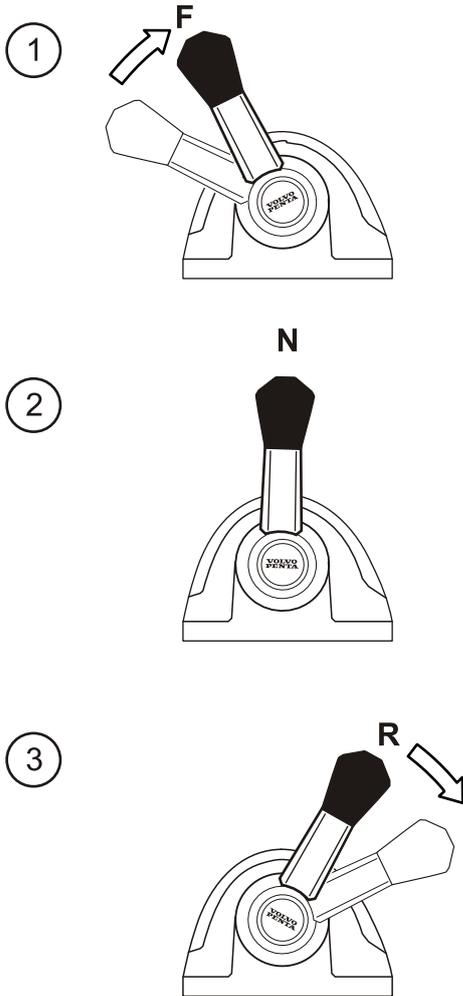
⚠ WARNING!

Never shift to reverse when the boat is planing.

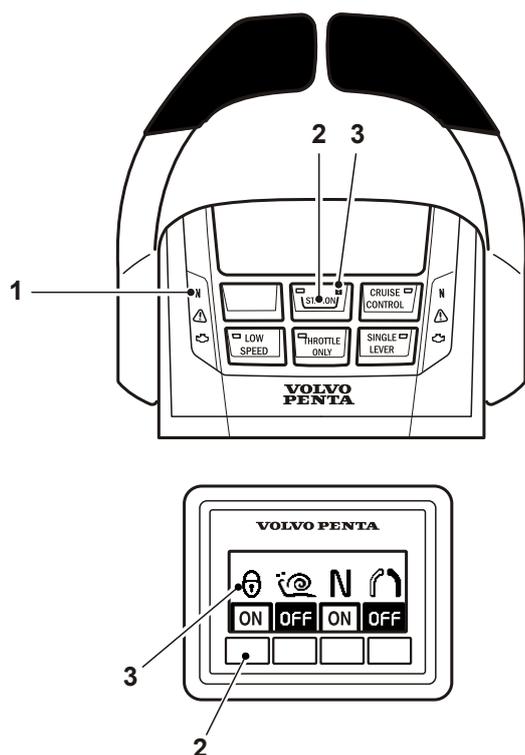
- 2 Move the control lever to **Neutral (N)** with a rapid, distinct movement. Make a brief pause.
- 3 Move the control lever to **Reverse (R)** with a rapid, distinct movement and increase engine speed.

IMPORTANT:

To avoid water entering the stationary engine via the exhaust pipe, it is important that all engines are running during reverse maneuvers.



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Helm Station Change

- 1 Move the control lever(s) to neutral (**N**).
The neutral lamp (**1**) on the control lights up when the drive is in neutral.
- 2 If the helm station is locked, unlock it by pressing the **STATION** button (**2**). The padlock icon light (**3**) is switched off, indicating that the station is unlocked.
- 3 Activate the helm station being occupied by pressing the **STATION** button (**2**).
The lamp in the control button will light up when the helm station is active.

If the helm station is inactive, the lamp will be switched off.

If the padlock icon (**3**) flashes, the helm station cannot be activated. Another helm station is active and locked, or unlocked with a drive selected (not in neutral).

Locking/Unlocking Helm Stations

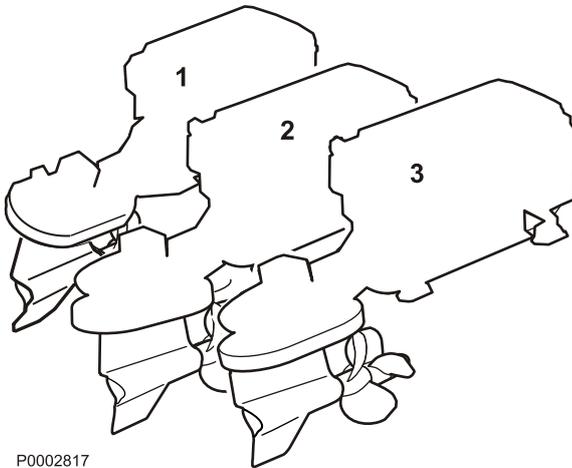
If a helm station is locked, it will only be possible to start and stop the engine or change helm stations from the locked helm station.

Lock or unlock an active helm station by pressing the **STATION** button (**2**).

The padlock icon (**3**) lights up when the helm station is locked.



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Cruising Speed

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

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

If the engine does not reach its maximum throttle range it can depend on a number of factors mentioned in the *Fault Handling, page 63* section.

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

Triple installation

Since the center propulsion unit is installed in a tunnel a slight efficiency loss for engine 2 is to be expected at cruising speed and wide open throttle.

At cruising speed engine 2 will show slightly higher fuel burn than engine 1 and 3. At wide open throttle engine 2 will run at a slightly lower RPM (-40–80 RPM) than engine 1 and 3.

Synchronizing Engine Speed

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

- 1 The engine speed levers for both engines are in (approximately) the same position.
- 2 The engine speed levers are in a forward position.

The synchronizer is disengaged as soon as the conditions are no longer met or if the engines reach maximum throttle.

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

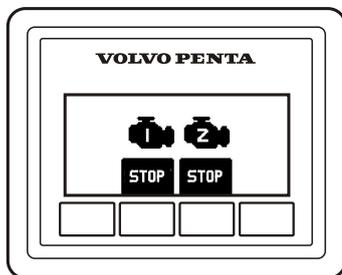
IMPORTANT:

Never disconnect the current using the main switches when the engine is running.

The alternator and electronics could be damaged.

IMPORTANT:

Make sure the ignition is turned off before the main switches are switched off. Otherwise the alternator and electronics could be damaged.



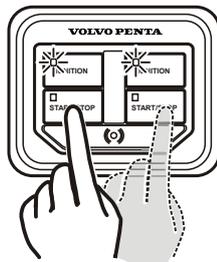
P0013099

Stopping Using the Start/Stop Panel

- 1 Disengage the drive/reverse gear by putting the control lever in **Neutral (N)**.
- 2 Stop the engine(s) by pushing the **STOP** button(s).

Stopping Using the e-Key Panel

- 1 Disengage the drive/reverse gear by putting the control lever in **Neutral (N)**.
- 2 Push the **STOP** button(s). Release the button(s) when the engine(s) has/have stopped.



P0016518

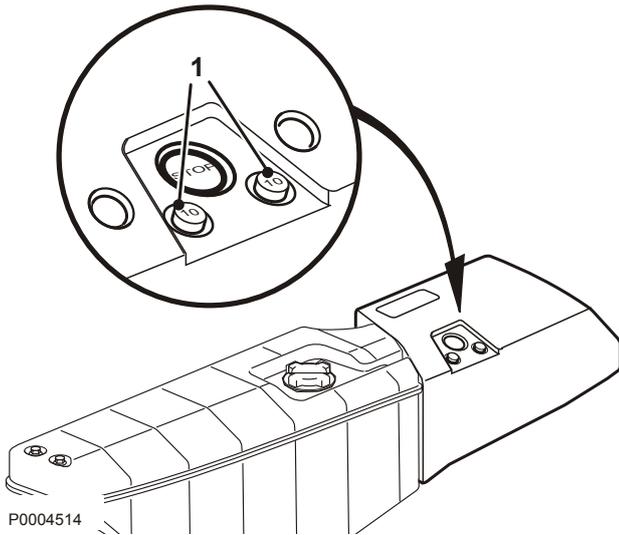
Turn the Ignition Off and Lock the EVC system

To turn the ignition off, press the **IGNITION** button. The green lamp in the **IGNITION** button is switched off to indicate that the ignition is off.

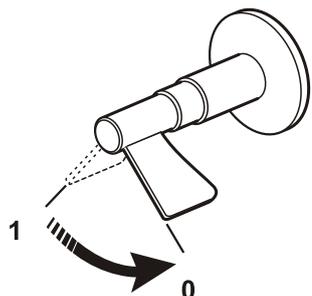
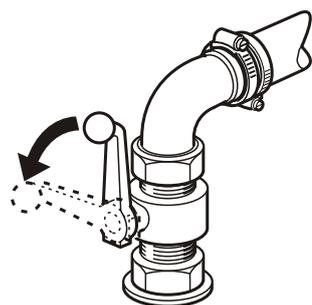
To lock the EVC system, hold the key fob in front of the  symbol on the e-Key panel. A flashing red light indicates that the system is locked.

Emergency Stop Switch

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



After Engine Shutdown



P0010432

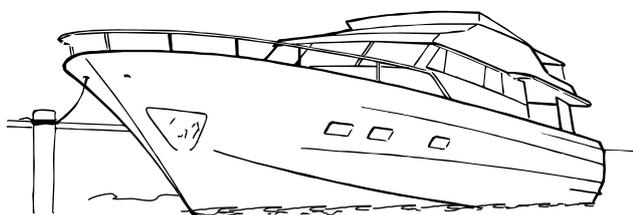
- Check the engine and engine bay for leakages.
- Close the fuel taps.
- Close the sea cock.
- Take an hour meter reading and carry out preventive maintenance according to the maintenance schedule.
- Turn off the main switches before any long stoppage.

Operation Break

Operation break with the boat in water

If the boat is not used, but left in the water, we recommend you to warm up the engine at least once every fortnight. This will prevent corrosion damage in the engine.

If you expect the boat to be unused for two months or more, we recommend you to preserve the engine, please refer to *Storage*.

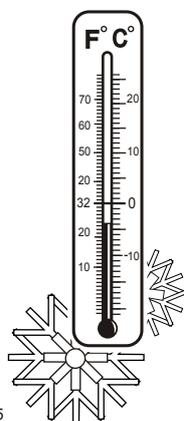


P0003077

Cold Weather Precautions

If the engine bay cannot be kept frost free, the sea water system must be drained and the freshwater system coolant must have sufficient frost protection to prevent frost bursting; refer to *Maintenance, page 91* and *Draining the Seawater System, page 96* respectively for more detailed information.

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



P0005905

Fault Handling

Despite regular maintenance according to the maintenance schedule and perfect operation conditions, faults that need to be attended to during travel, may occur. This chapter describes some possible alarms and fault handling. Note that the content of this chapter does not provide full coverage of the possible fault messages and alarms. Contact a Volvo Penta workshop for assistance with diagnostic readouts and unresolved faults.

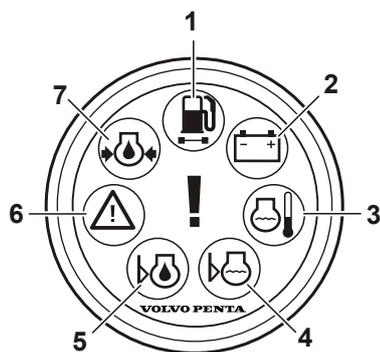
Alarm Handling

If a fault is discovered, the driver is warned via a buzzing alarm and a message in the display.

Refer to *Fault Code Register, page 65* for more information regarding cause of fault and measures to take.

The engine, transmission and EVC system are monitored by the diagnostic function. Should the diagnostics function discover a malfunction, it will ensure continued operation by protecting the engine. Depending on how serious the malfunction is, the affect on the engine will vary.

- 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.
- Serious malfunction on transmission or in the engine fuel injection system.
Affect on engine: Engine is stopped.



P0004761

Alarm Display (Optional)

If a lamp in the alarm monitor flashes, it means a malfunction has been detected.

- 1 If the orange **Water in Fuel** lamp is lit, there is too much water in the water separator on the fuel prefilter.
- 2 If the **Charging** lamp is lit, the alternator has stopped charging.
- 3 If the **Coolant Temperature** lamp is lit, the coolant temperature is too high.
- 4 If the orange **Coolant Level** lamp is lit during operation, the coolant level is too low.
- 5 If the orange **Oil Level** lamp is lit during operation, the engine oil level is too low.
- 6 If the red **Warning** lamp is lit during operation, a serious malfunction has been detected.
If the orange **Warning** lamp is lit during operation a malfunction has been detected.
- 7 If the red **Oil Pressure** lamp is lit during operation, the engine oil pressure is too low.

Acknowledge message

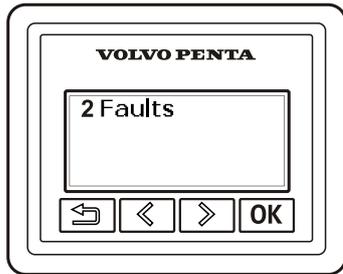
To acknowledge fault message in the panel follow this procedure:

- 1 Push the OK button on the panel to acknowledge the alarm. The alarm buzzer is turned off.
- 2 Read the alarm or message in the popup.
- 3 Select OK a second time and the popup disappears.

Faults List

NOTICE!

In Glass Cockpit Displays, the faults are listed in Warning Manager. For information about how to deal with the fault messages in Warning Manager, see the integrated Glass Cockpit Operator's Manual. Go to **Info > Owner's Manual** to see the manual in the display or download the latest manual on www.garmin.com.



P0012800

Information Display

The number of registered faults is displayed in the Information Display.

- 1 Press the **OK** button to navigate to the submenu.
- 2 If more than one fault is registered, use the arrow buttons to browse through the fault list.
- 3 Press the **OK** button twice to see information about the cause of the fault and the corrective action.
- 4 Return to the previous menu by pressing the  button.

Deleting Faults From the List in Information Display

Acknowledged faults are automatically deleted from the fault list when the ignition is turned off. Stop the engine and check that the ignition is turned off at all helm stations. The faults are still stored in the system and can be accessed via diagnostic readout by a Volvo Penta workshop.

When system power is reconnected, any remaining faults are displayed on the screen.

Faults that have not been remedied must be acknowledged every time system power is switched on.

Fault Tracing

A number of symptoms and possible causes of engine malfunctions are described in the table below. We recommend that you always contact your Volvo Penta dealer if problems occur which you cannot resolve by yourself.

NOTICE! Read through the safety advice for care and maintenance work in the *Maintenance, page 78* chapter before starting work.

| Symptoms and possible causes | |
|---|--|
| Pop-ups are shown in the tachometer display | See chapter <i>Fault Code Register</i> |
| Engine cannot be stopped | 2, 4, 5, 7, 8 |
| Starter motor does not rotate | 1, 2, 3, 4, 5, 6, 8, 9, 10, 36, 39 |
| Starter motor rotates slowly | 1, 2 |
| Starter motor rotates normally but engine does not start | 1, 11, 12, 13, 14, 38, 39 |
| Engine starts but stops again | 1, 11, 12, 13, 14, 19, 37, 39 |
| Engine does not reach full operating speed at full throttle | 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 34, 37, 39, 40 |
| Engine runs unevenly | 14, 15, 40 |
| Engine vibrates | 24 |
| High fuel consumption | 15, 16, 18, 21, 37 |
| Black exhaust smoke | 19 |
| Blue or white exhaust smoke | 21, 35 |
| Lubrication oil pressure too low | 22 |
| Coolant temperature too high | 25, 26, 27, 28, 29, 30, 31, 32, 33 |
| Coolant temperature too low | 32 |
| No charge or poor charge | 2, 27 |

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

17. Cabling to unit injector damaged
18. Faulty unit injectors
19. Insufficient air supply to engine:
 - blocked air filter
 - air leakage between turbocharger and engine inlet manifold
 - fouled compressor section in turbocharger
 - faulty turbocharger
 - poor engine bay ventilation
20. Excessive coolant temperature
21. Coolant temperature too low
22. Oil level too low
23. Faulty / wrong propeller
24. Faulty engine mounting
25. Coolant level too low
26. Air in the freshwater system
27. Drive belt broken/slips
28. Faulty circulation pump
29. Closed seawater inlet
30. Blocked seawater inlet/pipe/filter
31. Defective impeller in seawater pump
32. Defective thermostat
33. Blocked heat exchanger insert
34. Blocked charge air cooler
35. Oil level too high
36. Water entry into engine
37. High back pressure in exhaust system
38. Faulty engine speed sensor
39. Stored fault codes
40. Check valve in feed pump leaks

Fault Code Register

CAUTION!

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

When a malfunction is discovered the helmsman is warned by a sound alarm and at the same time a message is shown in the display.

This chapter gives a more detailed description of the messages together with suggested actions to take.

Contact your Volvo Penta dealer if the fault remains after trying the corrective actions associated with the fault.

Emergency Stop Switch

Possible cause: The auxiliary stop has been activated.

Corrective action: Reset the auxiliary stop. Refer to *Auxiliary stop*.

Battery Voltage

Possible cause: The alternator output voltage is too low.

Corrective action:

- Check the battery. Refer to *Battery, page 102*.
- Check belt tension. Refer to *Drive Belt, page 81*.

Check Corrosion Status

Possible cause: The active corrosion protection (ACP) is not available.

Corrective action: Check that the batteries are charged by land current or by the alternator.

Check Control Lever

Possible cause:

- Shift and throttle incorrect.
- Slip function not available.

Corrective action: Acknowledge the fault by moving the control to **Neutral** and press the **OK** button. Engine power is reduced and the gear is automatically set to **Neutral**.

Check Engine

Possible cause:

- Battery voltage is incorrect.
- The fuel pressure is incorrect. Engine performance might be affected.
- Communication failure automatically sets the gear to **Neutral**. Engine performance might be affected.
- The oil pressure is too low and the engine power is reduced.

Corrective action:

- Check the battery. Refer to *Battery, page 102*.
- Check the oil level and that there is no leakage. Refer to *Oil Level, page 83*.

Check EVC System

- Possible cause:
- Limited or no steering.
 - Shift and throttle are unavailable and the gear has automatically been set to **Neutral** as engine power is reduced and the helm station has lost communication with the engine.
 - Control panel failure.

- Corrective action:
- Use alternative helm station if possible.
 - Check if any buttons are stuck.

Check Joystick

Possible cause: Joystick failure.

Corrective action: Check if any button has stuck. Use steering wheel or choose alternative station.

Check Multilink

Possible causes: Limited instrumentation — the control unit has a communication fault.

Corrective action: Contact your Volvo Penta workshop.

Check transmission

- Possible cause:
- The gear is automatically set to **Neutral** and it is not possible to shift the gear until the fault has been acknowledged.
 - The gear shift is malfunctioning.
 - The slip function is limited.
 - **Lowspeed** is not available.
 - Transmission oil pressure is not available.
 - Transmission oil temperature is not available.
 - The engine is automatically emergency stopped.

- Corrective action:
- Acknowledge the fault by moving the control to **Neutral** and press the **OK** button.
 - Check transmission oil level.

Check Shift Actuator

Possible cause: The gear shift is unavailable.

Corrective action: Acknowledge the fault by moving the control to **Neutral** and pressing the **OK** button.

Check Steering Wheel

Possible cause: Steering is limited or unavailable.

Corrective action: Contact your Volvo Penta workshop.

Coolant Level

Possible cause: The coolant level is too low. The sensor cable is disconnected.

Corrective action:

- Check the coolant level and also check for leakage. Refer to *Coolant Level, Checking and Topping Up, page 92*.
- Check the sensor cable connection.

Coolant Pressure

Possible cause: The coolant pressure is too low.

Corrective action:

- Check the coolant level. Refer to *Coolant Level, Checking and Topping Up, page 92*.
- Check that the seawater filter is not blocked. Refer to *Seawater Filter, page 99*.
- Check the impeller in the seawater pump. Refer to *Impeller, Check and Change, page 98*.
- Check that there is no leakage.

Coolant Temperature

Possible cause: The coolant temperature is too high.

Corrective action:

- Check the coolant level. Refer to *Coolant Level, Checking and Topping Up, page 92*.
- Check that the seawater filter is not blocked. Refer to *Seawater Filter, page 99*.
- Check the impeller in the seawater pump. Refer to *Impeller, Check and Change, page 98*.
- Check that there is no leakage.

Engine Oil Filter

Possible cause: There is an oil pressure difference and engine power is reduced.

Corrective action: Contact your Volvo Penta workshop.

Engine Oil Level

Possible cause: The oil level is too low.
NOTICE!
 In rough following seas or head seas, the system may incorrectly sense that the engine oil level is too low. If this happens, acknowledge the fault, and perform corrective actions just in case.

Corrective action:

- Check the engine oil level. Refer to *Oil Level, page 83*.
- Check that there is no leakage.

Engine Oil Pressure

Possible cause: Oil pressure is too low and the engine power is reduced.

Corrective action:

- Check the engine oil level. Refer to *Oil Level, page 83*.
- Check that there is no leakage.

Engine Oil Temperature

Possible cause: The engine oil temperature is too high and the engine power is reduced.

Corrective action:

- Check the oil level. Refer to *Oil Level, page 83*.
- Check that there is no leakage.

Engine Speed

Possible cause: Engine performance may be compromised and engine power is reduced.

Corrective action: Contact your Volvo Penta workshop.

Fuel pressure

Possible cause: The fuel pressure is too low.

Corrective action:

- Check the fuel level.
- Check that there is no fuel leakage.
- Check that the fuel filters are not blocked. refer to, *Maintenance, page 86*.

Fuel Temperature

Possible cause: The fuel temperature is too high.

Corrective action:

- Check the fuel level.
- Check that there is no fuel leakage.

Helm Restarted

Possible cause: The engine has lost communication with a helm station and engine power is reduced.

Corrective action: The helm station is automatically restarted.

Intake Manifold Temperature

Possible cause: Charge air temperature is too high and engine power is reduced.

Corrective action: Contact your Volvo Penta workshop.

Key Failure

Possible cause: A button on the e-Key panel is pressed down.

Corrective action: Verify that the button is not pressed down.

Primary Battery

Possible cause: Poor batteries or poorly charged batteries.

Corrective action: Change or charge batteries. Refer to *Battery, page 102*.

Secondary Battery

Possible cause: Poor batteries or poorly charged batteries.

Corrective action: Change or charge batteries. Refer to *Battery, page 102*.

Sensor Failure

Possible cause: A sensor failure may be affecting engine performance.

Corrective action: Contact your Volvo Penta workshop.

Steering failure

Possible cause: The helm station has lost communication with the steering actuator.

Corrective action: Please contact a Volvo Penta workshop.

Transmission Oil Pressure

Possible cause: The reverse gear oil pressure is too low.

Corrective action: • Check the reverse gear oil level.

Water in Fuel

Possible cause: Water has entered the fuel filter(s).

Corrective action: Empty the water trap underneath the fuel filters. Refer to *Maintenance, page 86*.

In Case of Emergency

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

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

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

If fault occurs, acknowledge any alarm and take the recommended measures. Please refer to this chapter and *Alarm Handling*, page 60.

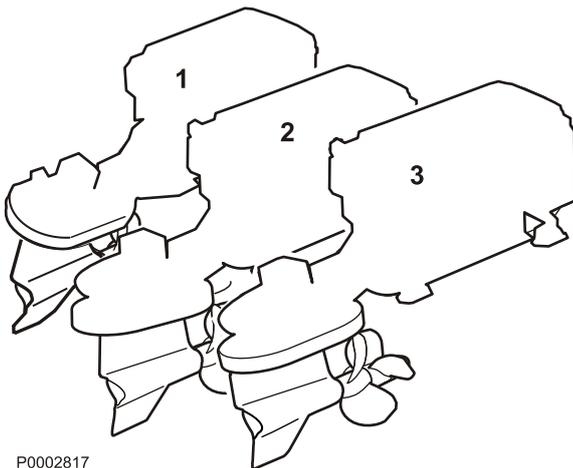
If one or two engine(s) stops working, or operates at reduced engine speed, do not operate at wide open throttle or high speeds unless the situation calls for it. The engine load for the engine(s) that is (are) still working will be much higher than it normally should be when all engines are working and this could cause excessive wear to the engine(s) and propulsion unit(s). Run the boat at low speed (max. 10 knots, 11.5 mile/h) to the nearest harbor for repair.

Triple installation

A boat with a triple 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 two 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 the engines and propulsion units on each side (1 & 3) are working it is also possible to operate the boat with the joystick.

Run the boat at low speed (max. 10 knots, 11.5 mile/h) to the nearest harbor for repair.



P0002817

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 at low 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.

Towing the Boat

Towing must only be carried out in an emergency situation to get help, not as a way to transport the boat.

All towing must be done in low speeds, at max. 10 knots (11.5 mile/h).

If the boat must be towed long distances then the propellers has to be removed.

Starting Using Auxiliary 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 cable (-) come in contact with the positive connection on the starter motor.

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

▲ WARNING!

Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

▲ WARNING!

Do not touch the connections during the start attempt: Risk of arcing.
Do not bend over any of the batteries either.

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

Emergency Steering

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.

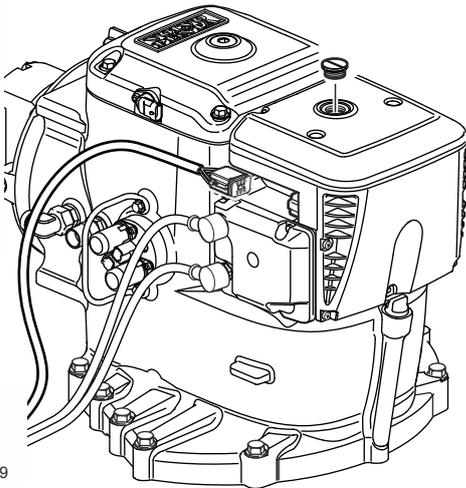
If steering is out of order on all propulsion units, align all propulsion units and use control levers to steer the boat.

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

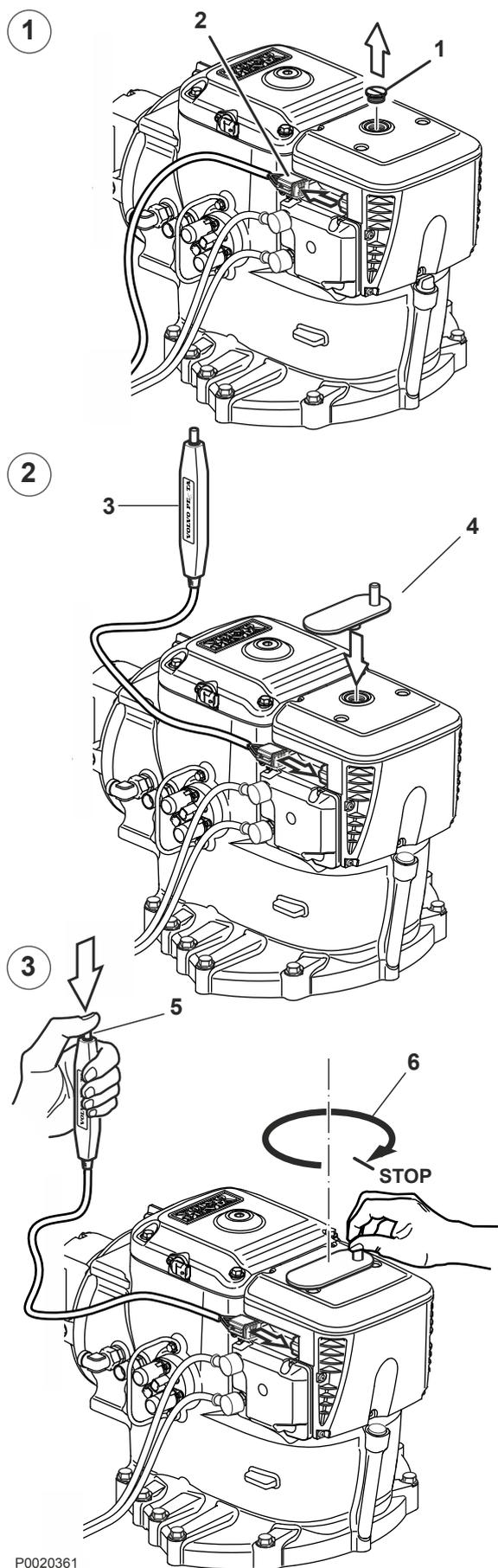
▲ WARNING!

Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

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.



P0021579



P0020361

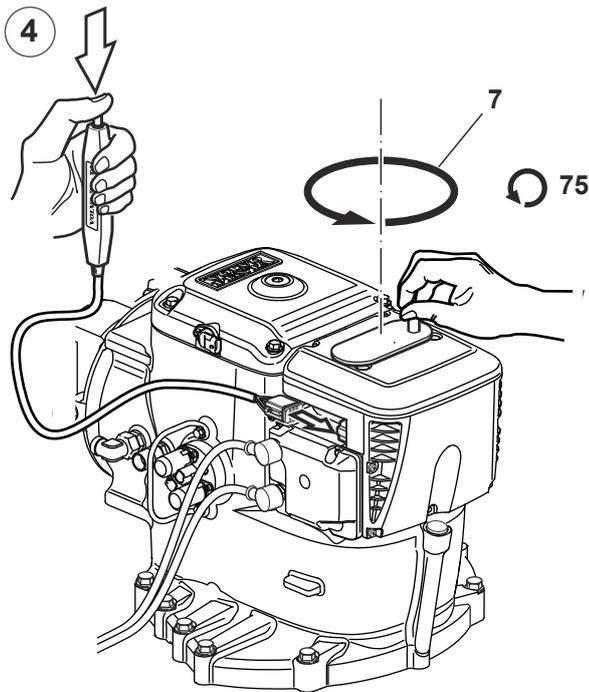
- 1 Unscrew and remove the plug (1). Disconnect the cable by pressing down the lock (2) and at the same time wiggle the connector in forward position.
- 2 Connect the switch (3) and fit the yellow crank tool (4).
- 3 Press down the switch button (5) and keep it pressed while turning the crank tool carefully to an end position (6). When the end position is reached, stop turning. The end position feels like a compression spring.

IMPORTANT:

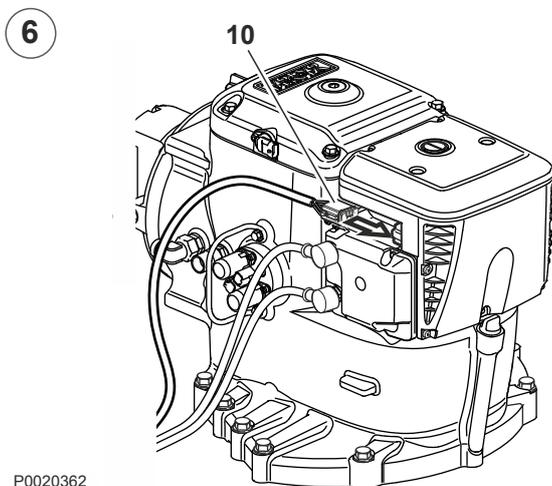
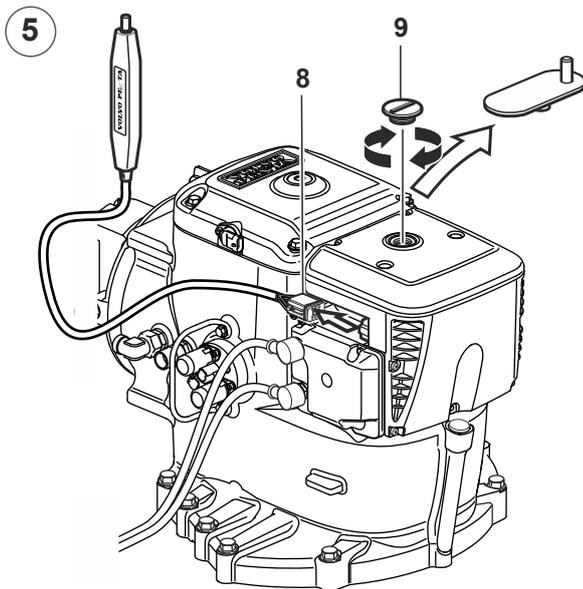
Do not force the crank tool beyond the end position, it could damage the propulsion unit.

NOTICE!

Do not use the crank tool while rampage.



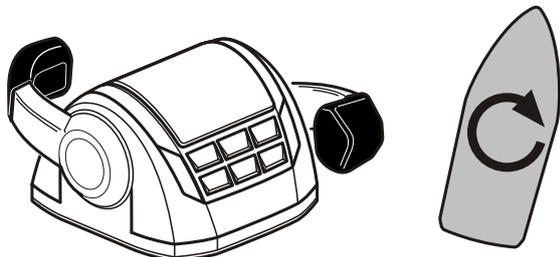
- 4 Turn the crank tool back 75 turns (7). The propulsion unit is now aligned for straight forward motion. Release the switch button.
- 5 Remove the crank tool. Disconnect the switch (8) by pressing down the lock and at the same time unplug the switch by slowly wiggling it. Screw the plug (9) back on.
- 6 Reconnect the cable (10) disconnected in step 1.



P0020362

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 harbor.



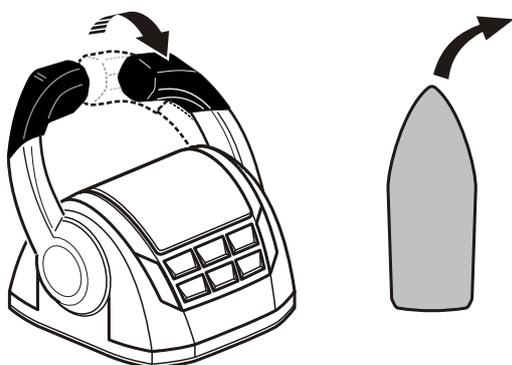
P0012505

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

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 maneuvering.

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.



P0012506

Steering the boat

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

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

Your Volvo Penta engine and its equipment are designed for high reliability and long life. The engines are built to have the smallest possible environmental impact. If given preventive maintenance, according to the maintenance schedule, these qualities will be retained and unnecessary malfunctions will be avoided. In order for the warranty to be valid, the owner must make sure that the services in the service intervals are performed.

Service Intervals

Service intervals are shown below. The service content can be found in the Service Protocol available for download at www.volvopenta.com.

Volvo Penta reserves the right to make changes to the service intervals and service content without notice. The downloadable documents are valid.

Extended service intervals

The interval between engine oil changes may be extended in certain circumstances. To determine whether the service interval may be extended, Volvo Penta's conditions for extended service intervals must be met and an oil analysis performed. Contact your Volvo Penta dealer for further information.

Where both operational and calendar times are specified, perform the maintenance item at whichever time is the sooner.

S1, S2, S3 = Special Interval Service
A-F = Type of service (regular service)

| | |
|-----------------------|---|
| S1 | Every 100–500 hours of operation or at least every 12 months. ⁽¹⁾⁽²⁾ Replace engine oil and oil filters / By-pass filter. |
| S2 | Oil analysis. ⁽³⁾ |
| S3 | After the first 1200 hours of operation. Valve clearance. |
| Type A Service | Every 400 hours of operation. (At least every 12 months.) |
| Type B Service | Every 800 hours of operation. (At least every 12 months.) |
| Type C Service | Every 1200 hours of operation. (At least every second year.) |
| Type D Service | Every 2000 hours of operation. (At least every second year.) |
| Type E Service | Every 3000 hours of operation. |
| Type F Service | Every 8000 hours of operation. (At least every fourth year.) |

1) Oil change intervals vary, depending on oil grade, sulfur content of the fuel and running conditions. See *Oil Grade and Oil Change Interval*.

2) Change the oil filters at every oil change.

3) See dealers recommendation for oil analysis interval.

NOTICE! Make sure that the service book gets stamped after performed service.

Maintenance

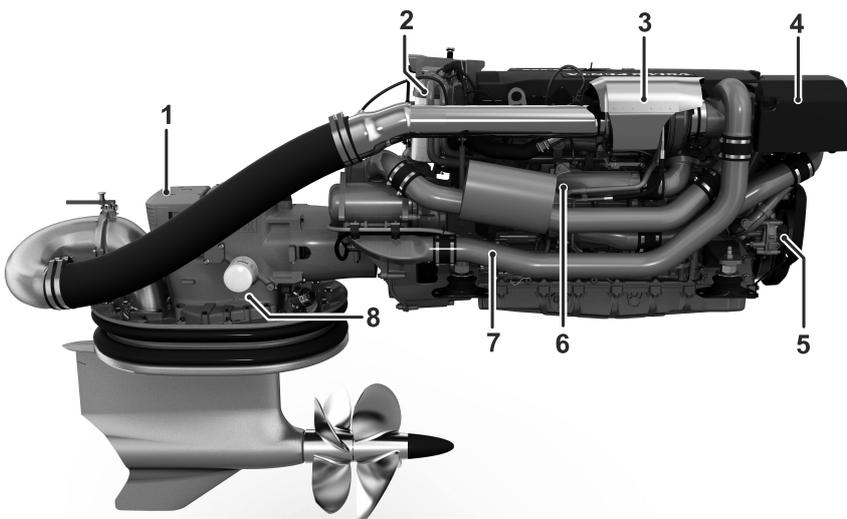
This chapter contains general technical information and instructions on how the prescribed maintenance items must be carried out. Read through the instructions carefully before starting work. The times when maintenance items must be carried are indicated in the *Maintenance Schedule*, page 76.

Read through the safety precautions for maintenance and service in the *Maintenance*, page 78 chapter before work on the engine is begun.

Volvo Penta recommend that all servicing with the engine running should be undertaken by an authorized Volvo Penta workshop.

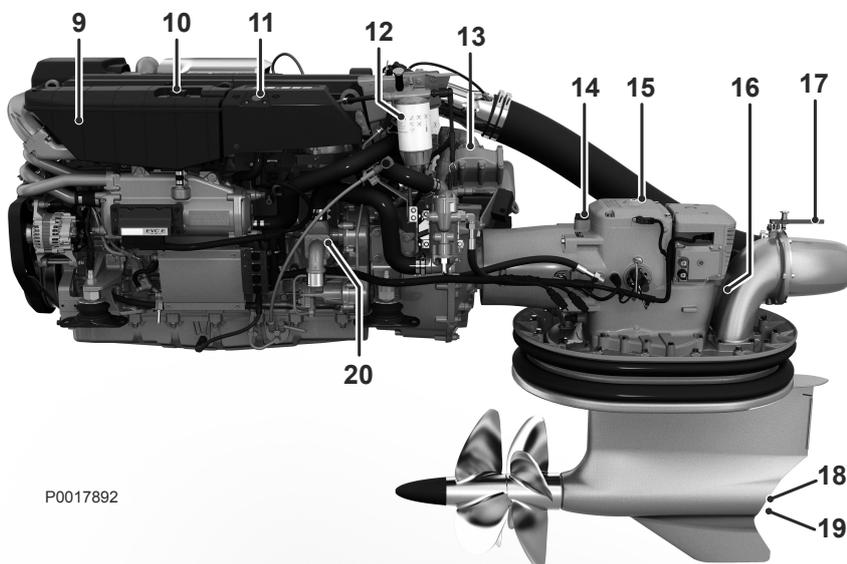
⚠ WARNING!

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.



P0017932

- 1 Volvo Penta IPS, Servo Unit
- 2 Engine oil filter and by-pass oil filter
- 3 Turbocharger (located under the heat protection)
- 4 Air filter
- 5 Circulation pump
- 6 Charge air cooler
- 7 Starter motor
- 8 Oil filter, IPS
- 9 Expansion tank
- 10 Coolant filler cap
- 11 Auxiliary stop
- 12 Fuel filter
- 13 Charger
- 14 Oil filler cap, IPS
- 15 Oil drain, IPS
- 16 Oil dipstick, IPS
- 17 Exhaust tap, IPS
- 18 Anode, IPS
- 19 Oil drain, IPS
- 20 Seawater pump



P0017892

Maintenance 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 that is running is a safety risk. Loose clothing, hair, fingers or a dropped tool can be caught in the rotating parts of the engine and cause serious personal injury.

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.

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.

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

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

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

Non-original components

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

Using spare parts that comply with the specifications for Volvo Penta original spare parts is recommended to avoid fire and explosion.

Start spray

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

Hot surfaces and fluids

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

Carbon monoxide poisoning

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

Chemicals

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

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

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

Cooling system

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

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

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

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.

The engine and the area around the engine must be kept clean from fuel to avoid accidents, engine damage and injuries.

Electronic Vessel Control (EVC)

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

Installing components that do not comply with the quality for Volvo Penta original spare parts may cause the system to malfunction. We strongly recommend to use Volvo Penta original spare parts.

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.

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.

Engine, General

General inspection

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

⚠ WARNING!

Accumulations of fuel, oil and grease on the engine or in the engine room constitute a fire hazard and must be removed as soon as 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.

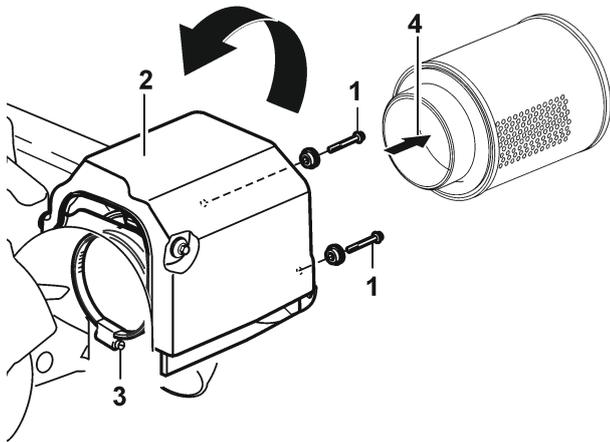
Never direct the jet from a high-pressure washer at seals, rubber hoses or electrical components. Never use the high pressure setting for engine cleaning.

Air Filter

- 1 Remove the two screws (1).
- 2 Flip the cover (2) up and remove the clamp ring (3).
- 3 Remove the old filter cartridges (4). Make sure that no contaminants enter the engine.
- 4 Install a new filter and reinstall the clamp ring (3) before flipping the cover (2) back and retightening the two screws (1) to secure the cover.

IMPORTANT:

Scrap the old filter; it may not be cleaned.



P0021606

Drive Belt

▲ WARNING!

Stop the engine before doing any maintenance work.

General

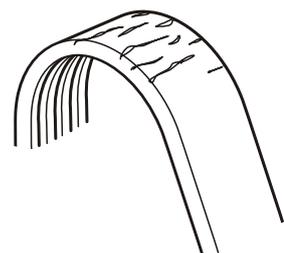
The drive belt has an automatic tensioner and does not need manual adjustments. Regularly check the belt condition and belt tension. Make sure that the belt tensioner does not bottom.

IMPORTANT:

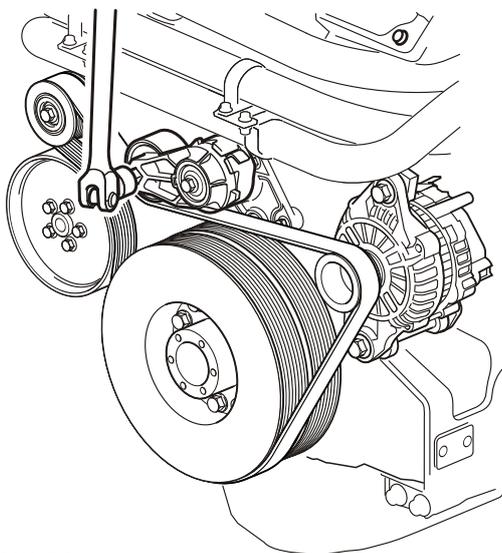
Always change a belt which looks worn or cracked.

Changing the Drive Belt

- 1 Remove the protective cover over the drive belt.
- 2 Put a socket wrench in the tensioning roller square fitting. Turn the tensioning roller aside and secure it by inserting a screwdriver or similar into the space which opens up.
- 3 Remove the drive belt.
- 4 Install the new drive belt and release the locking of the belt tensioner. Make sure the drive belt fits properly into the grooves.
- 5 Fit the protective cover over the drive belt.



P0003090



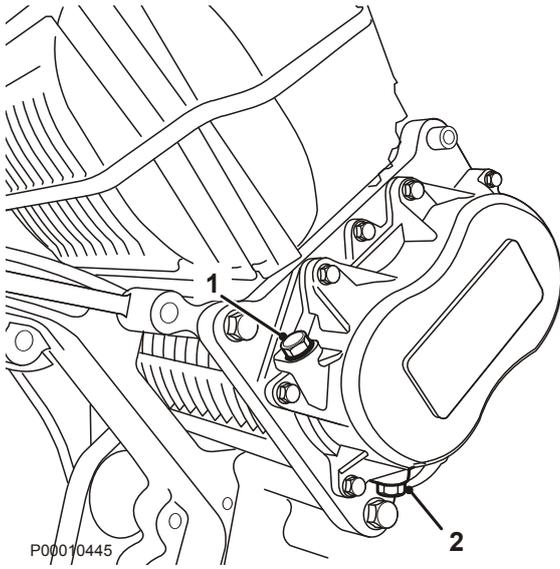
P0004718

Compressor, oil

Follow the recommended oil change interval, see *Maintenance Schedule*, page 76.

Compressor, oil change

- 1 Clean the area around the drain plug and filling hole to avoid dirt getting into the system when changing oil.
- 2 Remove the filling hole plug (1).
- 3 Have a container ready to avoid oil spillage. Remove the drain plug (2) and let the oil run out.
- 4 Replace the drain plug.
- 5 Fill with oil. Oil quantity and grade, see *Technical Data, Lubrication System*.
- 6 Replace the filling hole plug.



Lubrication System

Oil change intervals can vary depending on oil grade and sulphur content of the fuel, please refer to *Technical Data*, page 124.

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

If you want longer oil change intervals than stated in the table *Technical Data*, page 124, the condition of the oil must be checked by the oil manufacturers through regular oil testing.



P0002089

Oil Level

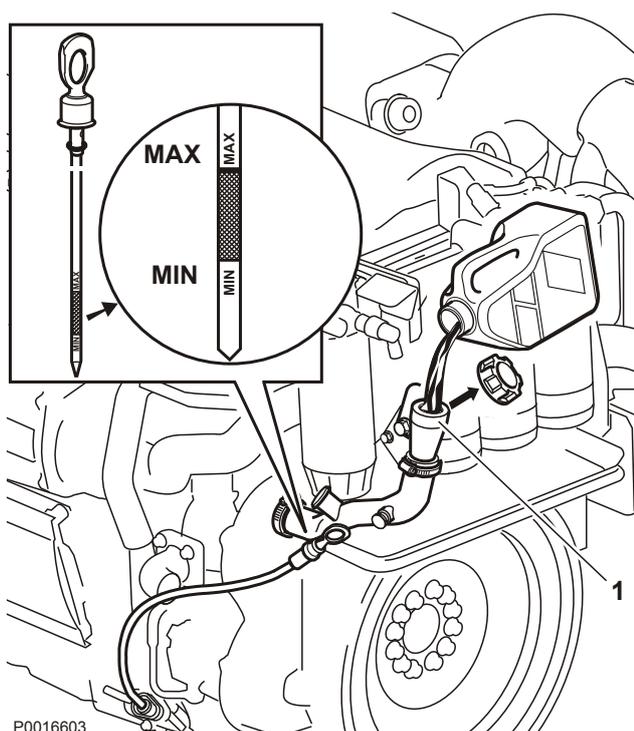
The oil level must be inside the marked area on the dipstick and should be checked daily before the first start.

When checking the oil level; take the oil dipstick out and wipe it. Put it back and remove it again to read the oil level.

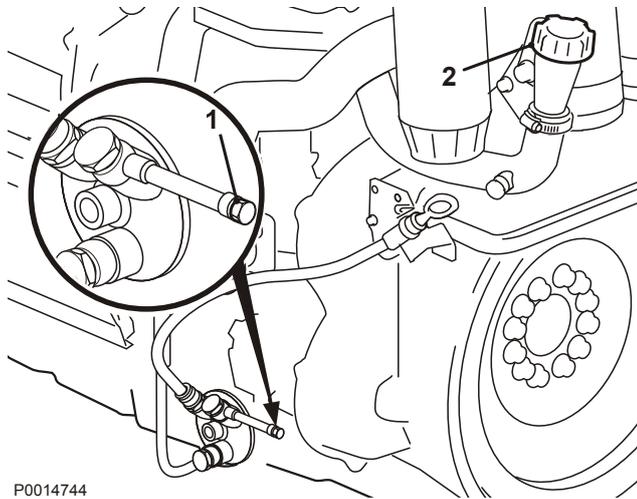
IMPORTANT:

Do not fill up above the maximum oil level. Only use a recommended grade of oil.

- 1 Top up the oil through the filling hole at the back of the engine (1).
- 2 Wait 15 minutes after topping up to allow the oil to reach the sump before checking the level again.
- 3 Check the level again.



P0016603



P0014744

Engine Oil

Always follow the recommended oil change interval. Use an oil drain pump to pump the oil out of the oil pan. An electrical oil drain pump is available as an accessory.

- 1 Run the engine until it is warm so that the oil is easier to pump, then stop the engine. Wait 15 minutes after topping up to allow the oil time to reach the sump.

▲ WARNING!

Hot oil and hot surfaces can cause burns.

- 2 Connect the suction pipe on the oil drain pump to the drain pipe (1). Pump out the oil.
- 3 Replace the oil filter and bypass filter at every oil change.
- 4 Fill oil to the correct level through the filler opening at the rear of the engine (2). For engine oil quantity, see the chapter entitled *Technical Data*.

IMPORTANT:

Do not fill up above the maximum oil level. Only use a recommended grade of oil.

- 5 Start the engine and let it idle. Check that the low oil pressure warning lamp goes out and that there are no leaks.

▲ WARNING!

Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

- 6 Stop the engine. Wait 15 minutes before checking the oil level. Top up if needed.

Hand in the old oil and oil filter to a recycling station.

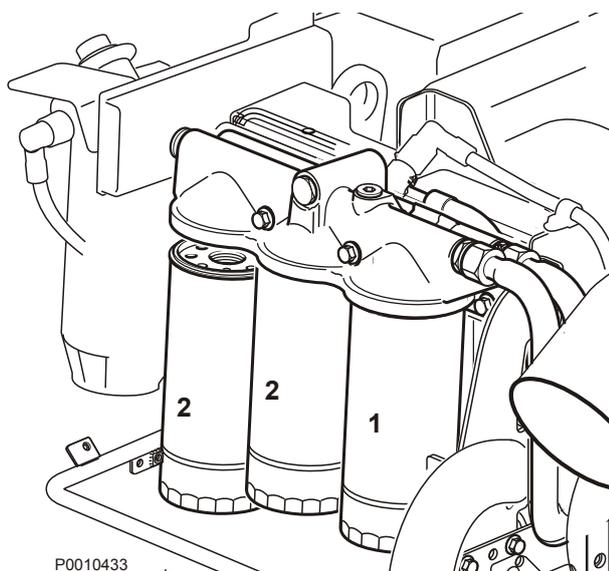
Oil Filter/By-pass Filter, Change

Change the oil filter and bypass filter during each oil change.

Remember to hand the old filters in to a re-cycling station.

▲ WARNING!

Hot oil and hot surfaces can cause burns.



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

Fuel System

Only use the grades of fuel recommended in the fuel specification, refer to *Technical Data, page 125*. Always observe the greatest cleanliness during refueling and work on the fuel system.

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

⚠ WARNING!

Fire hazard.

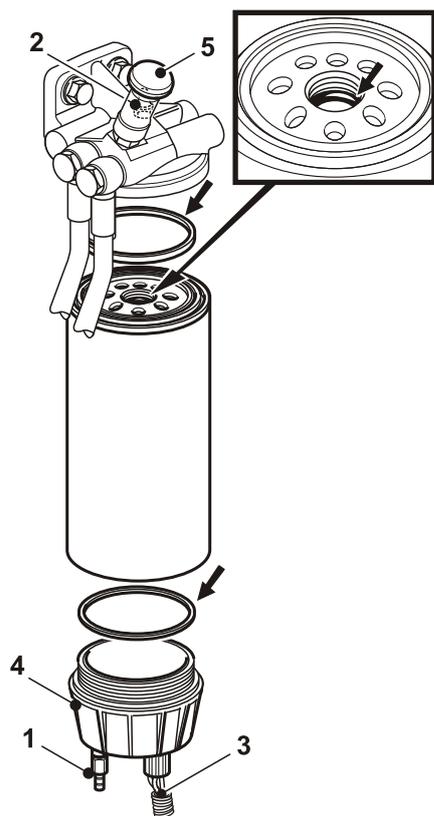
A fuel spill onto a hot surface or electrical components can cause fire.

When carrying out work on the fuel system, make sure the engine is cold.

⚠ WARNING!

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

Engine Fuel Filter Replacement



P0016604

- 1 Close the fuel tap(s).
- 2 Clean the filter holder and place a suitable vessel under the fuel filter.
- 3 Release the pressure in the filter by first opening the drain tap (1) on the bottom of the water separator and then the bleeding nipple (2) so that the filter is emptied of fuel.
- 4 Undo the union (3) from the water separator (4) and unscrew the water separator from the filter.
- 5 Unscrew the filter. Use a filter wrench if necessary.
- 6 Clean the sealing surfaces on the filter holder. Make sure that the filter is clean and that the sealing rings are undamaged. Moisten the sealing rings with engine oil, including the rubber seal located in the thread in the center of the filter.

IMPORTANT:

Do not fill the new fuel filter with fuel before assembly.

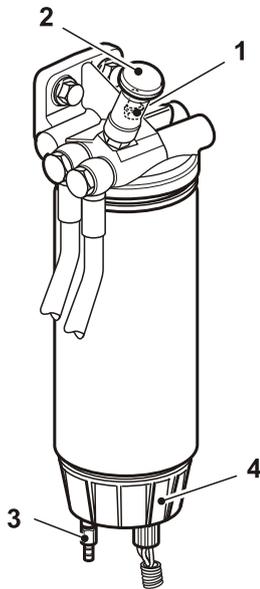
There is a risk that contamination could get into the system and cause malfunctions or damage.

- 7 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. Close the drain tap.
- 8 Open the main fuel tap.
- 9 Open the bleeding nipple and pump fuel with the hand pump (5) until the fuel is free from bubbles. Close the bleeding nipple while fuel is flowing out.
- 10 Remove the hose and replace the protective cover on the purging nipple.
- 11 Start the engine and check that there are no leaks.

Fuel system, bleeding

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

- 1 Put a suitable vessel underneath the hose.
- 2 Remove the protective cap from the venting nipple (1) on the filter bracket.
- 3 Open the venting nipple and pump up fuel with the hand pump (2) until air-free fuel flows out. Tighten the venting nipple while fuel is flowing out.
- 4 Fold the hose back and put the protective cap back on the venting nipple.
- 5 Run the engine at idling speed for a couple of minutes to allow any remaining air out of the system. Make sure there are no leaks.



P0016605

Fuel filter, draining the water trap

▲ WARNING!

Hot fuel can cause burns.

- 1 Put a suitable vessel underneath the filter.
- 2 Open the tap (3) and drain water and contamination from the water trap (4) by pumping with the hand pump (2) until clean fuel flows out.
- 3 Close the tap.

Fuel pre-filter

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

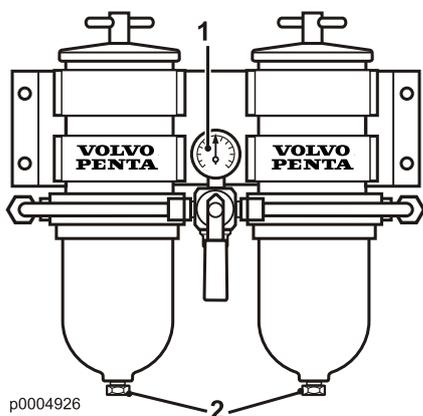
Checks

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

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

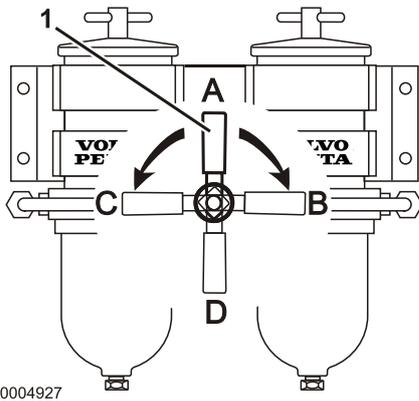
▲ WARNING!

Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.



Draining

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



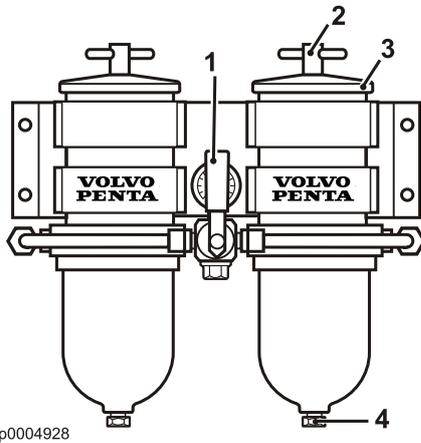
Replacing filter cartridges

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

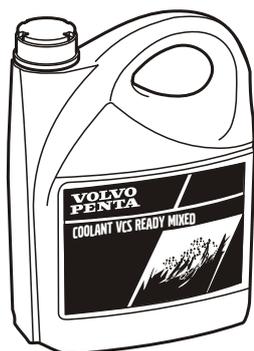
Fuel flow is controlled by moving the lever (1) to the following positions:

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

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



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



P0013077

Freshwater System

The cooling system ensures that the engine operates at the correct temperature. It is a closed system that should always be filled with a coolant mixture.

IMPORTANT:

Coolant of a suitable chemical composition must be used all year round to protect the engine against internal corrosion, cavitation and frost bursting. This even applies when there is no risk for frost damage, to make sure the engine always has a complete corrosion protection.

Therefore, the use of anti-corrosion agents alone, or water alone as a coolant, is not permitted in Volvo Penta engines.

The coolant must be based on Organic Acid Technology (OAT). Using an improper coolant or mixing with another coolant will rapidly reduce the performance and lifetime of the engine. Material incompatibility can lead to leakages, which - in the worst case - can cause engine breakdown.

Volvo Penta strongly recommend the use of our own coolants, "Volvo Penta Coolant VCS Ready Mixed" or the concentrate "Volvo Penta Coolant VCS", which ensure the protection of the cooling system components from corrosion, ageing, swelling and cracking, thereby ensuring optimal engine lifetime.

Over time the corrosion protection additives become less effective, and consequently the coolant must be changed at regular intervals to maintain sufficient protection of the engine. The latest Service Protocol that specifies service intervals can be found at volvopenta.com.

Coolant, Mixing

It is extremely important that the system is filled with the correct coolant concentration; refer to *Technical Data, page 126*.

The coolant should be mixed with distilled, deionized water. For Volvo Penta specified water requirements; refer to *Technical Data, page 126*.

NOTICE! If water quality can not be guaranteed, use ready mixed coolant.

Coolant Level, Checking and Topping Up

Checking the coolant level

⚠ WARNING!

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

The coolant level must be about 5 cm (2") below the expansion tank pressure cap sealing surface.

If a separate expansion tank is fitted, the coolant level must be between the MIN and MAX marks.

Where necessary, top up coolant in accordance with the instructions below.

Filling coolant

⚠ WARNING!

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

IMPORTANT:

Always use the same type of coolant that is already in the engine.

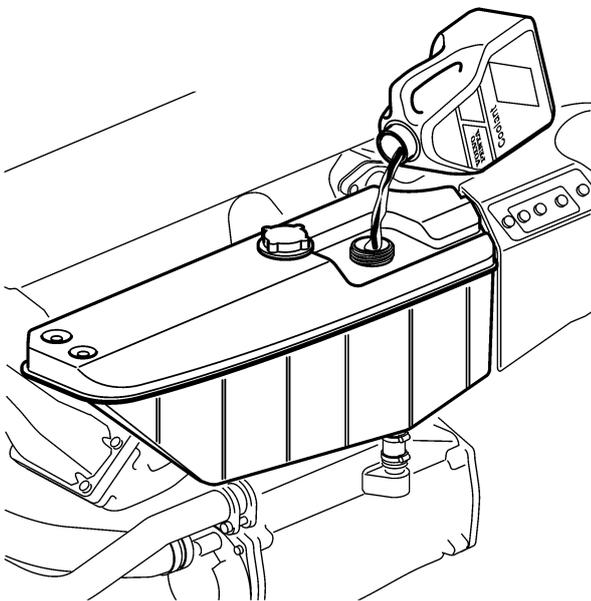
Different types of coolant must not be mixed with each other.

Risk of reduced cooling function and performance by clogging and isolation.

Topping up

Top up coolant to the correct level through the filler opening on the expansion tank. Top up slowly, to allow air that is displaced to flow out through the filler opening.

When filling an empty system, or if the coolant level for some reason has sunk so low that it cannot be seen through the filler opening, filling must be carried out according to "Filling a completely empty cooling system".



P0003719

Filling a completely empty cooling system

- 1 Mix a sufficient quantity of coolant in a vessel before filling. Note that if a heating system, water heater or such is connected to the engine cooling system, a correspondingly greater quantity of coolant will be required.
- 2 Ensure that any heating system, water heater or such connected to the engine cooling system is purged (open the heater regulator valve).
- 3 Fill coolant through the filler opening in the expansion tank.
Fill slowly, to allow air that is displaced to flow out through the filler opening.
- 4 Fill with coolant to approx. 5 cm (2") below the filler cap sealing surface.
- 5 Start the engine and let it idle for about 1 hour.

IMPORTANT:

Do not start the engine until the system is purged and completely filled.

- 6 Stop the engine and let it cool. Check coolant level. Top up as needed.

Draining the Coolant System

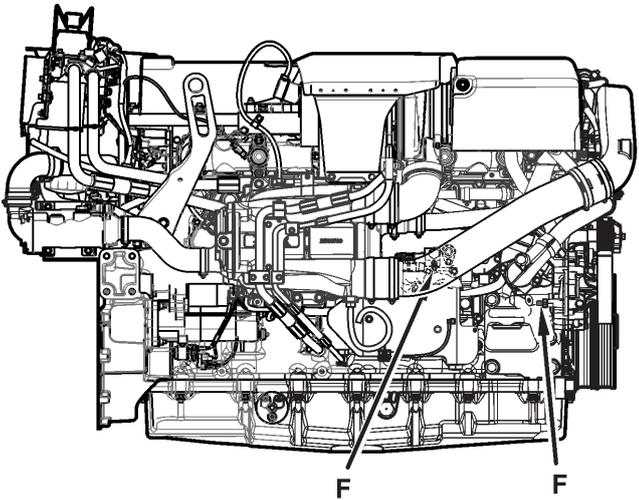
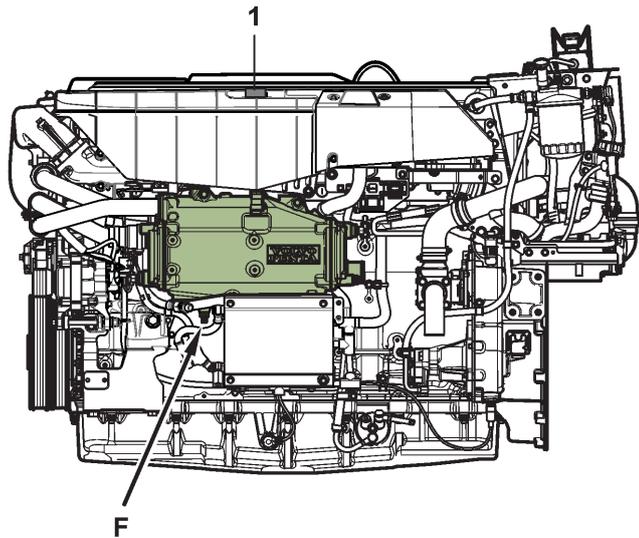
⚠ WARNING!

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

⚠ WARNING!

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

Drain the coolant via taps (F).



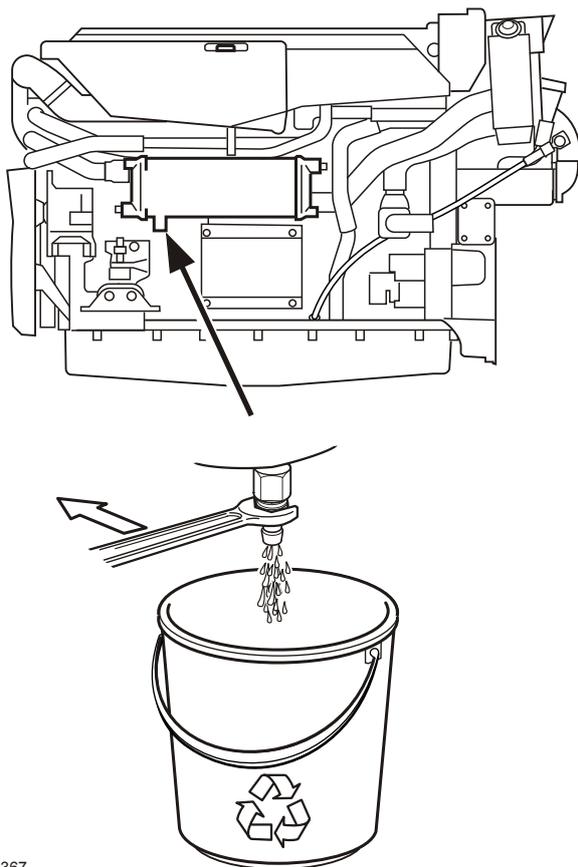
- 1 Remove the filling cap (1) from the expansion tank.
- 2 Connect a hose to each drain point. Open the taps and allow all the coolant to drain off into a suitable vessel.
Check that all coolant really does drain out. Deposits may need to be cleared away, inside the drain plug(s)/tap(s).
- 3 Also drain the heating system, tap water heater etc., if connected to the engine's freshwater system.
- 4 Close all drain taps.
- 5 Collect the old coolant and hand it to a recycling station.

P0021476

Freshwater system, Flushing

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

- 1 Drain the coolant, please refer to *Draining the Coolant System, page 94*.
- 2 Put a hose into the filling hole in the heat exchanger and flush with fresh water.
- 3 Flush until the water which runs out of the drain points is clean.
- 4 Close all drain points when all coolant has run out.
- 5 Fill up with coolant, please refer to *Coolant Level, Checking and Topping Up, page 92*.



P0006367

Seawater System

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

▲ WARNING!

Risk of water entry. Water will flow into the boat if any hose, plug etc. located below the waterline is removed when the boat is in the water. Always close the sea cock.

Draining the Seawater System

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

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

▲ WARNING!

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

Draining:

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

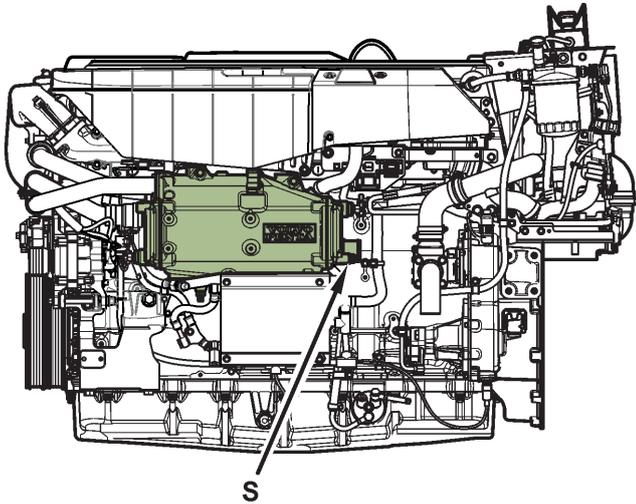
Drain points:

- tap at rear of heat exchanger
- tap at rear of charge air cooler

Check that all water really does drain out.

Deposits may need to be cleared away, inside the drain plug/tap.

- 4 Also drain/empty any auxiliary equipment such as the seawater filter, flushing/bilge pump etc.
- 5 Install the lid on the flushing/bilge pump, if fitted.
- 6 Close all drain taps and plugs and check for leaks before leaving the boat.

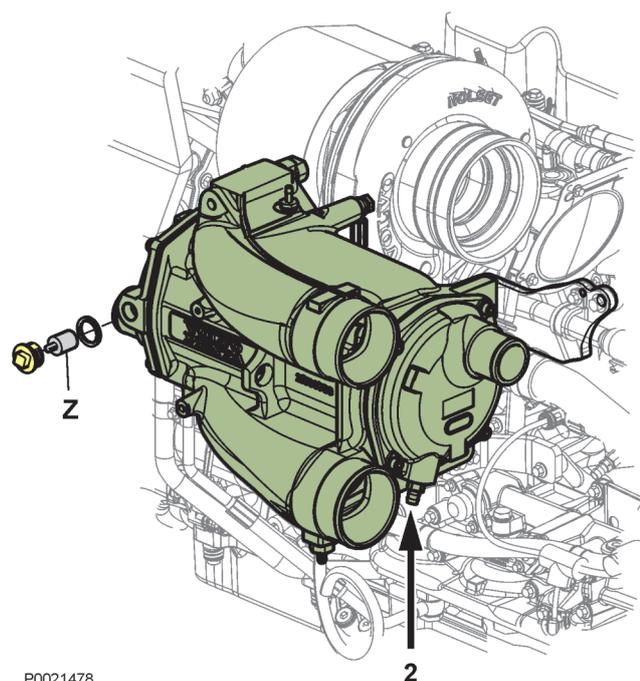
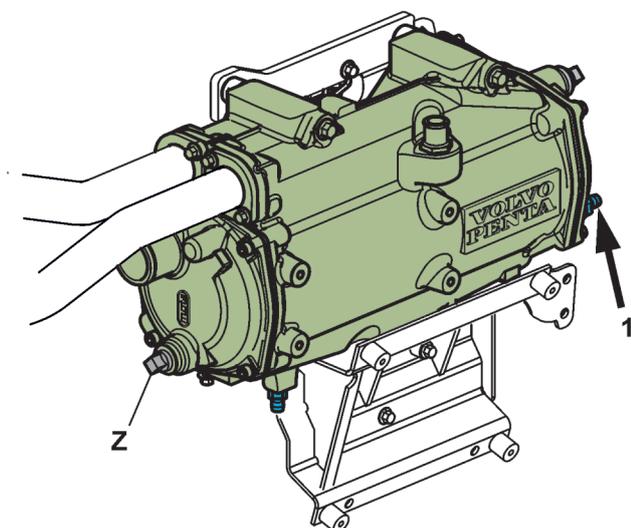


P0021477

Zinc Anodes

▲ WARNING!

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



P0021478

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

IMPORTANT:

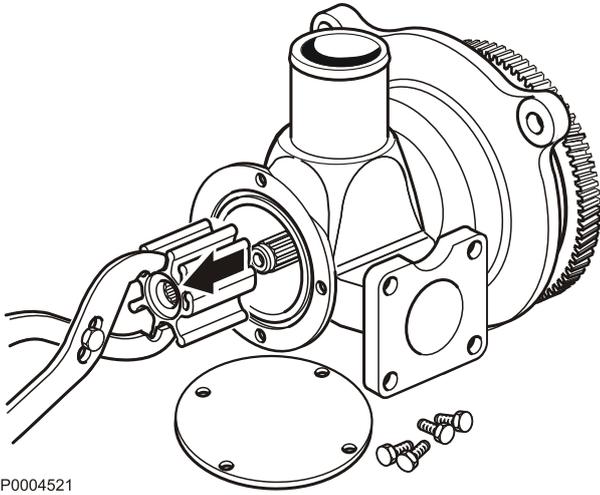
Use an emery cloth for cleaning. Do not use steel tools, since this could impair the galvanic protection.

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

Impeller, Check and Change

▲ WARNING!

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



P0004521

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

NOTICE! Always carry a spare impeller on board.

Seawater Filter

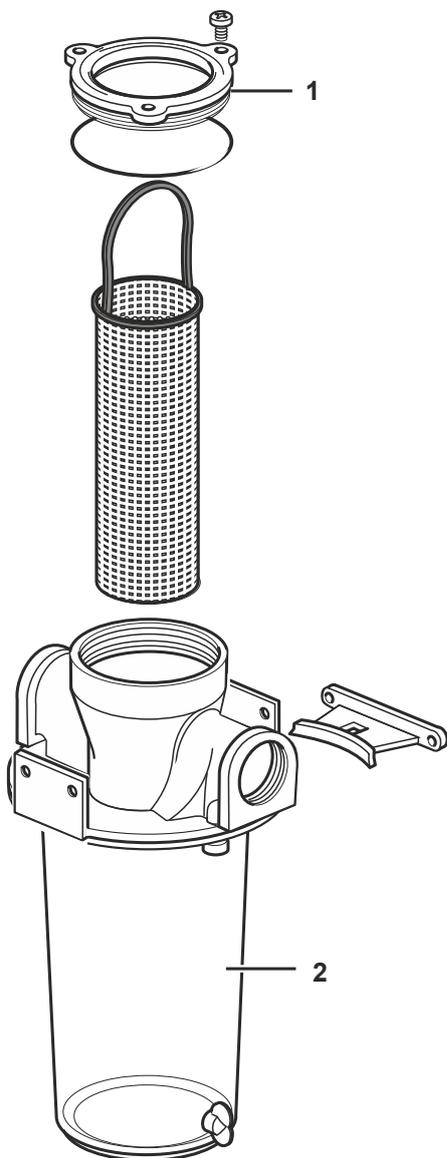
The seawater filter is auxiliary equipment.

If the water where the boat is used has a lot of 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 in engine overheating.

▲ WARNING!

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

- 1 Close the sea cock.
- 2 Remove the cover (1) and lift out the insert.
- 3 Clean the insert and the housing (2).
- 4 Install the parts as illustrated. Inspect the gaskets. Replace if necessary.
- 5 Open the sea cock and check for leaks.



p0021602

Electrical System

The engine is equipped with a 2-pole electrical system and an alternator.

⚠ WARNING!

Always stop the engine and break the current using the main switches before working on the engine.

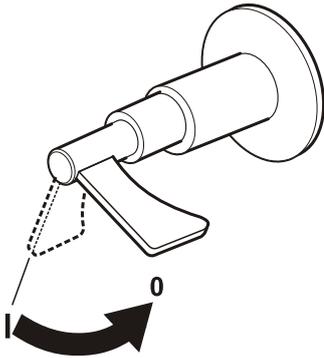
Main switch

IMPORTANT:

Never disconnect the current using the main switches when the engine is running.

The alternator and electronics could be damaged.

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



P0002576

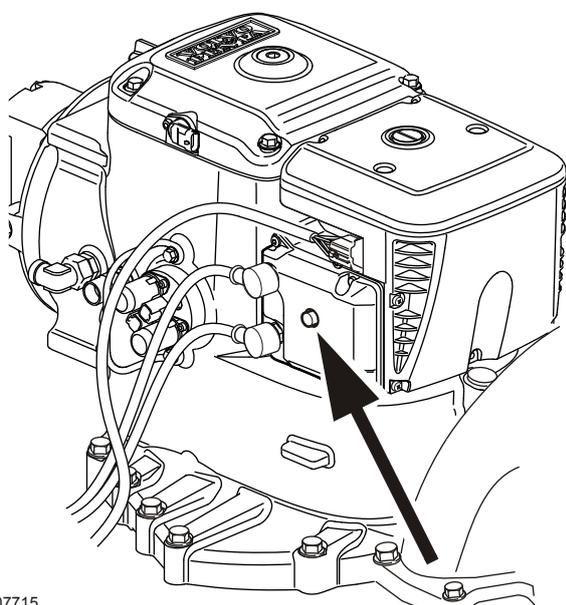
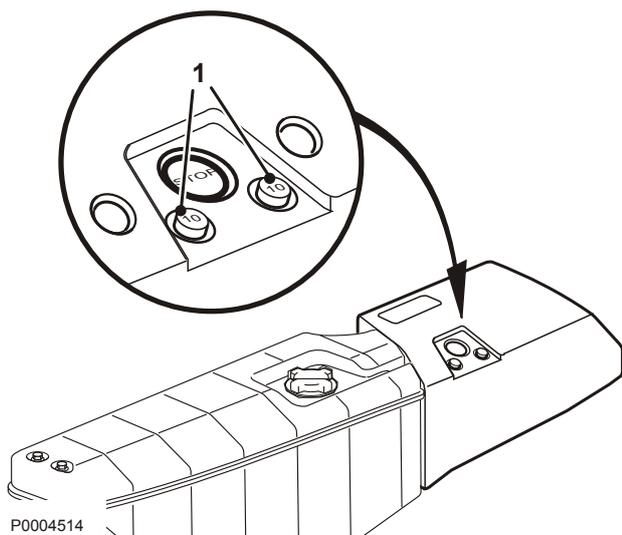
Fuses

IMPORTANT:

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

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

If it is not possible to start the engine or if the instrument stops working while running, the circuit breaker may have been activated. Reset by pressing in the circuit breaker (1).



IPS

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

Electrical Connections

Check that electrical connections are dry, free from oxide, and that they are securely tightened.



P0002107

Battery

⚠ WARNING!

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

⚠ WARNING!

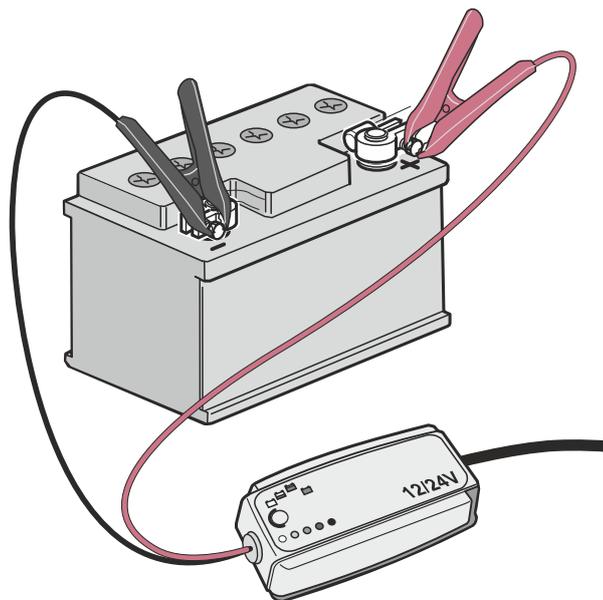
Battery electrolyte is a corrosive acid and should be handled with care. If you spill or splash electrolyte on any part of the body, immediately flush the exposed area with liberal amounts of water and seek medical attention as soon as possible.

⚠ WARNING!

Ventilate the engine compartment before working on batteries or battery connections.

IMPORTANT:

Batteries can be damaged if they are left discharged, and can also freeze and burst easier in cold weather. If the engine is not going to be used for a longer period of time, the batteries should be fully charged, trickle charged if possible.



P0022892

Maintenance

It is important to always follow the battery manufacturer's recommendation and instruction when replacing and charging batteries. Depending on battery type, the instructions for maintenance and charging may vary. Modern batteries are normally maintenance free, but there are some actions that are recommended to increase the battery service life and avoid accidents:

- Keep the batteries clean and dry. Contamination and oxide on the batteries and battery poles can result in 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. Loose battery connections may cause damage to the engine's electrical system.
- Charge the battery regularly. A battery that is kept fully loaded has a maximum service life. The easiest way to check if a battery needs charging is to use a voltmeter.

Replacing Battery

IMPORTANT:

Make sure that the new battery fulfills the specifications in *Technical Data*. Read the information supplied with the battery before you begin the installation.

IMPORTANT:

Do not disconnect the batteries with the engine running as sensitive electrical components may be immediately damaged.

⚠ WARNING!

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

Disconnecting (A)

- 1 Untighten the nut and remove the – cable (black).
- 2 Untighten the nut and remove the + cable (red).

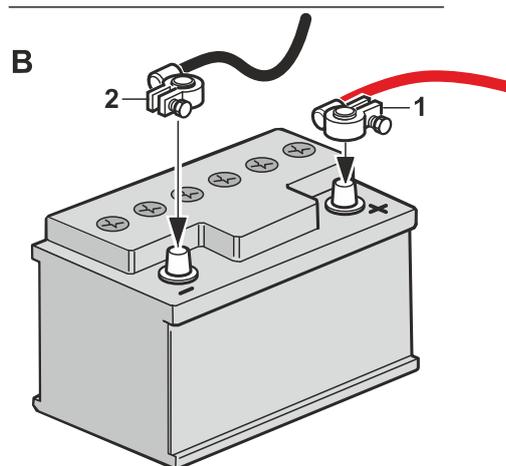
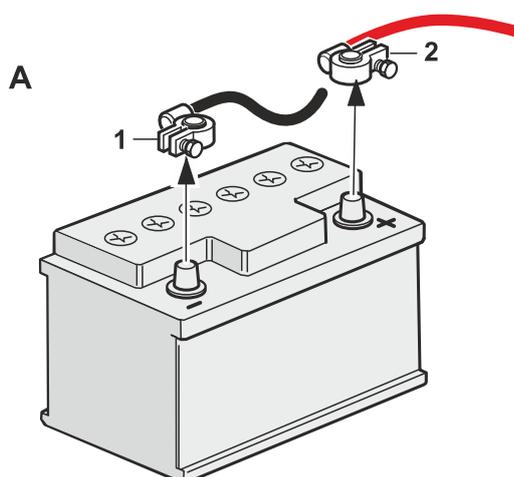
Remove the battery.

Connecting (B)

Place the new battery.

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

NOTICE! Hand in the old battery to a re-cycling station.



P0022893

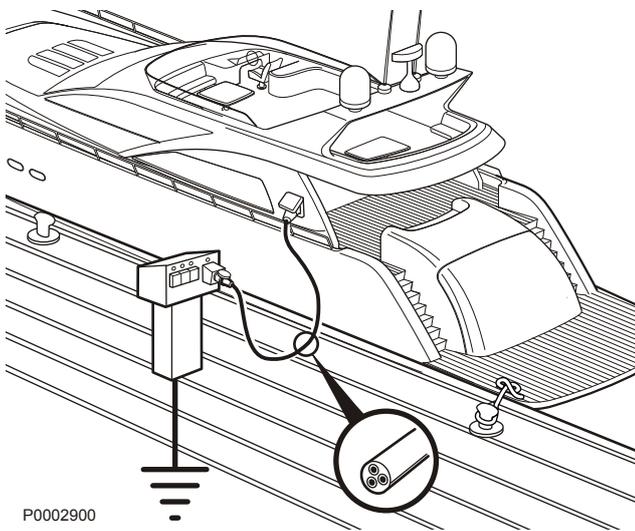
Electrical Installations

An incorrectly designed electrical installation may generate leakage current from the electrical system. Leakage current can in turn render galvanic protection inadequate in respect of propellers, propeller shafts, rudder posts, the 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.

The following must always be heeded:

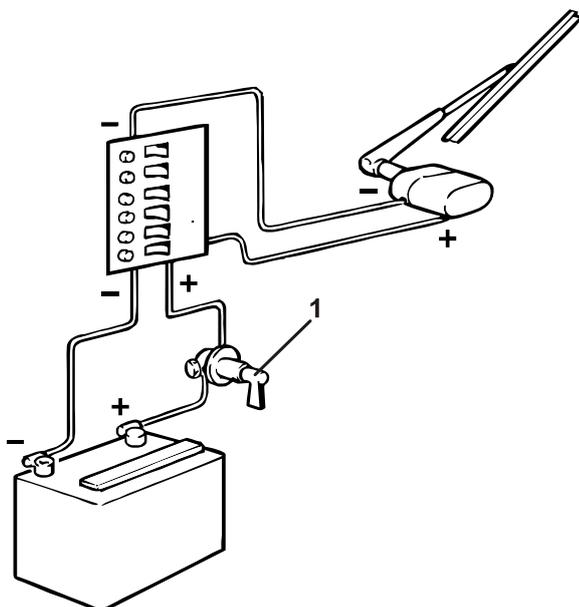


P0002900

- 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 circuit interrupter. The shore power installation (transformer, inverter, battery charger etc.) must be designed for marine use **where the high-tension side is galvanically separated from the low-tension side.**
- 2 Electrical cables must be run and clamped such that there is no risk of exposure to chafing, damp or bilge water.
- 3 Ground protection for radios, navigation instruments, rudder, boarding ladders or other equipment where separate cables for ground protection are present, must be clustered to a common ground connection that is not connected to the engine or reverser gear.

IMPORTANT:

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



P0002486

- 4 The start battery must have a main switch (1) connected to the battery's positive (+) 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 positive (+) 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.

Electrical Welding

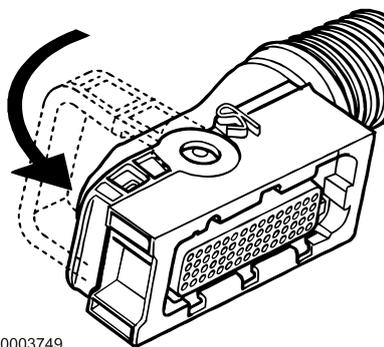
Remove the positive and negative cables from the batteries, then disconnect all cables connected to the alternator.

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

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

IMPORTANT:

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



P0003749

Drive

The propulsion unit has an electronically controlled hydraulic clutch. Two solenoid 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 100*.

Checking and Topping Up Transmission Lubricant

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.

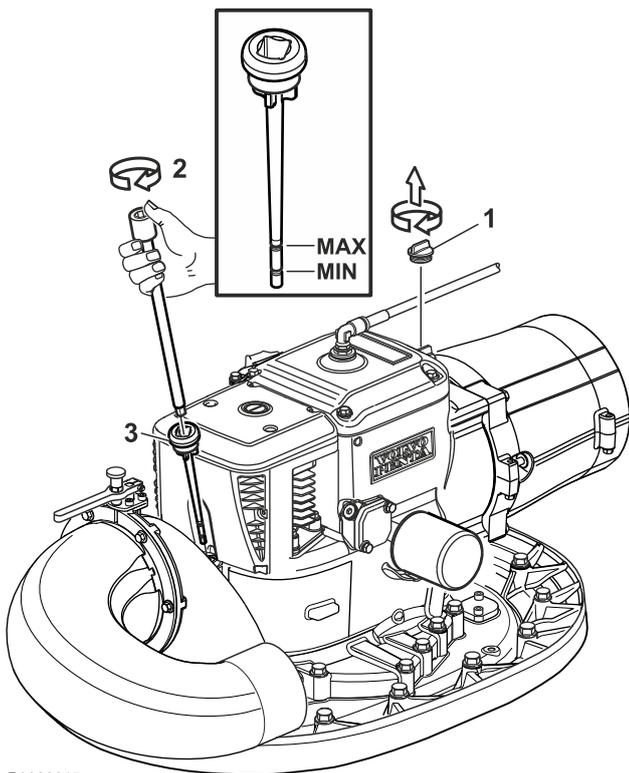
Open the oil filler cap (1). Remove the dipstick (3) using a standard 3/8" extender (2). Dry off the dipstick and reinstall it in the propulsion unit, do not screw down the oil dipstick when checking the oil level. Remove the oil dipstick again and check the oil level. The correct oil level is inside the marked area.

IMPORTANT:

Always remove and install the oil dipstick by hand, using tools may cause damage to the oil dipstick installation.

If necessary, top up the oil through the filling hole. For oil grades and volume, refer to *Technical Data, page 127*.

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.



P0022015

Changing Transmission Oil

An oil change can be carried out when the boat is afloat or ashore. If the boat is afloat an oil drain pump must be used. If the oil change is carried out with the boat ashore, the IPS unit can be drained according to alternative B.

See the chapter entitled *Technical Data*, page 127 for oil grade and volume.

IMPORTANT:

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

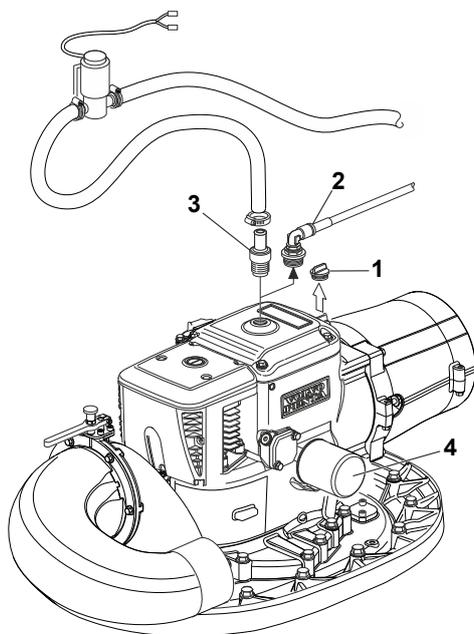
IMPORTANT:

After an oil change, the water-in-oil sensor must be calibrated.

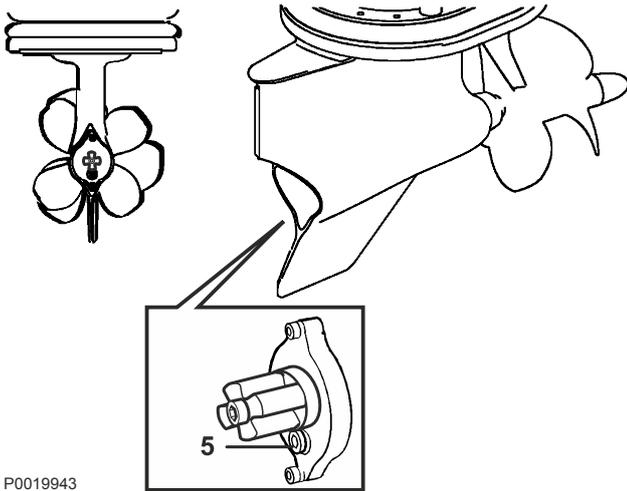
For information regarding calibration, see the chapter entitled *Calibration and Settings*, page 117.

Alternative A; draining using an oil drain pump

- 1 Open the oil filler cap (1) and the nipple and hose (2) so that excess pressure is released. Fit the nipple (3) and connect the oil drain pump suction hose. Pump out as much oil as possible (approximately 22 liters).
- 2 The oil that collects in the bottom of the drive must also be pumped out. Remove the nipple (3) from the drive and connect the 1320 mm long hose to the vertical shaft. Pump out the remaining quantity of oil.
- 3 Change the filter (4).
- 4 Remove the oil drain pump and hose. Reinstall the plug (2); tightening torque 20 Nm.
- 5 Measure out the correct volume of oil and fill the drive via the oil filler hole. See the chapter entitled for oil grade and volume.
- 6 Calibrate the water-in-oil sensor. See information in the entitled *Service*.



P0022016

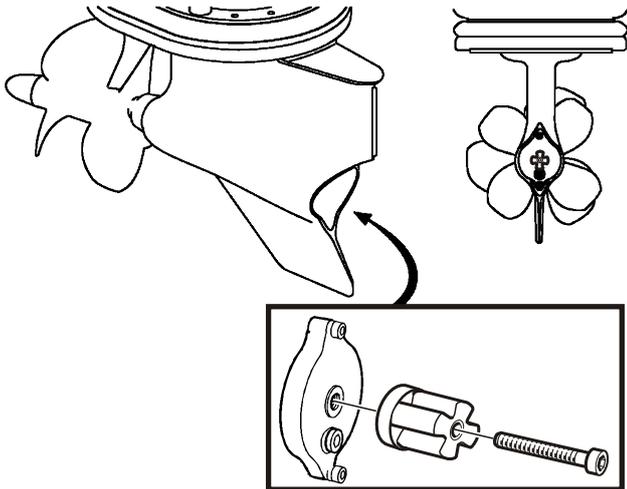


P0019943

Alternative B, draining through the drain plug

- 1 Open the oil filler cap (1) so that excess pressure is released. Open the drain plug (5) and let the oil run out.
- 2 Change the filter (4).
- 3 Reinstall the drain plug with a new O-ring. Always fit a new O-ring when the drain plug has been removed.
- 4 Measure out the correct volume of oil and fill the drive via the oil filler hole.
- 5 Calibrate the water-in-oil sensor. See information in the chapter entitled *Calibration and Settings*, page 117.

Corrosion protection, checking and changing



Check the sacrificial anodes regularly. There are two anodes per stern drive; one is fixed to the drive and the other to the transom. Refer to the illustrations. Replace an anode when approximately 1/3 of it has corroded away.

When the boat is stored ashore, corrosion protection deteriorates due to sacrificial anode oxidization. Even new anodes oxidize on the surface. The anodes must be cleaned before the boat is launched.

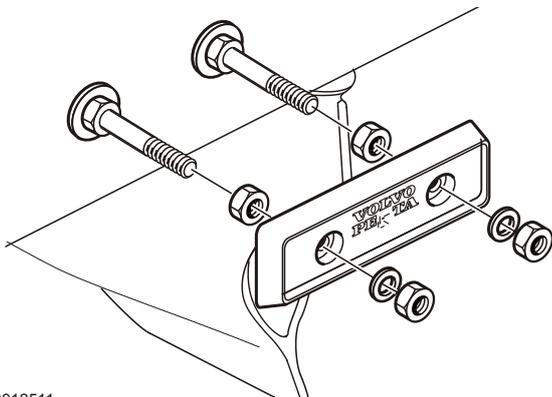
The anode in the exhaust outlet is made of iron and does not need cleaning.

IMPORTANT:

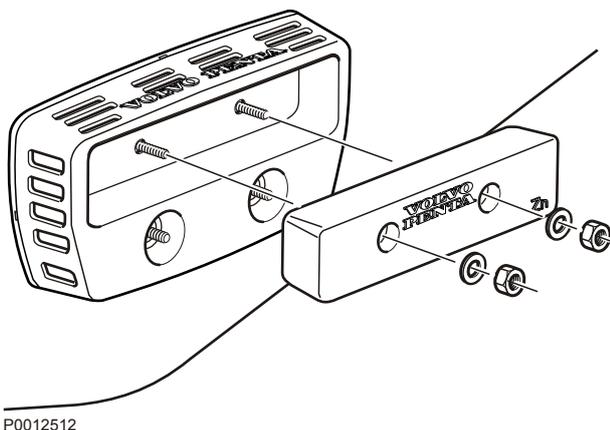
Use emery paper. Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.

Replacing corrosion protection

All anodes are secured by bolts or nuts. Remove the anode retaining bolts or nuts. Clean the contact surface and secure the new anode. Tighten the new anode so that it makes good electrical contact.



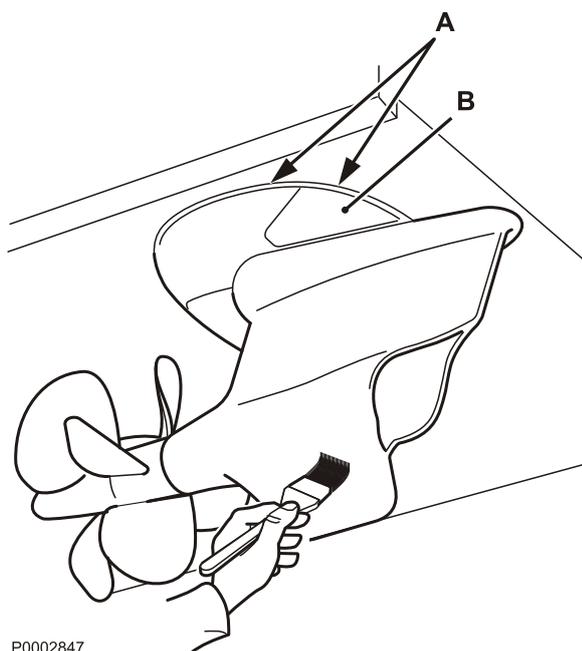
P0012511



P0012512

ACP, Active Corrosion Protection

Boats equipped with ACP (option) have a zinc anode integrated in the ACP unit; see illustration. Replace the anode when about 1/3 has corroded away.



P0002847

Inspect the drive unit anti-fouling

Inspect the anti-fouling paint on the drive annually. All steel and bronze surfaces, including propellers, should be protected by anti-fouling paint for unpainted surfaces. Follow the anti-fouling paint supplier's instructions regarding how the paint must be used on the drive unit.

Do not apply coating in the groove (A) between the drive unit and the hull or the plastic surface of the exhaust cushion (B).

Painting the hull bottom

All paints containing anti-fouling agents are poisonous and damage the marine environment. Avoid these preparations. Most countries have introduced legislation that regulates the use of anti-fouling agents. Find out about legislation applicable in the area where the boat is used.

Always follow these regulations. In many cases it is strictly forbidden to use anti-fouling agents on leisure craft, e.g. in freshwater.

Tin-based agents (TBT paints) may not be used.

Do not paint in the groove (A) between the drive unit and the hull or the exhaust cushion (B).

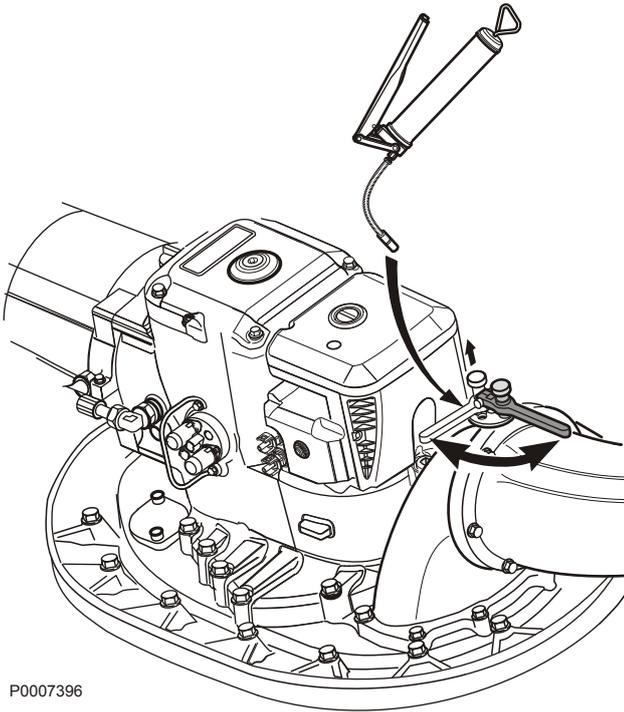
Allow the paint to dry before launching the boat.

Checking seawater- and exhaust cock

Regularly check the function of the seawater- and exhaust cock. The cocks must not show any signs of malfunction or of being stuck. The exhaust cock's lock shall be greased with water-resistant grease every year.

IMPORTANT:

If it is not possible to make the cocks work properly or if they have other malfunctions, please contact your Volvo Penta workshop.



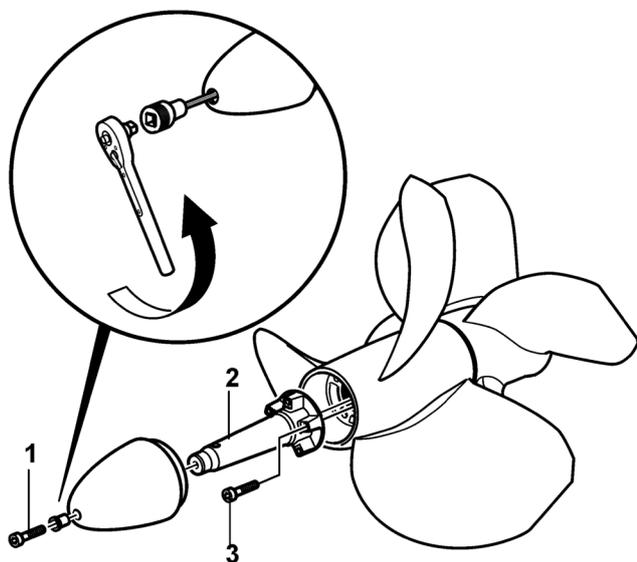
P0007396

Propeller

⚠ WARNING!

Make sure that the engine cannot start during work on the propeller(s). Ensure that ignition keys are removed or that the ignition is turned off on the **Start/Stop** panel.

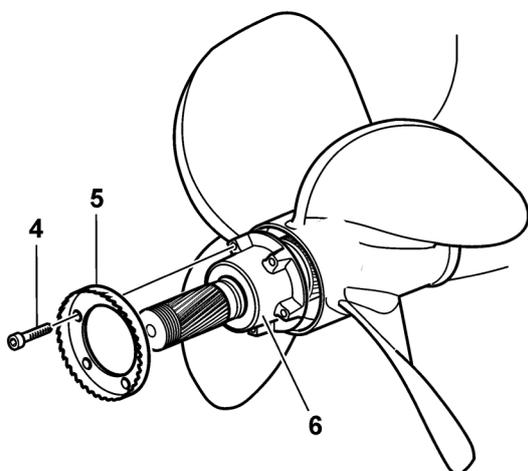
Damaged propellers must be replaced as soon as possible. If you have to drive a boat with a damaged propeller, do so with extreme caution and only at reduced rpm.



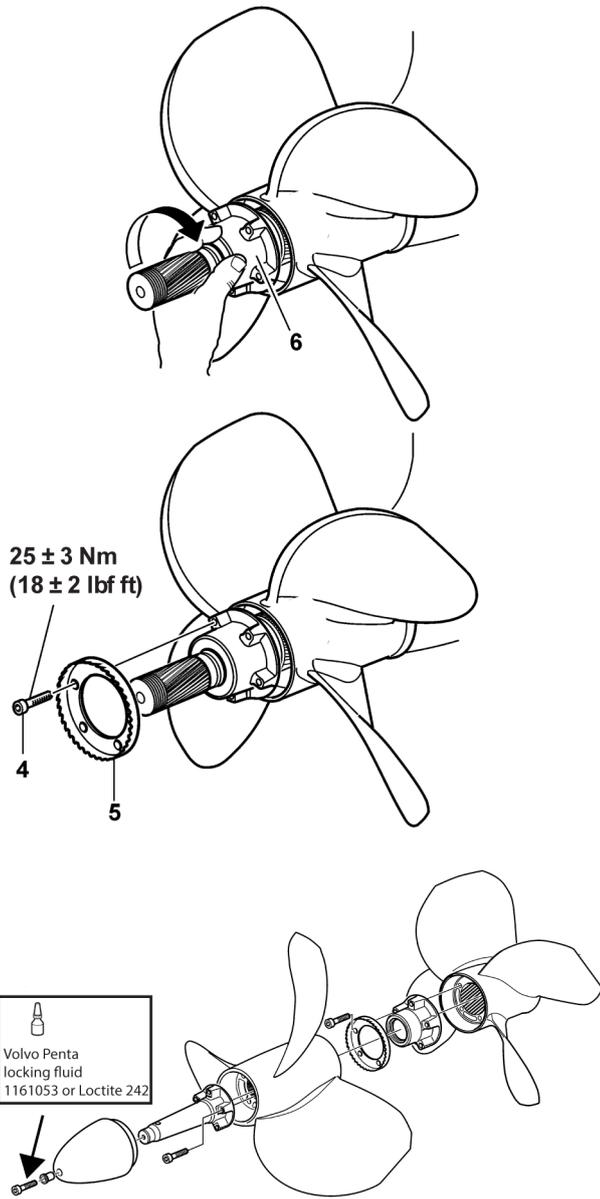
A special tool for removing and reinstalling propellers is supplied with the IPS unit.

Disassembly

- 1 Unscrew the bolt (1) using the special tool and remove the propeller cone.
- 2 Remove the nut (2) by unscrewing the bolts (3) using the special tool.
Remove the front propeller from the propeller shaft.
- 3 Unscrew the bolts (4) using the special tool and remove the line cutter (5).
Remove the nut (6) and the rear propeller from the propeller shaft.
- 4 Wipe the propeller shafts clean.



P0022017



Installation

- 1 Wipe the propeller shafts dry and clean. Make sure that no dirt or other foreign objects such as fishing line is stuck to the sealing rings. Check that the sealing rings are not damaged. Apply water-resistant grease, part no. 828250 (or 21347121), to the splines and threads on both propeller shafts.
- 2 Slide on the rear propeller until it bottoms. Install the propeller nut (6) by turning it clockwise until it bottoms. Adjust its position by turning it back until the bolt holes align.
- 3 Mount the line cutter (5) on the rear propeller nut (6) using the existing bolts (4) and holes. Tighten Allen bolts. **Tightening torque 25 ± 3 Nm (18 ± 2 lbf.ft)**
- 4 Slide the front propeller onto the propeller shaft until it bottoms. Install the propeller nut (2) by turning it clockwise until it bottoms. Adjust its position by turning it back until the bolt holes align.
- 5 Install the Allen bolts (3). **Tightening torque 25 ± 3 Nm (18 ± 2 lbf.ft)**
- 6 Press on the propeller cone by hand. Install the center bolt (1). Use Volvo Penta locking fluid 1161053 or Loctite 242.
- 7 Tighten the center bolt (1). **Tightening torque 25 ± 3 Nm (18 ± 2 lbf.ft)**

P0022018

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.

IMPORTANT:

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. If the seawater pump is run dry the impeller could be damaged. Always check the impeller after dry runs.

Refer to chapter *Impeller, Check and Change*, page 98.

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. Refer to *Corrosion protection, checking and changing*, page 108.

To avoid fault codes in the ACP function, select inactive mode (refer to *Optional*, page 44) 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 technical 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.
- 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:

When cleaning with a high pressure washer, make sure to never aim the water jet at seals, rubber hoses or electrical components. Never use a high pressure washer for engine cleaning.

- 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 perform these points shortly before starting to use the boat again:

- Clean the hull directly after taking up the boat (before it dries).
- Clean the outside of the propulsion unit directly after taking up the boat (before it dries).

IMPORTANT:

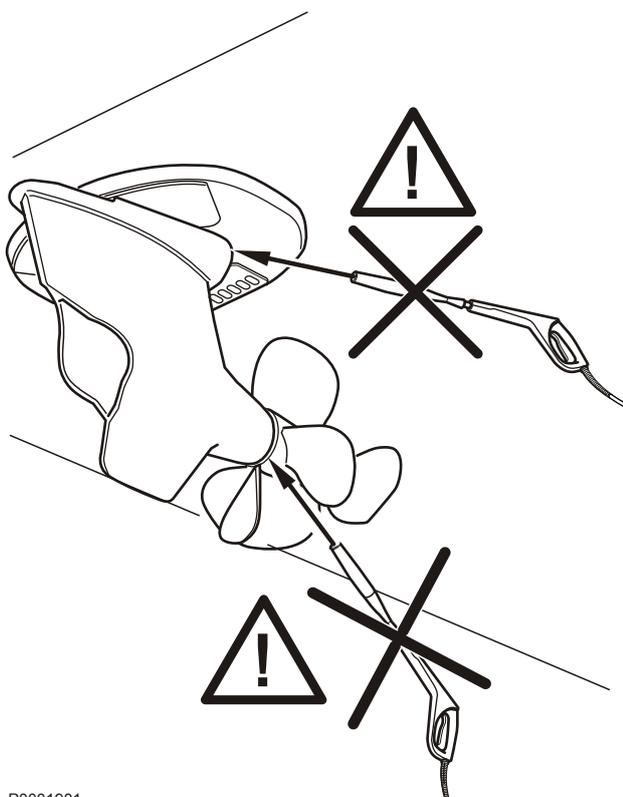
Be careful when cleaning with a high pressure washer. Never point towards the propeller shaft seal or the steering seals.

- 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.



P0001901

Bringing Out of Storage

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

- Paint the hull.
- Check the sacrificial anode on the propulsion unit. If there is less than 2/3 of the anode left, it must be replaced. Clean 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.
- 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 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

Glass Cockpit, Settings

NOTICE! For further information about calibrations and settings in Glass Cockpit, go to **Info > Owner's Manual** to see the integrated Glass Cockpit manual in the display or download the latest manual on www.garmin.com.

Navigate to the settings menus:
Select **Settings > Preferences** or **> My Vessel** to open calibration and settings menus.

Select **Home** to return to main screen.



P0022494

Glass Cockpit, Neutral Beep

The neutral beep is an audible signal that sounds when the control is in the neutral position.

Select **Settings > System > Beeper and Display** and turn the audible signal On or Off.

Glass Cockpit, Reset Trip

The trip information can be reset.

Select **A/V, Gauges, Controls > Gauges > Menu > Trip Reset** and follow the instructions on the display to zero the trip information.

Glass Cockpit, Service Calibration

IMPORTANT:

The first time the new engine is in use and every time oil is changed in the drive, the water-in-oil sensor must be calibrated.

- 1 Start the engine and let it run at a speed below 1000 rpm.
- 2 Select **Settings > Communications > EVC Networks > Starboard > Service > Drive Oil change** and follow the instructions on the screen.

The message **CALIBRATION COMPLETED SUCCESSFULLY!** will be displayed to confirm the calibration.

Repeat the calibration procedure for each drive.

Restart the system to confirm the calibration.

Glass Cockpit, Fuel Tank

Go to **My Vessel > Fuel Tank**

Carry out calibration in the following sequence:

- 1 Fuel Tank Volume
- 2 Empty Tank
- 3 Full Tank
- 4 Multipoint

Select a calibration and OK to begin the wizard in question and then follow the instructions on the display.

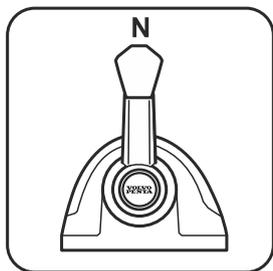


P0022495

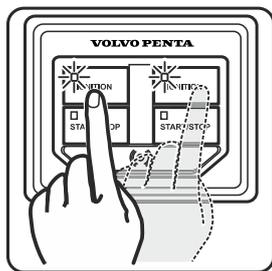
Add e-Key, Glass Cockpit

NOTICE! The ignition must be on and engine(s) stopped.

Up to four e-Keys can be added.



1. Move control to neutral.



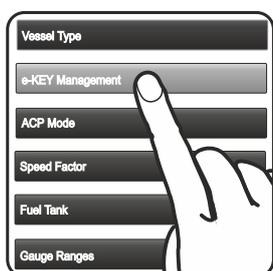
2. Turn the ignition on.



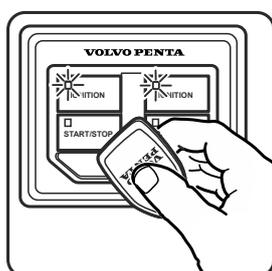
3. Main Menu > Settings.



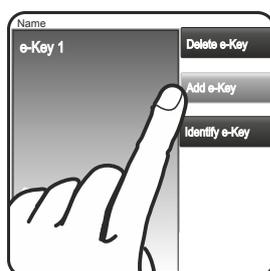
4. My Vessel.



5. e-Key management. Select Add e-Key.



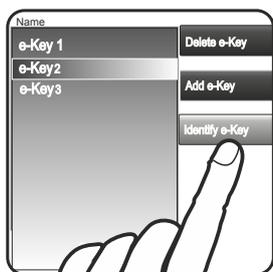
6. Hold the new e-Key in front of the Start/Stop panel. Confirm with OK.



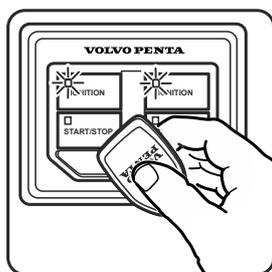
7. e-Key added. Remaining available locations for e-Key in display. Further options appear in right side menu.



8. Repeat step(s) 6 for additional e-Keys.



9. Settings Menu:
 • Delete key(s)
 • Identify e-Key
 Hold the new e-Key in front of the Start/Stop panel.



10. **NOTICE!** A valid e-Key is required as authorization for future e-Key Management.



11. Ignition must be turned off for at least 15 seconds to confirm the calibration.

Joystick

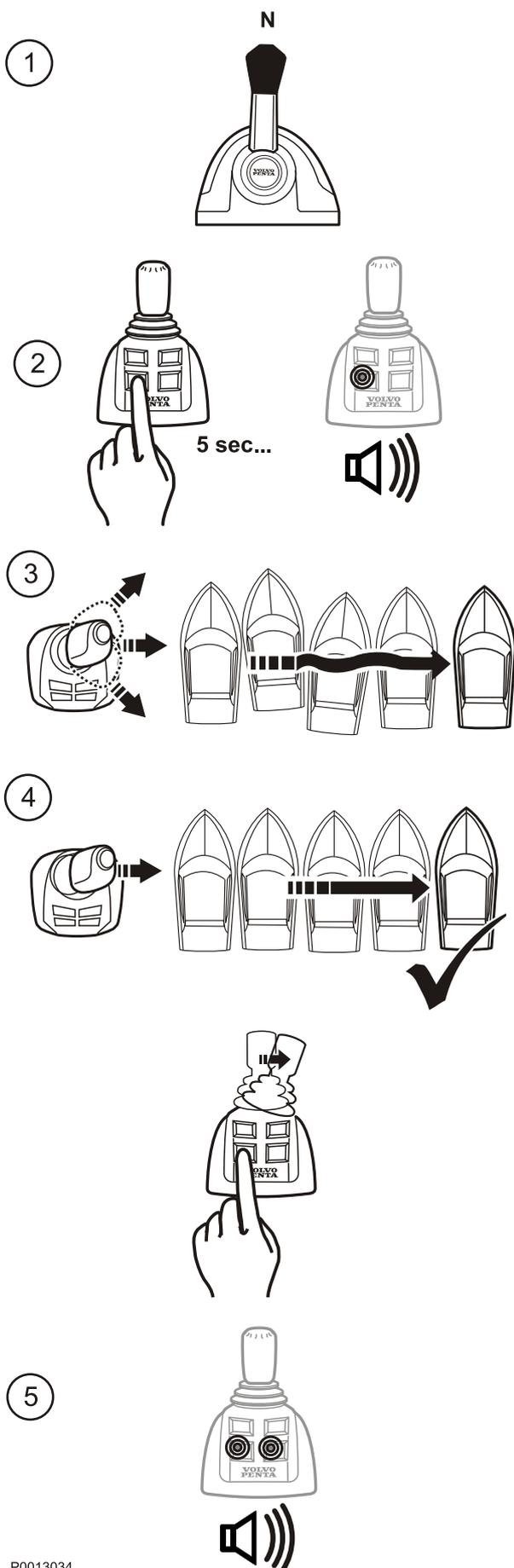
Joystick calibration need only be carried out if boat movements do not correspond to joystick movements. When calibrating the joystick, the boat must be driven on open waters in safe conditions. Avoid calibrating in high winds or currents that can influence the result of the calibration.

Allow the boat to run for a fairly long distance during 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.

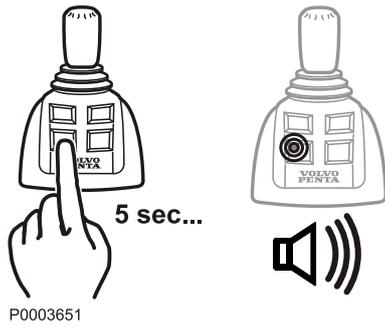
Joystick Docking calibration



- 1 Turn the ignition on and move the control levers to neutral.
- 2 Start the engines.
Activate calibration mode by depressing the docking button for 5 seconds.
An audible signal confirms that docking mode is activated and the docking button lights up.
- 3 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.
- 4 When the boat is moving straight abeam, depress the docking button once again.
- 5 An audible signal will sound and both lower button lamps on the joystick will flash to confirm that calibration is complete and stored. The system is now in docking mode.

When the joystick returns to the central position the lamps will stop flashing and will instead show continuously.

P0013034



Resetting the calibration

- 1 Turn the ignition on and move the control levers to neutral.
Start the engines.
- 2 Activate calibration mode by depressing the docking button for 5 seconds.
An audible signal will confirm that docking mode is activated and the docking button lamp will light up.
- 3 Press the docking button. Calibration is now reset, which is confirmed by an audible signal.
The system is now in docking mode

Technical Data

Engine

| Type designation | IPS-650 MC | IPS-800 | IPS-950 |
|---------------------------------|--|--|--|
| Aftermarket designation | D11B2-A MP | D11B2-A MP | D11B2-A MP |
| Crankshaft power ⁽¹⁾ | 375 kW (510 hp) @ 2250 rpm | 459 kW (625 hp) @ 2400 rpm | 533 kW (725 hp) @ 2500 rpm |
| Max torque | 1850 Nm (1100–1900 rpm) | 2200 Nm (1100–1900 rpm) | 2440 Nm (1300–1900 rpm) |
| No. of cylinders | 6 | 6 | 6 |
| Bore | 123 mm (4.8") | 123 mm (4.8") | 123 mm (4.8") |
| Stroke | 152 mm (6.0") | 152 mm (6.0") | 152 mm (6.0") |
| Displacement | 10,8 dm ³ (660 inch ³) | 10,8 dm ³ (660 inch ³) | 10,8 dm ³ (660 inch ³) |
| Engine, dry weight | 1195 kg (2634 lbs) | 1195 kg (2634 lbs) | 1195 kg (2634 lbs) |
| Dry weight with drive IPS | 1820 kg (4012 lbs) | 1820 kg (4012 lbs) | 1820 kg (4012 lbs) |
| Compression ratio | 16,5:1 | 16,5:1 | 16,5:1 |
| Idling speed ⁽²⁾ | 600 (±50) rpm | 600 (±50) rpm | 600 (±50) rpm |

1) According to ISO 8665

2) At delivery, the idle speed is adjusted to 600 rpm. If needed, the speed can be adjusted within the range 550–700 rpm.

Lubrication System

| | |
|--|------------------------------|
| Engine | |
| Oil capacity including oil filters, approx.: | 38 liters (10.0 US gal) |
| Oil volume difference MIN - MAX | 4 liters (1.0 US gal) |
| Oil pressure, hot engine: | |
| at normal running rpm (1100 rpm or higher) | 300–500 kPa (50.8–72.5 PSI) |
| Oil pressure during neutral | min. 250 kPa (36.3 PSI) |
| Compressor, oil | |
| Oil capacity | 0.,09 litre (0.19 US pint) |
| Oil quality | Volvo Penta, art nr: 1141641 |

Oil Grade and Oil Change Interval

| Oil quality (1) | Sulfur content in fuel, by weight | | |
|-----------------|--|-------------------------------|-------------------------------|
| | up to 0,5% | 0,5–1,0% | more than 1,0% (2) |
| | Oil change interval, reached first in operation: | | |
| VDS-3 | 500 hours or 12 months | 200 hours or 12 months | 100 hours or 12 months |

1) Lowest recommended oil grade. Engine oil with higher oil grade is always possible to use.

2) If sulphur content is more than 1.0 per cent by weight, use oil with TBN over 15.

NOTICE!

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

TBN = Total Base Number

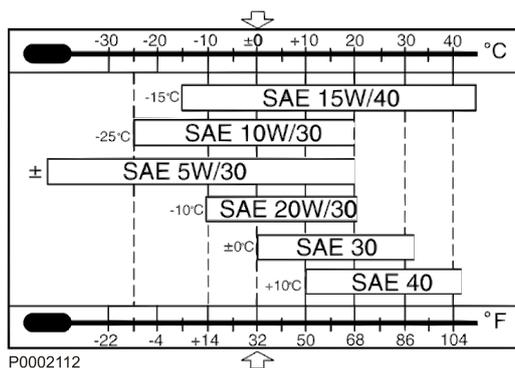
VDS = Volvo Drain Specification

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

General fuel requirements

The fuel quality is essential for engine function, durability and emission compliance. Only fuels meeting relevant legal requirements and national and international standards shall be used; such as European EN590 diesel and North American ASTM D975 diesel.

Usage of fuels or fuel blends that do not comply with the below specifications given in this document is not allowed and Volvo Penta will not accept warranty in case of fuel related engine damages.

Diesel fuel requirements

An insufficient **cetane number** ("ignitability") leads to poor startability and increased exhaust emissions.

Requirement; cetane number min 45.

Insufficient **density and viscosity** will reduce the power and increase the fuel consumption.

Excessive density and viscosity will endanger the durability and function of the fuel injection equipment.

Requirement; viscosity 1.5-4.5 mm²/s (cSt) at 40 °C and density 800-860 kg/m³ at 15 °C.

Sufficient **fuel lubricity** is essential to protect the fuel injection system against excessive wear.

Requirement; wear scar max 520 µm in the HFRR test (ISO 12156)

Excessive **sulfur content** will increase emissions and give engine corrosion and wear.

Requirement; The max allowed sulfur content is 5000 ppm, with the restriction that oil of quality VDS 3 must be used for sulfur content above 3000 ppm.

Water will give corrosion and wear of engine parts and enables microbial growth in the fuel tank

Organic contaminants (bacteria, fungi etc.) can block fuel filters and **inorganic contaminants** (dust, sand) can cause severe damage to the fuel injection system.

Requirement; max allowed water content 200 ppm and max allowed total contaminant content 30 ppm.

Cold flow properties are determined by the cloud point (the temperature when wax crystals start to fall out) and the CFPP (cold filter plugging point). The oil companies are always responsible for providing fuels with the correct cold flow properties for any time of the year.

FAME ("biodiesel")

Requirement; The max allowed FAME content is the same as for fuels EN 590 (at present 7% FAME that complies with EN 14214) respectively ASTM D975 (at present 5% FAME that complies with ASTM D6751).

NOTICE! Other FAME types and higher FAME blends are allowed only after agreement with Volvo Penta.

Paraffinic fuels ("Synthetic Diesel") — HVO GTL

HVO (Hydro-treated Vegetable Oil) are renewable, and GTL (Gas-To-Liquid) are fossil, paraffinic fuels. Usage of paraffinic fuels will give lower emissions, but also marginally higher fuel consumption.

NOTICE! Volvo Penta approves usage of neat HVO and GTL that complies with EN 15940, as well as HVO and GTL blends into diesel fuels complying with the quality requirements above.

Kerosene ("Jet fuel")

Usage of kerosene is not allowed.

Additives

The oil companies shall always ensure that their fuels meet relevant requirements and are fit for their purpose. Their responsibility includes any use of additives for proper engine performance and function.

NOTICE! It is not allowed to add secondary treatment additives ("diesel boosters"), lubricants, gasoline or alcohol into the fuel tank

Marine distillate fuels

NOTICE! Light marine distillate fuels, such as ISO 8217 DMX, are allowed only after agreement with Volvo Penta.

Cooling System

Freshwater system capacity including heat exchanger, approx.

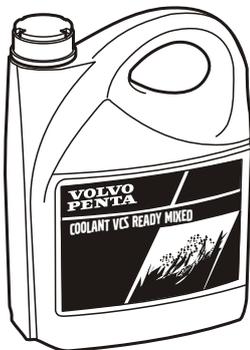
46 liters
12.1 US gal



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Coolant

Volvo Penta Coolant VCS and VCS Ready Mixed (yellow colour) are based on Organic Acid Technology, OAT.



P0013077

Coolant, Mixing

⚠ WARNING!

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

IMPORTANT:

Always use the same type of coolant that is already in the engine.

Different types of coolant must not be mixed with each other.

Risk of reduced cooling function and performance by clogging and isolation.

Coolant shall be based on Organic Acid Technology (OAT).

Follow the mixing recommendation on the product.

The coolant should be mixed with distilled, deionized water. For Volvo Penta specified water requirements; refer to *Water Quality*.

NOTICE! Always use "Ready Mixed" coolant if water quality cannot be determined or if it does not fulfill ASTM D4985.

NOTICE! Never mix more than 60% concentrated coolant with water. A greater concentration provides reduced cooling effect with the risk for overheating and reduced frost protection.



P0002463

Water Quality

ASTM D4985:

| | |
|---|-----------------------------|
| Total solid particles | <340 ppm |
| Total hardness | <9,5° dH |
| Chloride | <40 ppm |
| Sulfate | <100 ppm |
| pH value | 5.5–9 |
| Silica (acc. ASTM D859) | <20 mg SiO ₂ /l |
| Iron (acc. ASTM D1068) | <0.10 ppm |
| Manganese (acc. ASTM D858) | <0.05 ppm |
| Conductivity (acc. ASTM D1125) | <500 μS/cm |
| Organic content, COD _{Mn} (acc. ISO8467) | <15 mg KMnO ₄ /l |

Electrical System

| | |
|---|---|
| System voltage | 24V |
| AC generator, | |
| voltage/max. amperage | 28V/80A |
| output, approx. | 2240W |
| Alternative generator equipment (accessory): | |
| voltage/max. amperage | 14V/115A |
| output, approx. | 1610W |
| Battery capacity | 2 connected in series 12V, max. 152Ah |
| Battery electrolyte density at +25°C (77°F): | |
| fully charged battery | 1.28 g/cm ³ = 0.0462 lb/in ³ (1.24 g/cm ³ = 0.0448 lb/in ³)* |
| battery recharged at | 1.24 g/cm ³ = 0.0448 lb/in ³ (1.20 g/cm ³ = 0.0434 lb/in ³)* |

NOTICE! * Applies to batteries with tropical acid.

Propulsion Unit

WARNING!

Use of other transmission oils than recommended may result in increased gear shifting delay and show other handling characteristics than what you are used to with the factory filled Volvo Penta approved oil.

IMPORTANT:

For transmissions in the marine environment, it is extremely important that the correct transmission oil is used. Using an incorrect transmission oil may very quickly affect transmission life and function. Extensive testing has resulted in an oil developed to optimize the friction in clutch packages and maximize the lifetime for gears and bearings. AB Volvo Penta accepts no responsibility or liability for any damage or cost arising due to use of other oils than recommended.

| | |
|---------------------------------|--|
| Oil capacity, approx. | 26 liters 6.9 US gal |
| Oil volume difference MIN - MAX | 0.5 liters 0.5 US quart |
| Oil quality | VP 3809443 (liters) VP 1141679 (US quart) |
| Gear ratio | 1.59:1 |

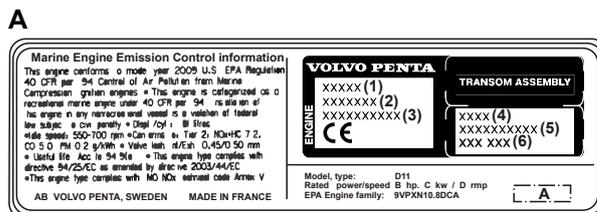
Identification Numbers

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.

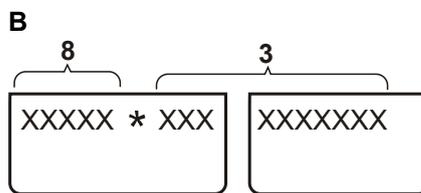
The appearance and location of the type plates is shown below. The figures in brackets refer to the location of the identification number on the type plate.

Engine

- Product number (1*)
- Chassis number (2*)
- Serial number (3*)
- Product designation (8*)



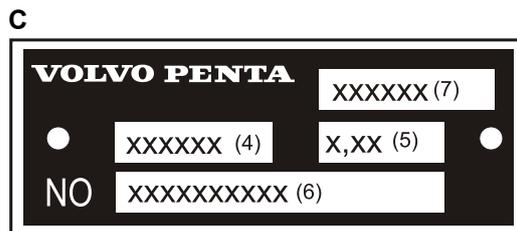
P0010431



P0010442

Propulsion Unit

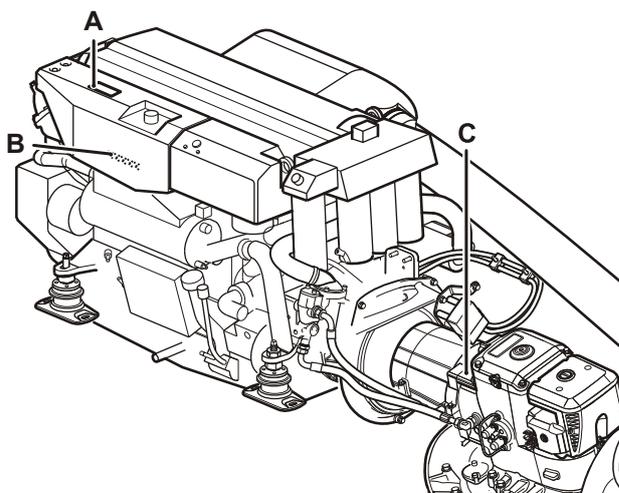
- Product designation (4*)
- Gear ratio (5*)
- Serial number (6*)
- Product number (7*)



P0002669

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

- A Warranty decal (Engine/Propulsion Unit)**
Warranty decal and EPA decal.
- B Engine designation and serial number (1)**
Stamped in engine block.
- C Propulsion unit plate**



P0007394

1. It is not possible to check the engine designation and serial number without removing engine components.

VOLVO PENTA

Declaration of Conformity for Recreational Craft Propulsion Engines with the sound and exhaust emission requirements of Directive 2013/53/EU

VOLVO PENTA IPS

Engine manufacturer

AB Volvo Penta, Gropegårdsgatan, 405 08 Göteborg, Sweden

Body for exhaust emission assessment

DNV GL SE Approval
Brooktorkei 18
20457 Hamburg
Germany
ID Number: 0098

Body for sound emission assessment

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

Modules used for exhaust emission assessment

B + C

Module used for sound emission assessment

A1

Other Community Directives applied: EMC 2014/30/EU

Description of engine(s) and essential requirements: 4 stroke diesel engine and stern drive with integral exhaust

Engine model(s) covered by this declaration

| Engine models | Exhaust EC Type certificate number | (Engine models)/IPS | Sound EC Type certificate number |
|---------------|---------------------------------------|--------------------------|-------------------------------------|
| D11-510 | | (D11-510) / IPS 650 | |
| D11-625 | | (D11-625) / IPS 800 | |
| D11-725..... | RCDB000001M | (D11-725) / IPS 950..... | SDVOLV009 |

| 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 18854:2015 | 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 | Annex I.C.1 |
| Operator's Manual | ISO 10240:2004 | Annex I.C.2 |
| EMC Directive | EN 60945, EN 55012, EN 5022 | Volvo Penta TR2135458 |

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 complies 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: Tom Tveitan, Laws and Regulations
(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title:
(or an equivalent marking)



Date and place of issue: (yr/month/day) 2016/06/15 Göteborg

LR-11/16-01

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 emission assessment

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

Module used for sound emission assessmentAa

Internal production control
Test according to Annex VI

Body for exhaust emission assessment

Germanischer Lloyd
Vorsetzen 32135
D-20459 Hamburg
Germany
ID Number: 0098

Modules used for exhaust emission assessmentB + C

Other Community Directives appliedEMC 2004/108/EC

Description of engine(s) and essential requirements

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

Engine(s) models covered by this declaration

Volvo Penta IPS 650 MC (D11-510)
Volvo Penta IPS 800 (D11-625)
Volvo Penta IPS 950 (D11-725).....

EC Type certificate number

SDVOLL009 (noise)
62737-12 HH (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 60945, EN 55012, EN 55022 | Volvo Penta TR 2135458 |

This declaration of conformity is issued under the sole responsibility of the manufacturer. I declare on behalf of the engine manufacturer that the engine(s) mentioned above comply(ies) with all applicable essential requirements in the way specified and is in conformity with the type for which above mentioned EC type examination certificate(s) has been issued.

Name and function: Tom Tveitan, Laws and Regulations
(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title:
(or an equivalent marking)



Date and place of issue: (yr/month/day) 2013/05/16 Göteborg

PL-05/13 issue 01

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