

# **OPERATOR'S MANUAL**

**D3**

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

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

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

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

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

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

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

Todos los datos recibidos son almacenados de forma interna por Volvo Penta AB y no se ponen a disposición de terceras partes.

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

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

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

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

**DUT** Een Nederlandse versie van dit instructieboek kan kosteloos worden besteld tot 12 maanden na aflevering, internet, post of fax. Zie het bestelformulier achterin het boek. Alle gegevens worden intern opgeslagen bij AB Volvo Penta en niet verstrekt aan derden.

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

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

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

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

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

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

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

Όλες οι πληροφορίες αποθηκεύονται από την AB Volvo Penta και δεν θα μεταβιβαστούν σε τρίτα πρόσωπα.

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

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

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

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

#### CALIFORNIA PROPOSITION 65 WARNING

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.



## Welcome aboard

Volvo Penta marine engines are used all over the world. They are used in all possible operating conditions for professional as well as leisure purposes. That's not surprising.

After 100 years as an engine manufacturer the Volvo Penta name has become a symbol of reliability, technical innovation, top of the range performance and long service life. We also believe that this is what you demand and expect of your Volvo Penta engine.

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

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

We also invite you to visit our home page on the Internet at [www.volvopenta.com](http://www.volvopenta.com)

With warm regards

**AB VOLVO PENTA**

# Contents

<b>Safety Information</b> .....	3–7	<b>Stopping the engine</b> .....	47
General.....	3	Completed operations .....	47
Boat trips .....	4	When there is a risk of frost .....	48
Service and maintenance .....	6	Intermission in operations .....	48
<b>Introduction</b> .....	8–10	Transportation by trailer .....	48
Environmental responsibility .....	8	<b>Maintenance schedule</b> .....	49
Running in .....	8	<b>Care</b> .....	51
Fuel and oils .....	8	Engine, general .....	51
Service and spare parts .....	8	Lubrication system .....	53
Certified engines .....	9	Fresh water system .....	56
Warranty information .....	9	Raw water system .....	59
Identification numbers .....	11	Fuel system .....	62
<b>Presentation</b> .....	12	Electrical system .....	65
Presentation .....	12	Reverse Gear .....	70
<b>Instruments</b> .....	14	Sterndrives .....	72
Starting lock.....	14	Steering .....	77
Start / Stop panel.....	14	Propellers .....	76
Instruments.....	15	<b>Laying-up / launching</b> .....	82
Control panel .....	16	Conservation .....	82
EVC tachometer .....	17	Removing conservation preparations .....	83
EVC system display.....	27	Painting the sterndrive and hull bottom .....	84
<b>Controls</b> .....	35	<b>In case of emergency</b> .....	87
Single-lever control .....	35	Starting with jumper cables .....	87
<b>Starting the engine</b> .....	36	Running aground.....	88
Starting, general. ....	36	Emergency shifting.....	89
Before starting .....	36	Fault tracing .....	90
Start method.....	37	Diagnostic function .....	91
Starting the engine. ....	38	<b>Fault code register</b> .....	94
<b>Operation</b> .....	39	<b>Technical data</b> .....	103
Reading instruments .....	39	Engine .....	103
Alarm .....	40	Fuel specification .....	103
Operations .....	40	Sterndrive and reverse gear .....	104
Cruising speed .....	41	Power Trim .....	104
Power Trim .....	42	Steering .....	104
Trim instrument.....	42		

# Safety Information

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

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



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

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

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

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

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

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



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

## Safety precautions to be taken when operating the boat

### **Your new boat**

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

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

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

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

### **Accidents**

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

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

### **Daily checklist**

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

### **Maneuvering**

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

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

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

### **Refueling**

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

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

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

### **Do not start the engine**

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

### **Safety breaker**

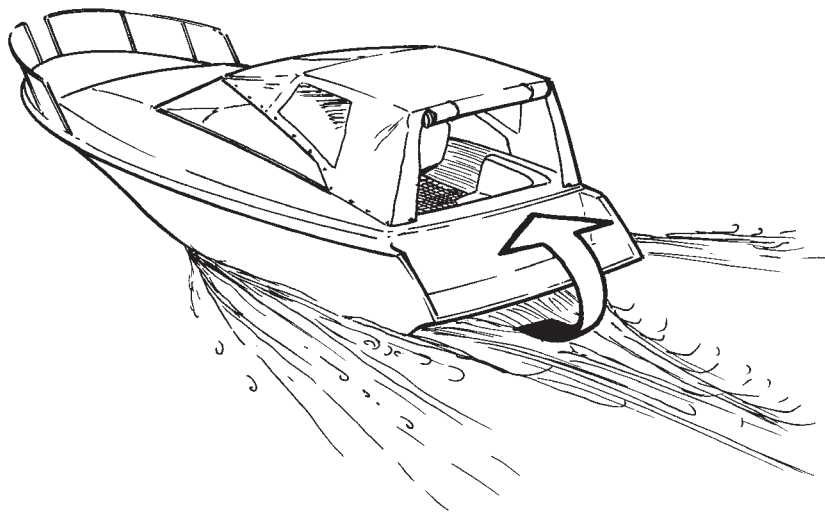
We recommend that you install and use a safety breaker (accessory), especially if your boat can travel at high speeds. The safety breaker stops the engine if the driver falls down and loses control over the boat.

### **⚠ Carbon monoxide poisoning**

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

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

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



### **⚠ Checklist**

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

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



## Safety precautions for maintenance and service operations

### Preparations

#### Knowledge

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

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

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

#### Stop the engine

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

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

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

#### Lifting the engine

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

#### Before starting the engine

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

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

### Fire and explosion

#### Fuel and lubrication oil

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

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

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

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

#### Non-original components

Components used in the fuel system and electrical systems on Volvo Penta products are designed and constructed to minimize the risk of fire and explosion. Using non-original Volvo Penta parts can result in fire or explosion on board.

#### Batteries

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

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

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

#### Start spray

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

### Hot surfaces and fluids

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



### **Carbon monoxide poisoning**

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

### **Chemicals**

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

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

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

### **Cooling system**

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

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

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

### **Lubrication system**

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

### **Fuel system**

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

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

### **Electrical system**

#### **Cutting off power**

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

#### **Batteries**

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

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

# Introduction

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

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

## Care of the environment

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

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

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

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

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

## Running-in

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

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

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

## Fuel and oils

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

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

## Service and replacement parts

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

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

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

## Certified engines

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

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

### This places special requirements for maintenance and service as follows:

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

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

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

**⚠ IMPORTANT!** Late or inadequate maintenance/ service or the use of spare parts not approved by Volvo Penta will invalidate AB Volvo Penta's responsibility for the engine specification being in accordance with the certificated variant.

Volvo Penta accepts no responsibility or liability for any damage or costs arising due to the above.



## Warranty

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

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

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

# VOLVO PENTA

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

### D3

#### Engine manufacturer

AB Volvo Penta, Gropegårdsgatan, 405 08 Göteborg, Sweden

#### Body for exhaust emission assessment

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

#### 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 + D  
EC Type Examination according to Annex VII  
Production quality assurance acc to Annex VII and IX

#### Module used for sound emission assessment

Aa  
International production control  
Test according to Annex VI

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

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

#### Engine model(s) covered by this declaration

Exhaust		Sound	
Engine model(s)	EC Type certificate number	Engine model(s)/drive	EC Type certificate number
D3-110i.....	31036-05 HH, 31037-05 HH	D3-130A drive SX.....	SDVOLLV001
D3-130i/A.....	31036-05 HH, 31037-05 HH	D3-160A drive SX.....	SDVOLLV001
D3-160i/A.....	31036-05 HH, 31037-05 HH	D3-160A drive DPS .....	SDVOLLV001
D3-190i/A.....	31036-05 HH, 31037-05 HH	D3-190A drive DPS .....	SDVOLLV001

Essential requirements	Standards Used	Other normative document used
<b>Annex I.B – Exhaust Emissions</b>		
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
<b>Annex I.C – Noise Emissions</b>		
Sound emission levels	EN ISO 14509:2000/prA1:2004	Annex I.C.1
Operator's manual	ISO 10240:2004	Annex I.C.2
<b>EMC Directive</b>	EN 61000-3-2, EN 61000-3-3, CISPR 25	

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

#### Name and function: Sam Behrmann, Product Liability

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

Date and place of issue: (yr/month/day) 2005/12/12 Göteborg

#### Signature and title:

(or an equivalent marking)



PL-69/05

## Identification numbers

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

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

**NOTE!** Install the appropriate sticker from shield and drive onto the warranty decal.

### Engine

Product designation (1\*) .....

Serial number (2\*) .....

Product number (3\*) .....

### Drive

Product designation (4\*) .....

Gear ratio (5\*) .....

Serial number (6\*) .....

Product number (7\*) .....

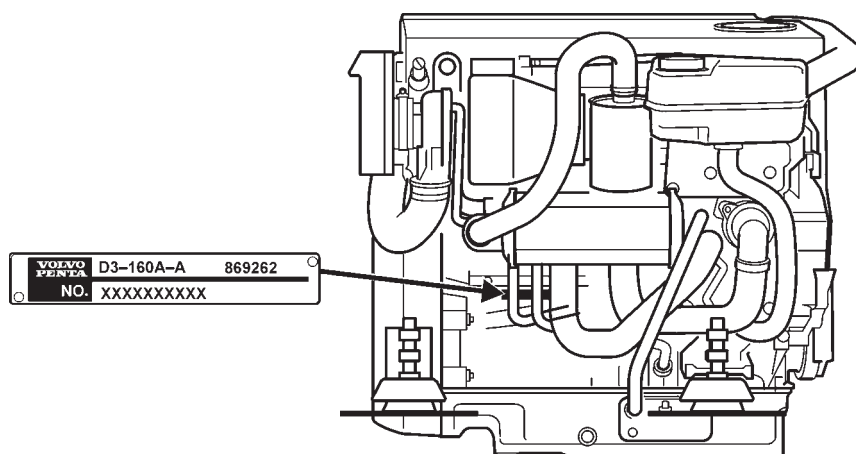
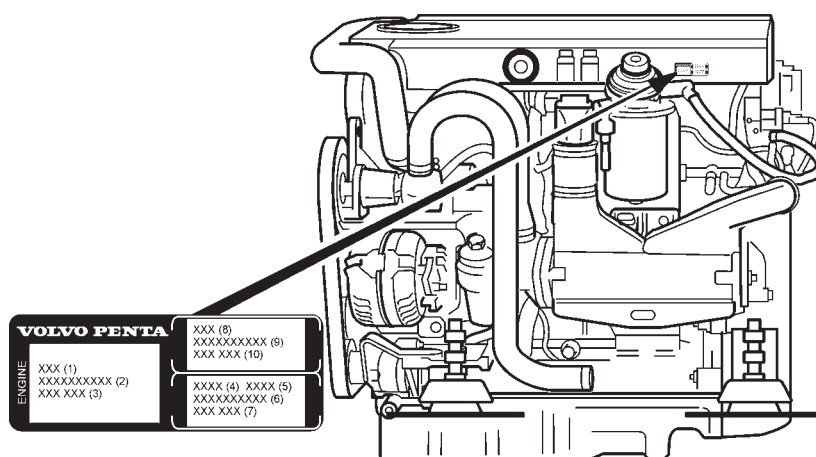
### Shield (Drive)

Product designation (8\*) .....

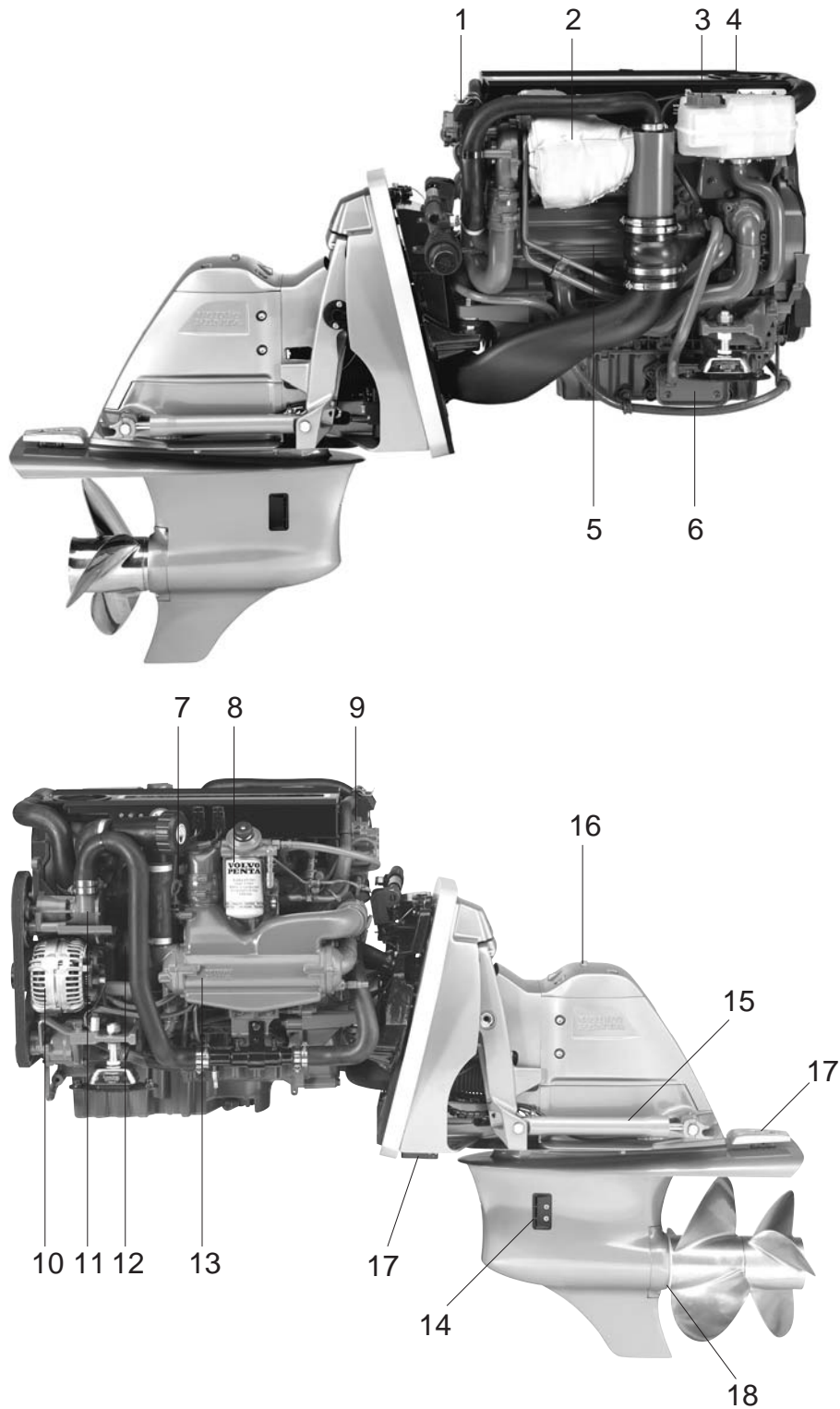
Serial number (9\*) .....

Product number (10\*) .....

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

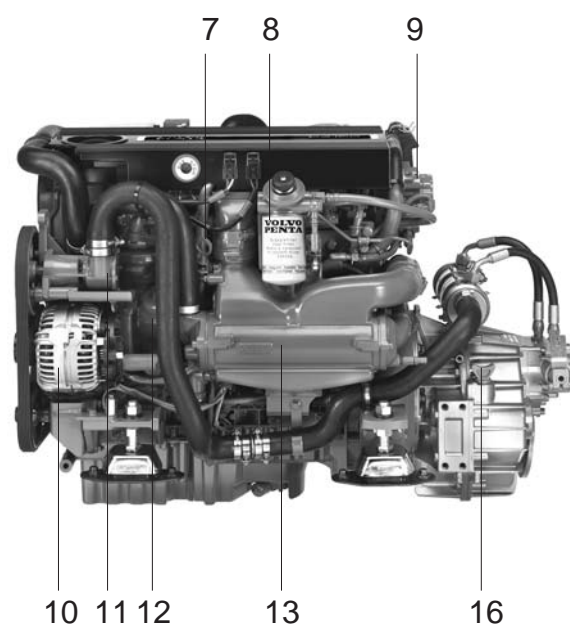
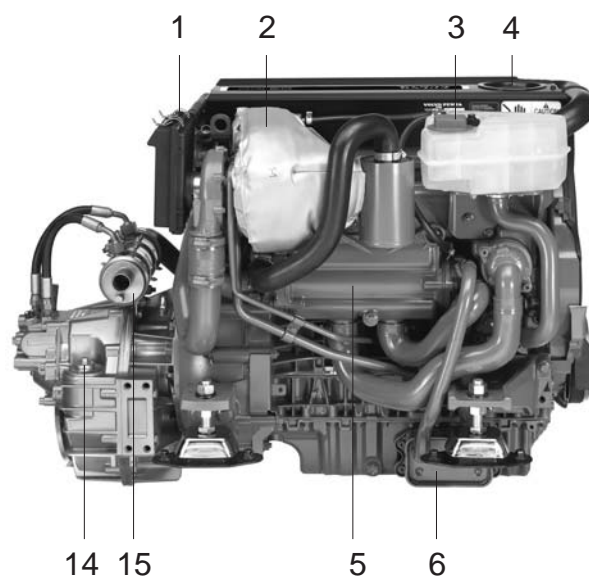


# Presentation



## D3 with SX / DPS drive

- |                            |                                     |
|----------------------------|-------------------------------------|
| 1. Air filter              | 10. Alternator                      |
| 2. Turbocharger            | 11. Seawater pump                   |
| 3. Coolant filler cap      | 12. Oil filter                      |
| 4. Oil filler cap (engine) | 13. Charge air cooler (CAC)         |
| 5. Heat exchanger          | 14. Seawater intake                 |
| 6. Oil cooler              | 15. Trim cylinder                   |
| 7. Oil dipstick (engine)   | 16. Oil dipstick                    |
| 8. Fuel filter             | 17. Sacrificial anode               |
| 9. High pressure fuel pump | 18. Oil draining (behind propeller) |



#### D3 with HS45 reverse gear

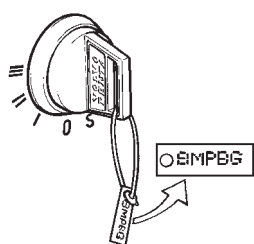
- |                            |                                |
|----------------------------|--------------------------------|
| 1. Air filter              | 9. High pressure fuel pump     |
| 2. Turbocharger            | 10. Alternator                 |
| 3. Coolant filler cap      | 11. Seawater pump              |
| 4. Oil filler cap (engine) | 12. Oil filter                 |
| 5. Heat exchanger          | 13. Charge air cooler (CAC)    |
| 6. Oil cooler              | 14. Oil filter, reverse gear   |
| 7. Oil dipstick (engine)   | 15. Oil cooler, reverse gear   |
| 8. Fuel filter             | 16. Oil dipstick, reverse gear |



# Instruments

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

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



## Ignition switch

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

S = Stop position.

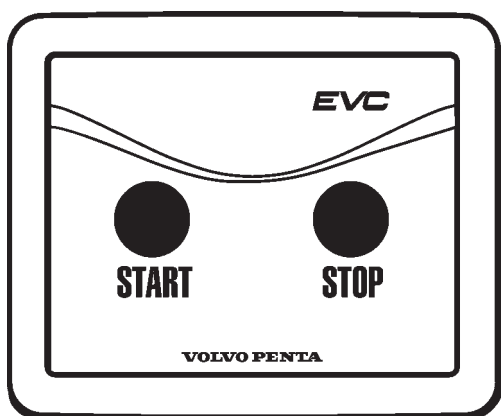
0 = Key can be inserted and removed.

I = System voltage on (drive position).

II = Not used.

III = Start position.

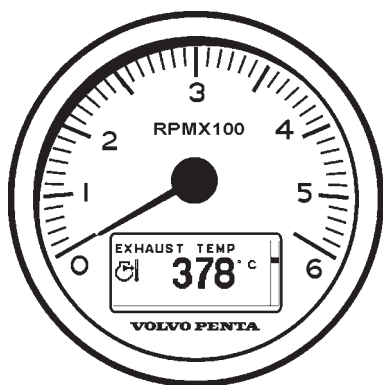
**⚠ IMPORTANT!** Read the starting instructions in the “Starting the engine” chapter.



## Start/stop panel

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

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



## Instruments

The tachometer shows engine speed; multiply the value shown on the dial by 100 to get the number of engine revolutions per minute.

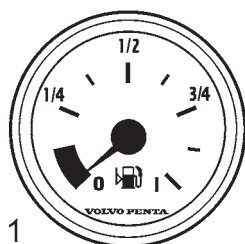
Boat and engine information is displayed in the tachometer window; information displayed depends on engine type, the number of sensors and what accessories are installed.

## Optional instruments

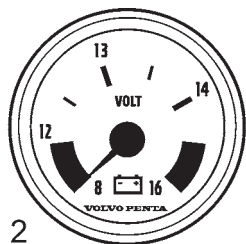
These instruments are sold as engine options by Volvo Penta.

### 1 Fuel level gauge

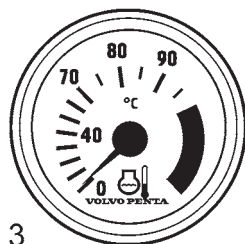
The fuel level gauge shows the quantity of remaining fuel.



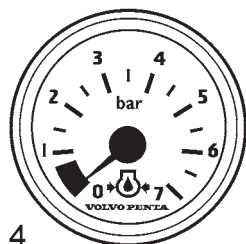
1



2



3



4

### 2 Voltmeter, battery charging

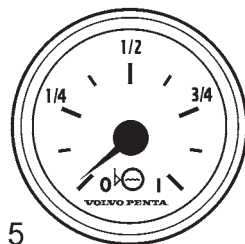
The meter shows the alternator charge current. During operations the charge voltage should be around 14 V. When the engine is stopped and electrical power switched on, the battery voltage should be around 12 V.

### 3 Coolant temperature gauge

The instrument shows the engine coolant temperature. During operations the coolant temperature gauge should normally read between 75-95°C (167-203°F).

### 4 Oil pressure gauge

The oil pressure gauge shows engine oil pressure. During operations the oil pressure gauge should normally show 3-5 bar. At idle, lower values are normal.



5



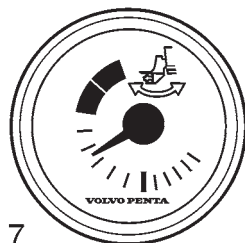
6

### 5 Freshwater level sensor

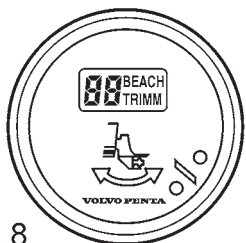
Freshwater tank level gauge.

### 6 Rudder position indicator

The instrument shows rudder position.



7



8

### 7 Trim instrument, analog, for Aquamatic engines

The analog trim instrument shows the position of the sterndrive in relation to the transom shield.

### 8 Trim instrument, digital, for Aquamatic engines

The digital trim instrument shows the position of the sterndrive in relation to the transom shield.



9

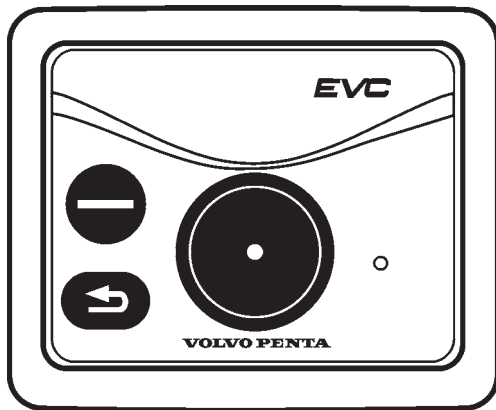
### 9 Alarm monitor

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

## Control panel

The control panel is used for helm station handling and for navigating through the EVC system menus. There are two control panel variants; one for single installations, and one for twin installations.

Always depress the buttons firmly for at least one second.



### Click wheel

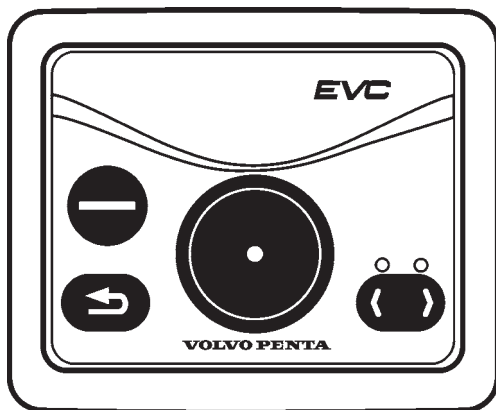
Navigate in the tachometer display menus by turning the click wheel. Confirm a selection by depressing the click wheel.

### Multi-function button

The multi-function button adjusts the display backlight for instruments and panel. Depress the button for more than 1 second to turn the backlight on or off.

The light can be adjusted through five levels by repeated, short (less than 1 second) depressions of the multi-function button.

If the button is depressed on an inactive control panel, operations information will be shown on the display, and it will be possible to navigate through the menus.



### Back button

The button is used to step backwards in the menu.

The button is also used for emergency trimming. Information regarding emergency trimming is found in the "If something happens" chapter.

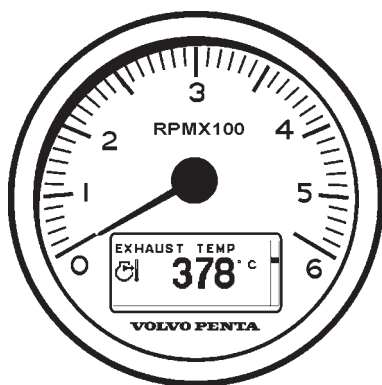
### Selecting the tachometer display

On boats with twin installations that have one tachometer for the starboard and port engines, it is possible to select which engine is to be handled by the control panel.

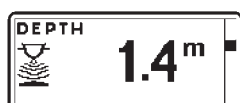
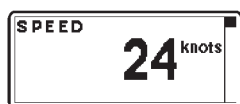
The lamp above the button shows which engine is selected; green for starboard and red for port.

**Extinguished lamp:** It is not possible to navigate in the menu.

**Lit lamp:** It is possible to navigate in the menu for the selected engine.



### Main menu structure



## EVC System Tachometer

### Introduction

Volvo Penta EVC System Tachometer presents relevant boat and engine information to the helmsman. Information is presented on a display in the tachometer.

Information is depending on engine model, number of sensors and type of accessories.

### Using the instrument

#### Start-up screen

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

#### Main menu

##### Navigating the menus

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

#### Speed (Option)

Boat speed. Requires multisensor or GPS.

#### Water temp (Option)

Water temperature. Requires multisensor.

#### Depth (Option)

Water depth. Requires multisensor.

#### Trip menu (Option)

Shows trip information. Requires the following:

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

#### Gauges menu

Shows data parameters.

#### Settings menu

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

#### Faults list

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

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

Trip menu (optional extra)

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

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

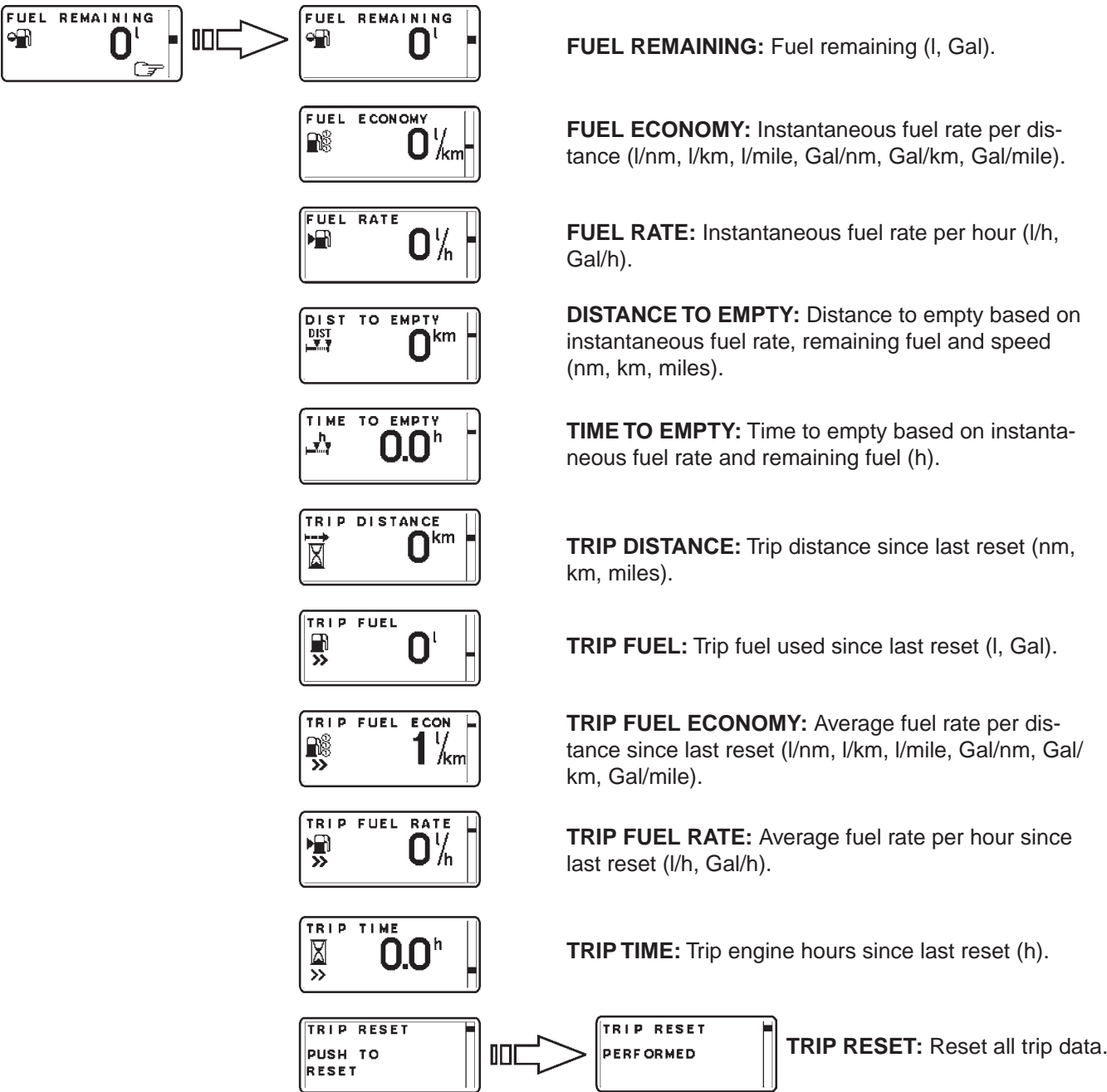
**NOTE!** The accuracy of trip information concerning, and based on, remaining fuel volume depends on which method the user has choosen for calibrating the fuel tank.

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

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

Units are user selectable. See section "Units"

Trip menu structure



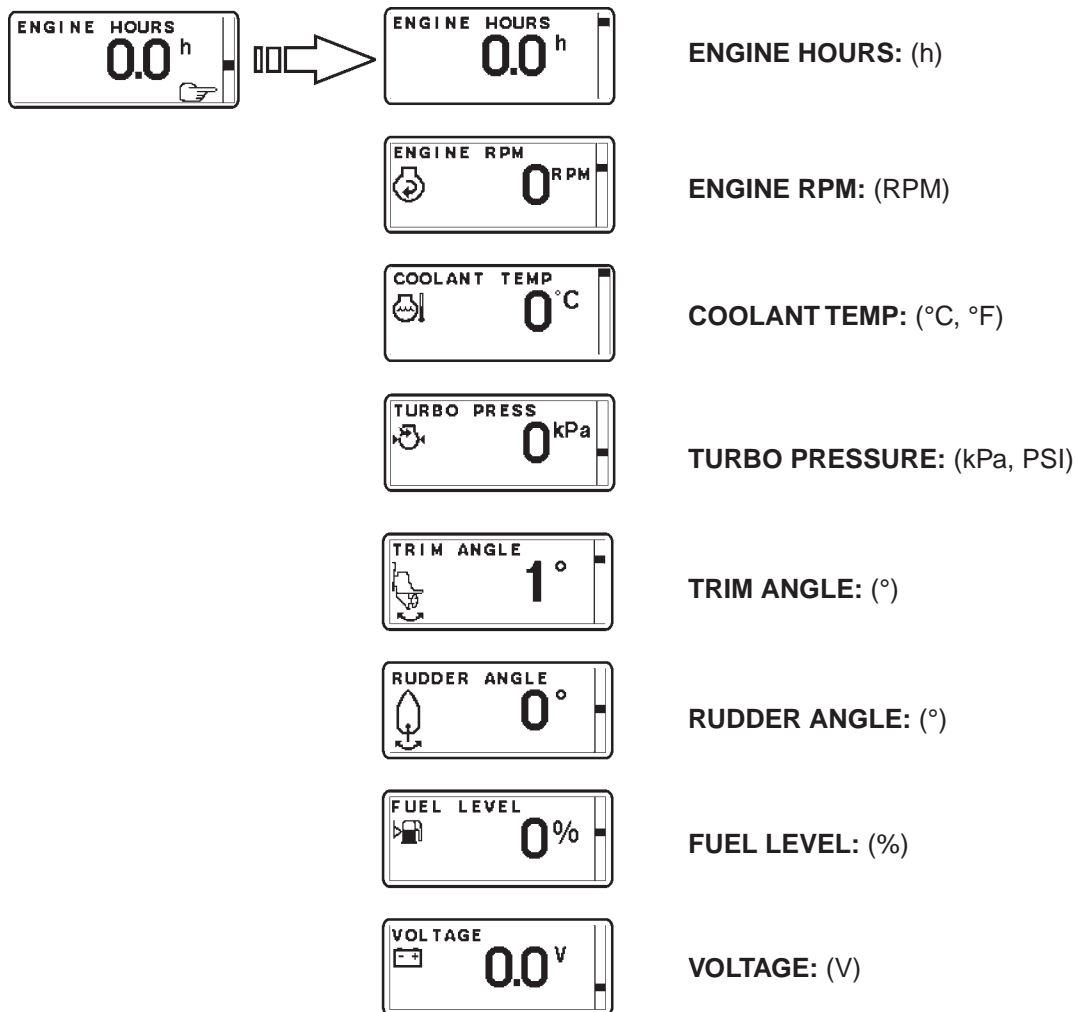
## Gauges menu

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

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

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

### Gauges menu structure



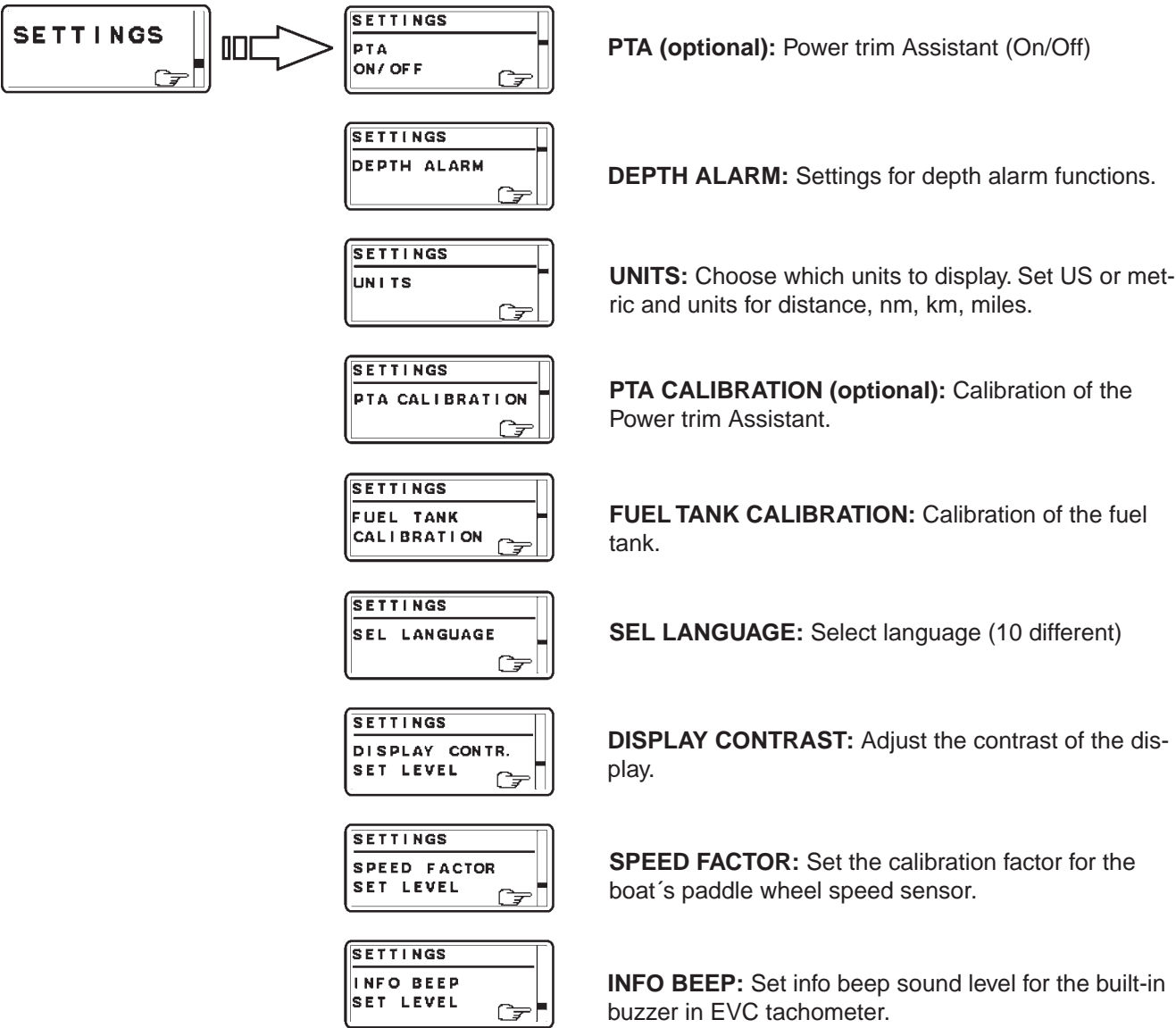
Settings menu

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

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

**NOTE!** For twin installations always perform the settings on the port side system. Port side is the master side.  
When in SETTINGS MENU, select view by turning NAVIGATION WHEEL. Views with a POINTING HAND-symbol indicates a SUB-MENU. To enter a SUB-MENU, push NAVIGATION WHEEL.  
Push BACK BUTTON to return to MAIN MENU.

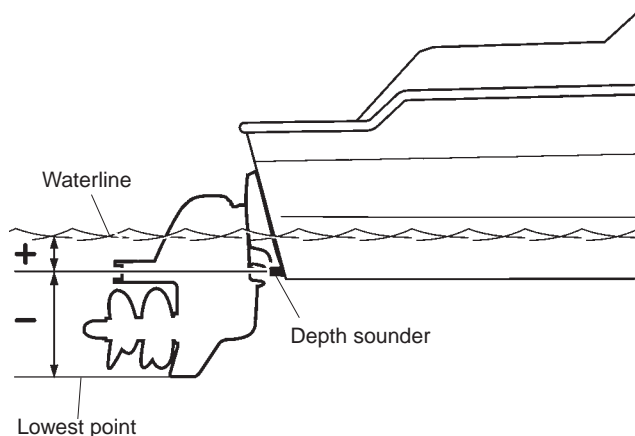
Settings menu structure





## Depth alarm (optional extra)

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



### DEPTH ALARM, ON/OFF

Depth alarm can be switched ON/OFF.

### SET DEPTH

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

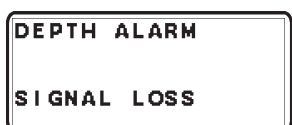
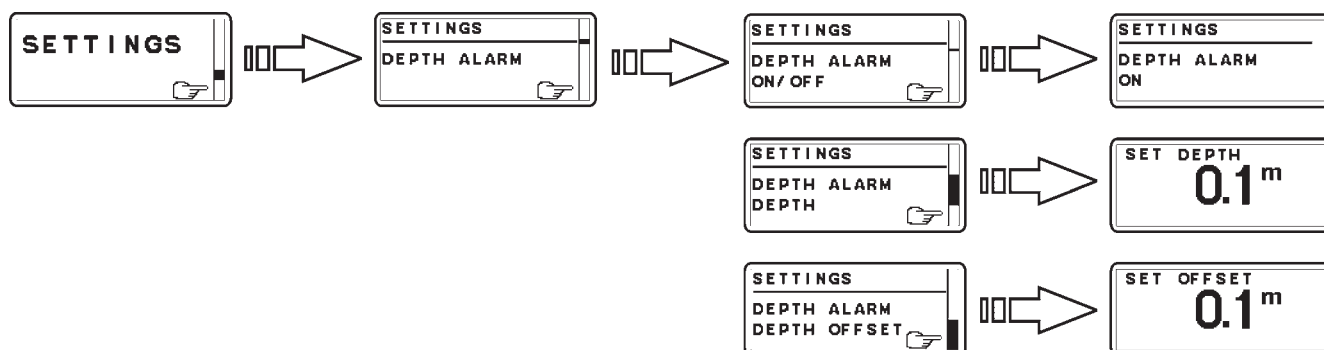
Once adjustment value is reached, the data is stored by pushing NAVIGATION WHEEL.

### DEPTH OFFSET

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

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

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



### Depth alarm pop-up

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

Acknowledge depth alarm by pushing NAVIGATION WHEEL.

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

### Depth alarm signal loss

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

## Select units and language

Choose which units and languages to display.

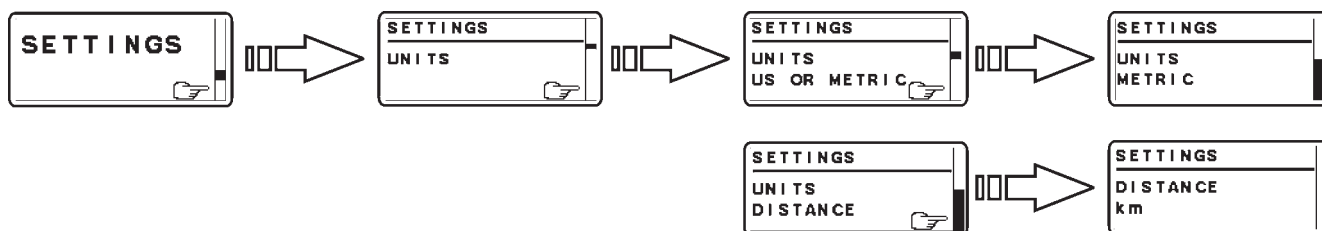
**NOTE!** Language and unit settings must be performed in all EVC system tachometers.

### US or METRIC

1. Select UNITS and push NAVIGATION WHEEL.
2. Select US OR METRIC and push NAVIGATION WHEEL.
3. Set US or METRIC units by turning NAVIGATION WHEEL and confirm by pushing NAVIGATION WHEEL.

### DISTANCE

1. Select UNITS and push NAVIGATION WHEEL.
2. Select DISTANCE and push NAVIGATION WHEEL.
3. Set distance unit: km, nm or miles and confirm by pushing NAVIGATION WHEEL.



### LANGUAGE

1. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
2. Select SEL LANGUAGE and push NAVIGATION WHEEL.
3. Select language and confirm by pushing NAVIGATION WHEEL.



## Power Trim Assistant, PTA (optional extra)

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

### PTA CALIBRATION

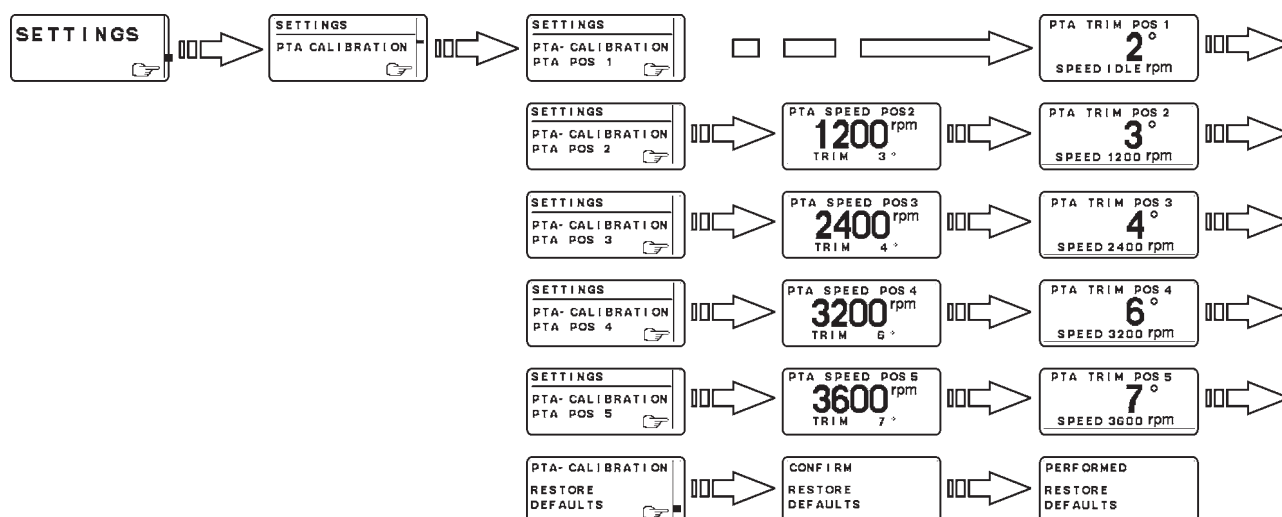
**NOTE!** For twin installations always perform the PTA CALIBRATION on the port side system. Port side is the master side.

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

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

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

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



## Fuel tank calibration

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

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

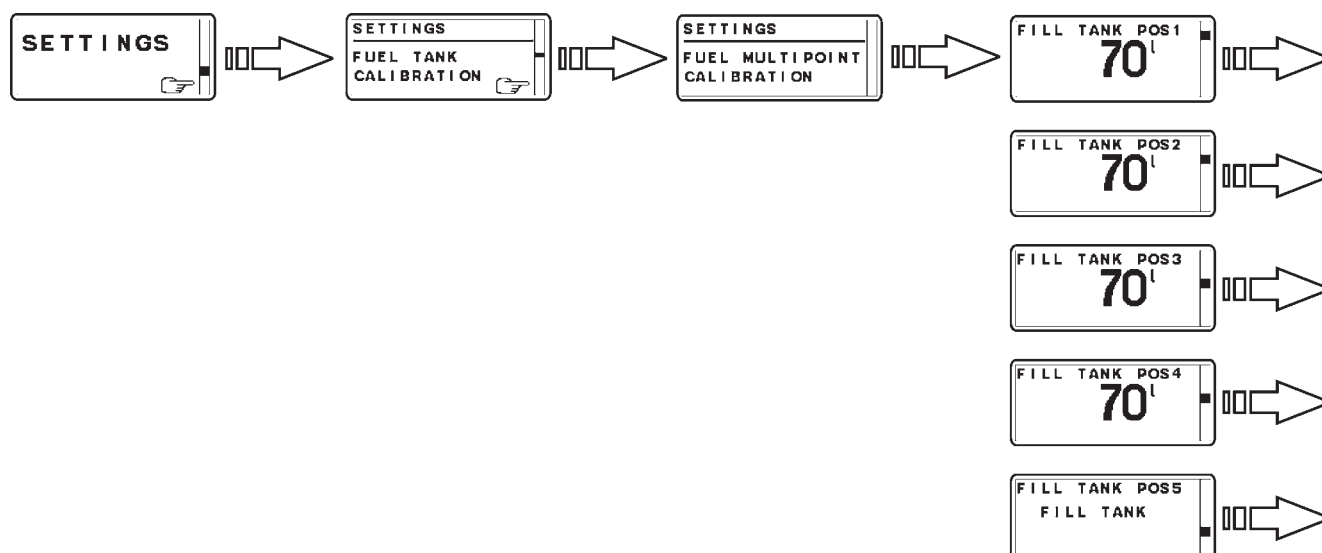
### FUEL MULTIPOINT CALIBRATION

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

When FUEL MULTIPOINT CALIBRATION is selected, the fuel level sender is calibrated in five equally divided steps; 20 % full, 40 % full, 60 % full, 80 % full and 100 % full.

1. Select **SETTINGS** from **MAIN MENU** by turning **NAVIGATION WHEEL**. Push **NAVIGATION WHEEL** to enter **SETTINGS MENU**.
2. Select **FUEL TANK CALIBRATION** and push **NAVIGATION WHEEL**.
3. Select **FUEL MULTIPOINT CALIBRATION** by turning **NAVIGATION WHEEL**. Push **NAVIGATION WHEEL** to enter **FUEL MULTIPOINT CALIBRATION**.
4. Fill fuel tank with displayed volume and push **NAVIGATION WHEEL**. Repeat procedure until the fuel tank is full.

Push **BACK BUTTON** to return to **SETTINGS MENU**.



### FUEL MULTIPOINT CALIBRATION

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

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

1. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
2. Select FUEL TANK CALIBRATION and push NAVIGATION WHEEL.
3. Select FUEL MULTIPOINT CALIBRATION by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter FUEL MULTIPOINT CALIBRATION.



### Approximated trip data

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

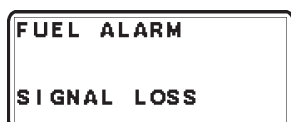


### Fuel alarm pop-up

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

Acknowledge fuel alarm by pushing NAVIGATION WHEEL.

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



### Fuel level signal loss

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

### Speed factor

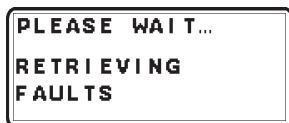
The speed factor for the boat's paddle wheel speed sensor can be adjusted at a resolution of 1% and is used by the EVC to apply a correction to the output from the speed sensor.

#### Set speed factor

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

Adjust the speed factor by turning the NAVIGATION WHEEL.

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



### Information message

#### Approximated trip data

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

#### Retrieving faults

The EVC system is retrieving faults from its nodes.

## EVC System Display (optional extra )

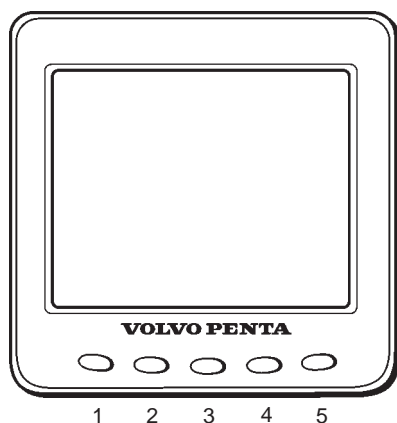
### Introduction

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

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

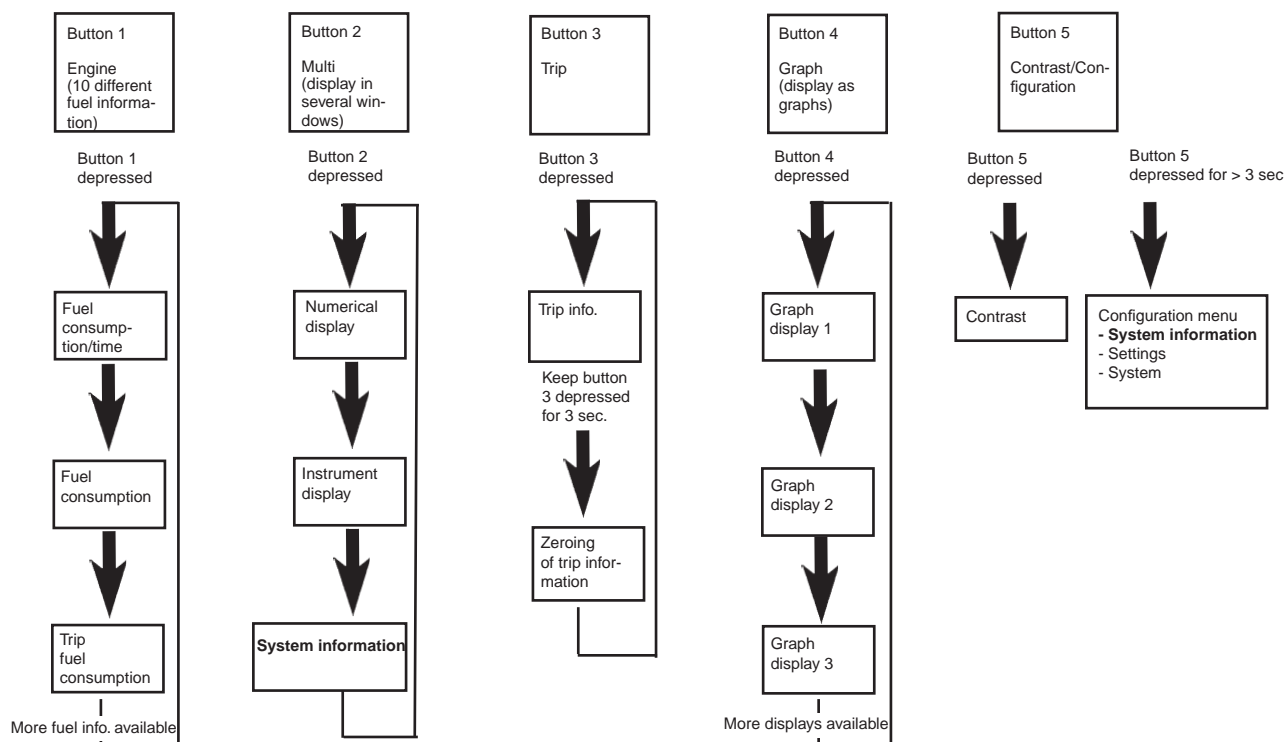
The four buttons at the furthest left are used to display operating information in different ways. The button at the furthest right is used to adjust the display contrast and to access the so-called configuration menu. Various settings etc. can be done in it. You can also use the configuration menu to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

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



1 2 3 4 5

### Structure of the display functions







**Start image**

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

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

**Symbols for operating information**

- |   |                     |   |                                |
|---|---------------------|---|--------------------------------|
|    | Engine speed        |    | Speed                          |
|    | Coolant temperature |    | Fuel consumption/time          |
|    | Engine temperature  |    | Turbocharge pressure (current) |
|    | Fuel pump pressure  |    | Induction air temperature      |
|    | Oil pressure        |   | Voltage                        |
|  | Coolant temperature |  | Fuel level                     |

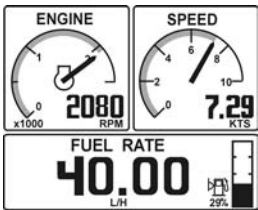


Figure for single engine installation

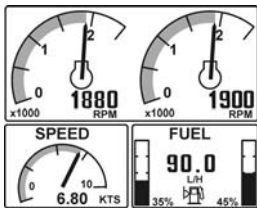
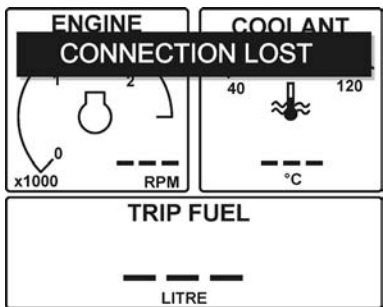


Figure for twin engine installation

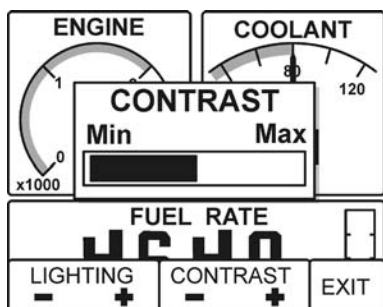
**Display after starting screen**

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



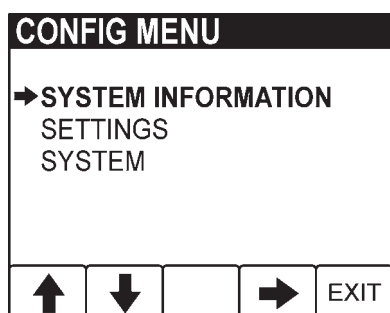
**Connection fault**

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



### Set display contrast

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



### Configuration menu (button 5)

(depressed for longer than 3 s)

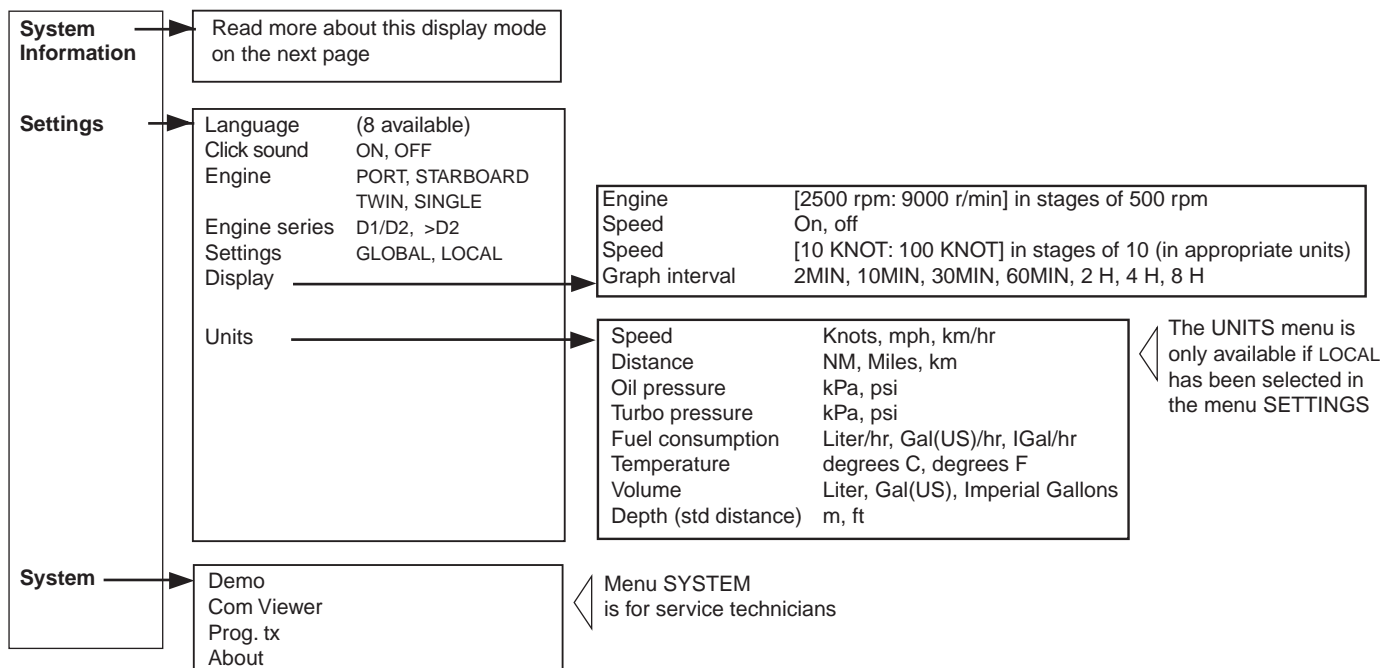
The configuration menu is used to:

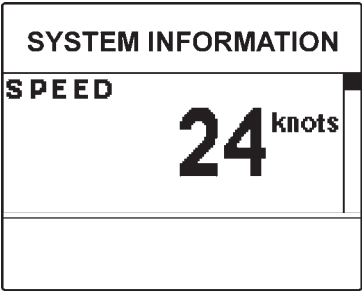
- access the display mode SYSTEM INFORMATION
- do various settings for the display
- reach information and functions for servicing the display

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

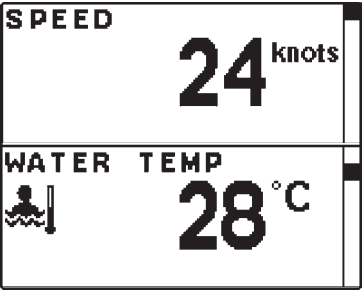
**Note!** The port engine or both engines must have the ignition switched on when display settings are changed.

### Configuration menu structure

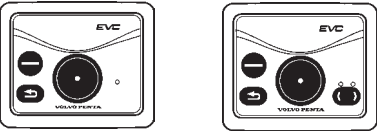




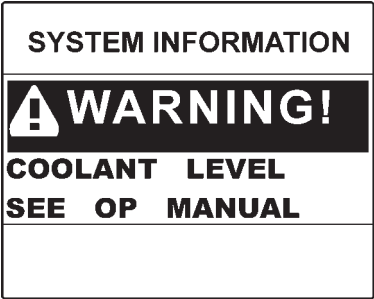
SYSTEM INFORMATION display mode for single engine installations



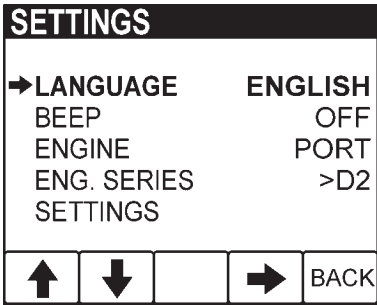
SYSTEM INFORMATION display mode for twin engine installations



Control panel



Alarm example



### Display mode System Information

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

In display mode SYSTEM INFORMATION there are several functions:

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

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

### Information message and alarm

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

### Settings

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

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

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

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

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

## System

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

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

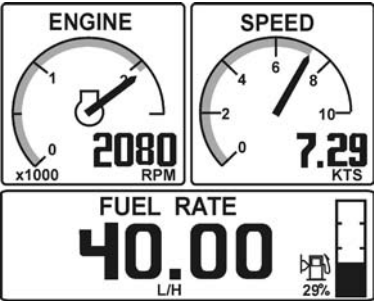


Figure for single engine installation

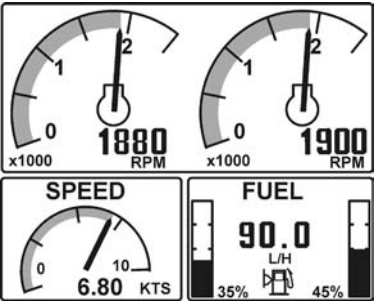


Figure for twin engine installation

Display mode Engine (Button 1)

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

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

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

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

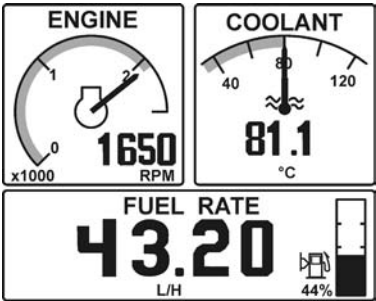
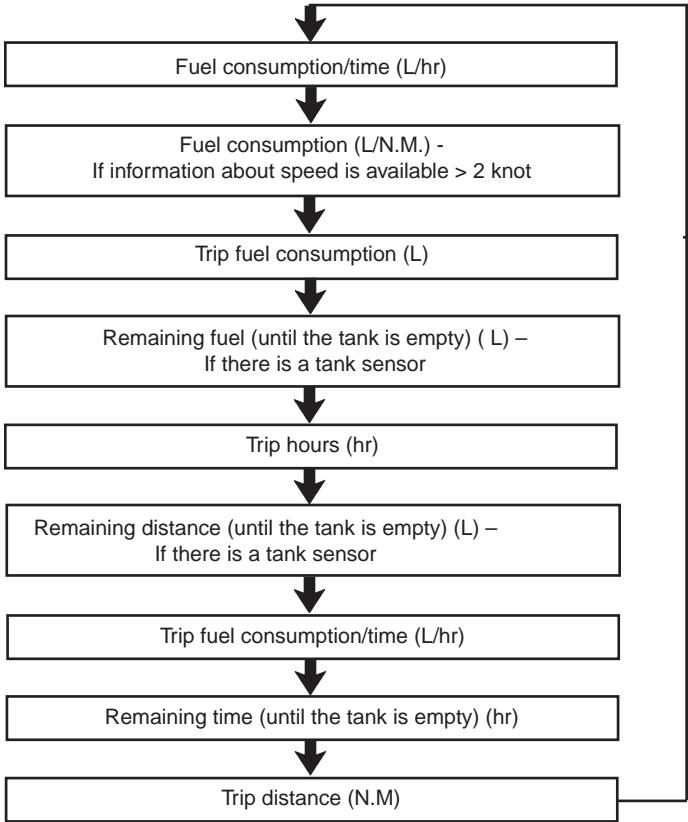
Only metric values are displayed, but other units can be displayed if they have been chosen in the configuration menu.

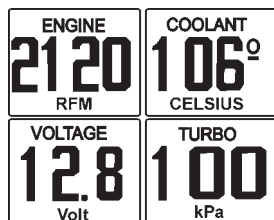
The scale values for maximum engine speed and maximum speed can be set in the configuration menu.

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

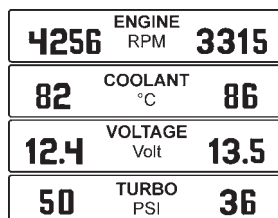
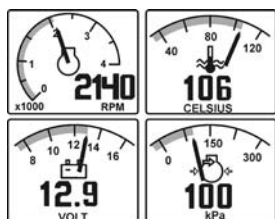
Menu, trip computer

Button 1  
Changes display each time the button is pressed





Example of display in several windows for single engine installation



Example of display in several windows for twin engine installation

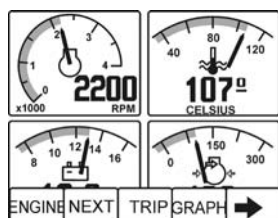
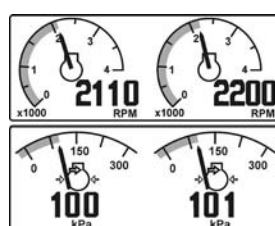
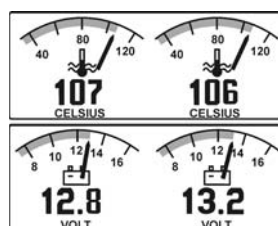


Figure for single engine installation

Press button 5 to choose setting mode

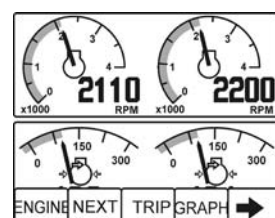


Figure for twin engine installation

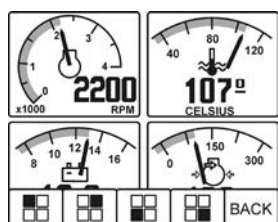


Figure for single engine installation

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

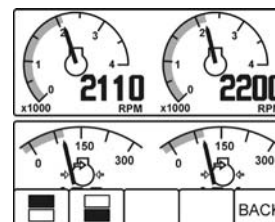


Figure for twin engine installation

## Display mode Multi (button 2)

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

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

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

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

## Set the appearance of the display mode Multi

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

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

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

**Note!** This applies to the graphic display:

The maximum engine speed range can be set on the configuration menu.

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

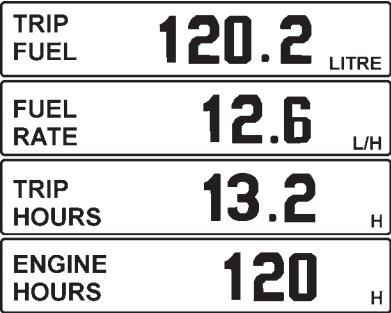


Figure for single engine installation

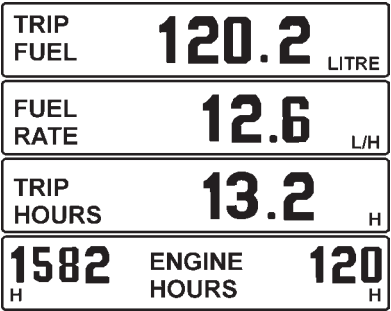


Figure for twin engine installation

Display mode Trip (button 3)

This display mode shows:

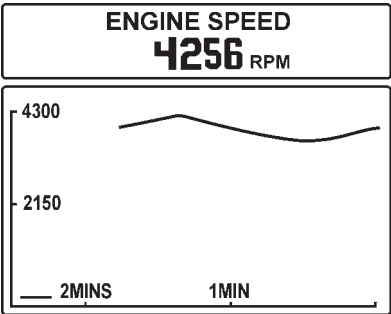
- Fuel used after last zeroing
- Instantaneous fuel consumption (amount of fuel used per hour) (If speed information is available, instantaneous fuel consumption can also be calculated in relation to distance.)
- Operation time after last zeroing
- Total operating time (can not be zeroed)

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

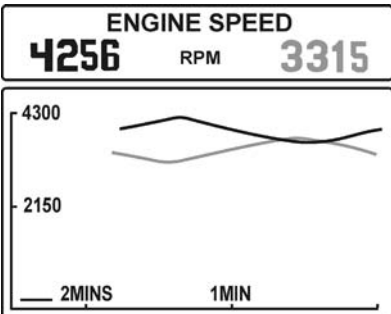
Note!

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

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



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



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

Display mode Graph (button 4)

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

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

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

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

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

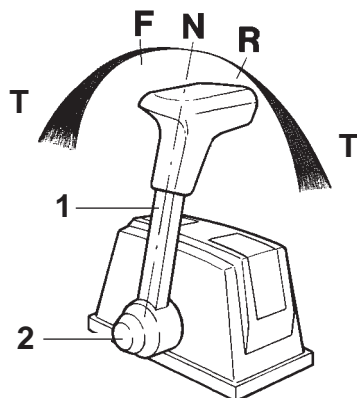
The maximum time interval can be set to one of the following values in the configuration menu: 2 min, 10 min, 30 min, 1 h, 2 h, 4 h, 8 h.

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

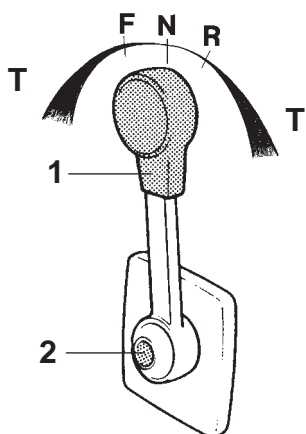


# Controls

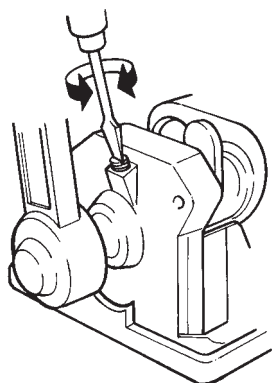
This chapter describes the controls sold by Volvo Penta for your engine. If your boat is equipped with controls which are not described here and you feel uncertain about the function, please contact the dealer you purchased the boat from.



Top-mounted control



Side-mounted control



## Single lever control

### Maneuvering

Shifting and engine speed are controlled with the same lever (1).

**N** = Neutral position. Drive disengaged.

**F** = Drive engaged for movement ahead.

**R** = Drive engaged for movement astern.

**T** = Engine speed control

### Disengaging the shift function

- Move lever (1) to the neutral position (**N**).
- Press in button (2), move the lever slightly forward and release the button. The shift function is now disengaged and the lever affects only engine speed.
- When the lever is moved back to the neutral position it will automatically re-engage.



**IMPORTANT!** Take care not to engage the drive by mistake.

### Adjusting the friction brake

The friction brake only affects the engine speed control movements.

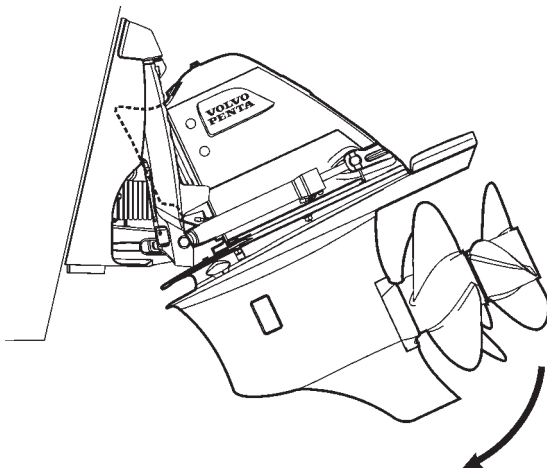
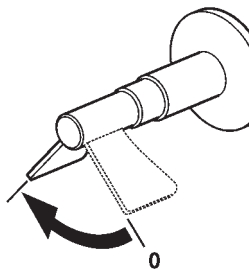
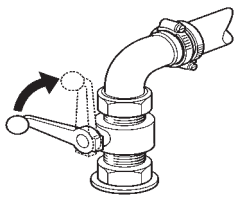
- Lift the cover over the control. For side-mounted controls the lever must first be removed.
- Set the lever to the half-open throttle/reverse position.
- Adjust the friction brake. Turning the screw clockwise (+) makes the lever movement stiffer, while turning counterclockwise (-) makes it easier to move the lever.
- Reinstall the cover and lever.

# Starting the engine

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

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

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



## General information about starting

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

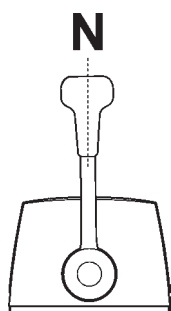
The idling speed is also governed by engine temperature, and is somewhat raised after a cold start.

## Before starting

- Open the fuel tap
- Open the seacock where fitted.
- Do the tasks under the “Daily before first start” heading in the maintenance schedule.
- Turn on the main switches.

**⚠ IMPORTANT!** Never disconnect the current with the main switches on when the engine is running. This can damage the alternator and electronics.

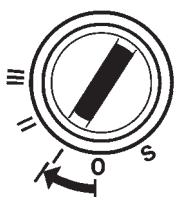
- Start the engine bay fan, if one is installed, and let it run for at least four minutes.
- Check that the amount of fuel aboard is enough for your planned voyage.
- Check the oil level.
- Lower the drive(s), if raised.



## Starting method

### Put the lever control in neutral

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



### Turn the ignition on

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

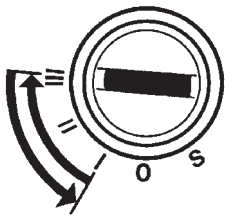


### Check the LEDs

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

### Check the tachometer display

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

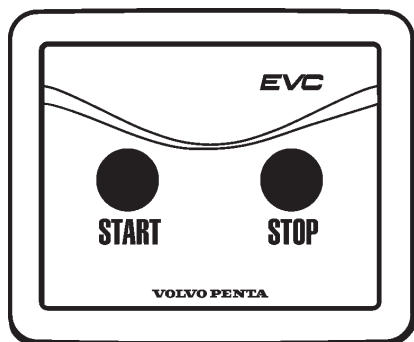


## Start the engine

### Start using the ignition switch

Turn the key to position "II". Release the key and let the key spring back to position "I" as soon as the engine has started. Stop cranking if the engine does not start within 20 sek.

All the warning lamps will light up right after the engine has started, check that all of them goes out again.



### Starting with the starter button

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

## Read the instruments and warm the engine up

Allow the engine to idle for the first ten seconds, and check that instruments and warning displays show normal values. Check that no warning lamps flash on the alarm display.

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

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

# Operation

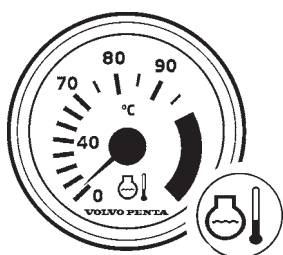
Learn to handle the engine, controls and other equipment in a safe and correct manner before you cast off on your maiden voyage. Remember to avoid sudden or surprising rudder movements and gear shifting. There is a risk that passengers could fall over, or overboard.

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

## Reading the instruments

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

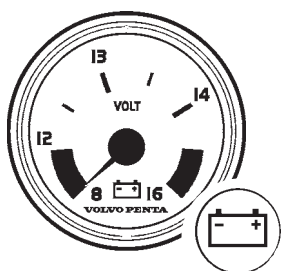
All the reading on the analogue instruments are also available in the Menu system on the LCD display.



### Coolant temperature (optional)

The temperature gauge should normally indicate between 75– 100°C (167-212°F) in normal operation.

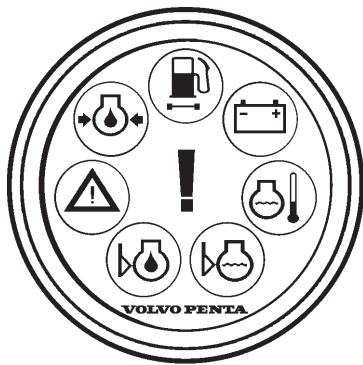
If the coolant temperature is too high, the audible warning will sound automatically at the same time as the lamp in the warning display will flash.



### Charging (optional)

During operation, system voltage should be about 14V. During warming of the engine the voltage is slightly higher.

If there is a charge failure the lamp in the warning display will flash.



## Alarm

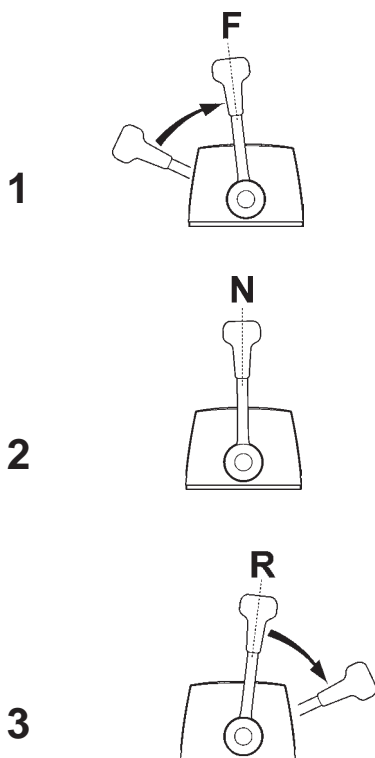
If a fault occurs, the audible warning will sound and the relevant warning lamp on the optional alarm display will start to flash and the tachometer display will show a alarm pop-up.

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

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

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

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



## Operation

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

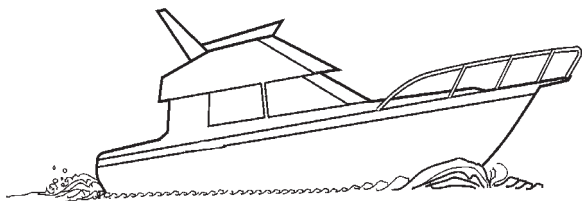
### Always do a forwards/reverse operation as follows:

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

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

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

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



## Cruising speed

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

### Full throttle range:

D3-130A/160A/190A.....	3800–4100rpm
D3-130i/160i/190i .....	3800–4100rpm
D3-110i.....	2700–3000rpm

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

## Power Trim

Your Volvo Penta sterndrive is equipped with a hydraulic trim system – Power Trim – that makes it possible to adjust the drive angle in relation to the transom from the helm station. Drive angle influences the boat's attitude under way, e.g. acceleration to plane is improved and the boat is held on the plane at a lower throttle setting. Trimming can also be used to achieve a more comfortable motion in choppy seas.

## Trim instruments

To use information from the trim instruments, it is important to understand the three trim ranges and their use.

### Trim range

The Trim range is used to achieve optimal comfort when under way – from start to top speed.

### Beach range

The Beach range is used for operations with reduced speed in shallow water or where the water depth is unknown,

The highest permissible engine speed in the Beach range is 1,500 rpm.



**IMPORTANT!** Check that the sterndrive water inlet is always below the surface of the water when operating the sterndrive in the Beach range.

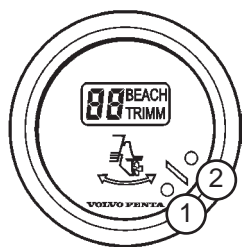
### Lift range

The Lift range is never used during operations; it lifts the sterndrive to maximum height and is used for example when the boat is transported by trailer. Power Trim has a limit switch that shuts off electrical power when the end position is reached. The limit switch resets automatically when the sterndrive is trimmed down.



**WARNING!** The engine may not be run with the sterndrive in the Lift range.

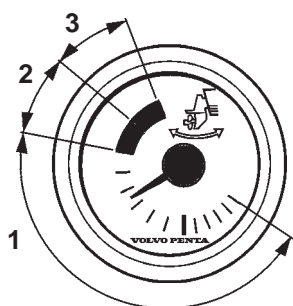




### Digital trim instrument

The trim instrument shows the drive trim position. The sterndrive trim angle is indicated in relation to the horizontal. The lowest value shows that the sterndrive is trimmed down to the maximum, and the highest value that the stern drive is trimmed up to the maximum. Note that the lowest value may vary from boat to boat depending on transom angle. When the sterndrive angle is within the Trim range, the text "TRIM" is shown on the display.

When the sterndrive angle is in the Beach range, lamp 1 glows orange and the text in the display shows "BEACH". When the sterndrive is in the Lift range, the stern drive angle is above +30° and lamp 2 glows red. No text is shown in the display.



**⚠ WARNING!** The engine may not be run with the sterndrive in the Lift range.

### Analog trim instrument

The trim instrument shows the drive trim position. Beach range is marked with an orange sector, and Lift range by a red sector.

- 1 Trim range
- 2 Beach range (orange)
- 3 Lift range (red)

The trim angle is also shown in the tachometer window.

## Trim control

The sterndrive can be trimmed with the Power Trim panel, or with the aid of the button on the control lever; on twin installations there is a trim control for each sterndrive. The trim panel is used for both single and twin installations. On twin installations the control panel can be used for individual or simultaneous adjustments of the sterndrives.

The current sterndrive position is shown on the trim gauge. By trimming the drive out from the transom the bow can be "raised" in relation to the horizon; if the drive is trimmed in, the bow is "lowered".

### Trimming the drive out

Depress button 1 to raise the bow – the drive is trimmed out.

Twin installation: On twin installations both stern-drives can be trimmed out at the same time by depressing button 1.

In order to trim out the drives individually, depress trim panel button 2 for the port drive and button 3 for the starboard drive.

The current sterndrive position is shown on the trim instrument.

### Trimming the drive in

Depress button 4 to lower the bow – the drive is trimmed in.

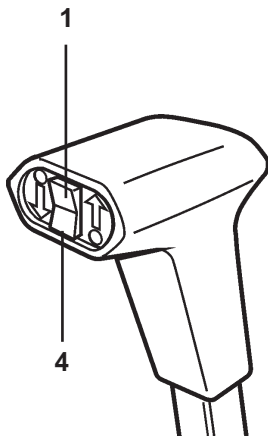
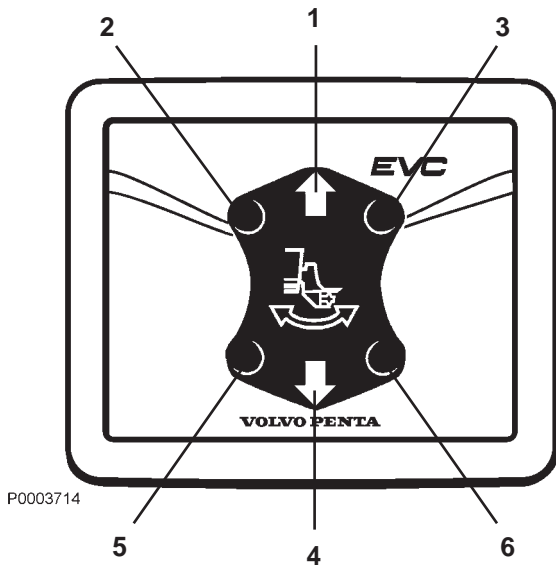
Twin installations: On twin installations both drives can be trimmed in at the same time by depressing button 4.

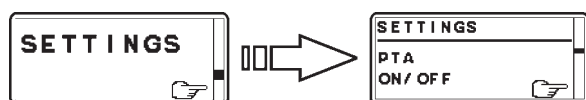
In order to trim in the drives individually, depress trim panel button 5 for the port drive and button 6 for the starboard drive.

The current sterndrive position is shown on the trim instrument.

## Emergency trimming

If a fault arises that prevents sterndrive trimming from the trim panel, it is possible to trim manually; refer to the Emergency trimming section in the "If something happens" chapter.





## Power Trim Assistant, (optional equipment)

The power trim assistant function automatically adjusts the trim angle depending on engine revolutions (rpm). Five trim angles can be set for five different engine speeds (including idle). Refer to the “Tachometer” section.

Power Trim Assistant is switched on or off in the tachometer menu SETTINGS / submenu PTA.

**IMPORTANT!** For twin installations, all power trim settings must be carried out from the system's port side. Port is the master side.

**WARNING!** If the boat is equipped with Power Trim Assistant, this function must be switched off before the boat is taken out of the water. This prevents automatic drive trimming if test runs are performed with the boat on land.

## Operation

Correct drive trim provides optimal comfort under way.

Every boat has its own unique qualities and is affected differently by how it is trimmed. Therefore we can only provide general advice on how to achieve the best trim angle for your boat. In general terms it can be said that when the boat feels well-balanced, is easy to steer and comfortable to drive, the optimal trim angle has been achieved.

Carry out a few test runs at lower speeds to become accustomed to Power Trim and the different trim positions to see what effect they have. Take note of how long it takes to get the boat up onto plane. Check the tachometer, the speed and the boat's behavior.

### Trimming the drive in

The bow is forced down and the boat can accelerate faster. It also provides improved driving and steering characteristics at speeds below the planing threshold.

### Operations in “bow down” position

“Bow down” position is normally used during acceleration up to planing speed, at low planing speeds, or into choppy seas. In full “bow down” position, the boat has a tendency to steer itself. It may be necessary to compensate at the wheel to keep the boat on a straight course. In this position the bow runs deeper through the water. If the boat is driven at high speed or in heavy seas the bow will dig into the water. The boat may begin to steer by the bow and yaw suddenly with the risk of passengers being thrown overboard. The boat's trim position must always be adjusted to provide well-balanced steering. Certain combinations of boats, engines and propellers may cause instability and / or self-steering tendencies when the boat is driven at or close to the maximum bow up or bow down positions. Boat stability and steering characteristics can also vary depending on sea conditions. If your boat displays instability and / or self-steering tendencies, contact your Volvo Penta dealer to have it remedied.

### **At planing speed**

Trim the drive to the angle that provides the most stable and comfortable running. If the boat has a twin installation the drives can be trimmed at different angles to compensate for sidewinds and to a certain extent counteract uneven loading.

### **Operations in “bow up” position**

The “bow up” position is normally used for operations at cruising revolutions, in choppy seas or at full speed. At full “bow up” the boat may have a tendency to self-steer. It may be necessary to compensate with the rudder to keep the boat on a straight course. In this position the bow will try to lift itself out of the water. Exaggerated “bow up” trim causes propeller cavitation with the result that the propeller loses grip. Engine revolutions also increase, but boat speed does not, and may indeed drop. Be careful when operating in choppy seas. Exaggerated “bow up” trim may cause the boat to heave up quickly with the risk for passengers being thrown overboard.

### **Operations in choppy or heavy head seas**

Trim in the drive so that the bow drops. This provides a more comfortable run. Refer to the section “Operations in bow down position”

### **Operations with the sterndrive in Beach range**

Beach range is used for operations with reduced speed in shallow water or where the water depth is uncertain.

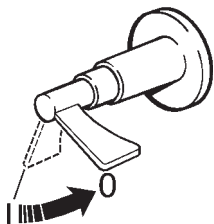
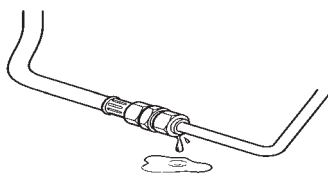
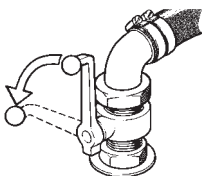
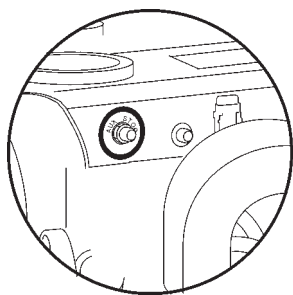
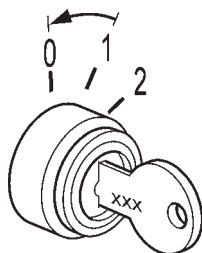
The highest permissible engine speed in the Beach range is 1,500 rpm.



**IMPORTANT!** Check that the sterndrive water inlet is always below the surface of the water when operating the sterndrive in the Beach range.

# Stopping the engine

The engine must be run for a few minutes at idle (in neutral) before it is stopped. This prevents boiling and evens out temperatures. This is especially important when the engine has been run at high rpm or under heavy load.



## Completed operations

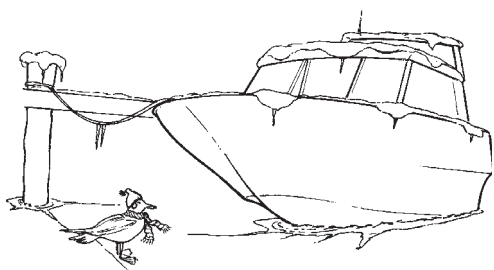
Turn the key to position “0”.

### Extra stop

If the engine cannot be stopped in the normal manner, it is possible to shut it down using the extra stop located on the side of the engine.

## After the engine has stopped

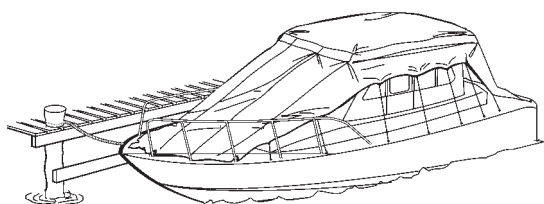
- Close the fuel tap
- Close the sea cock, if fitted.
- ⚠ **IMPORTANT!** Remember to open the seacock and fuel tap before the engine is started again.
- Inspect the engine and engine bay for leaks.
- Boats with sterndrives: Trim the drive down to maximum to protect the trim ram piston's untreated surfaces from fouling.
- ⚠ **IMPORTANT!** If there is a risk of the boat striking bottom with the drive, the drive must instead be trimmed up to the maximum lift position.
- Turn off the main switches if the boat will not be run for a while.
- ⚠ **IMPORTANT!** Make sure the start key is switched off (is in the “0”-position or removed) before the mainswitches are turned off. Otherwise the electrical system may be damaged.



### Cold weather precautions

To prevent freezing damage, the seawater system must be drained and the freshwater system coolant must have sufficient antifreeze protection. Please refer to "Maintenance: Freshwater system".

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

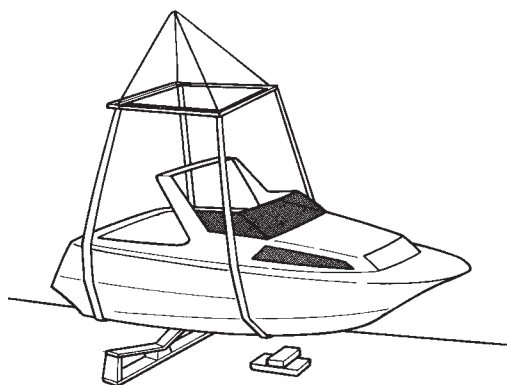


### Operation break

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

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

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

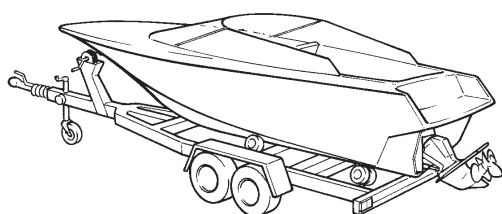


### Transporting on a trailer

Before pulling boats with or on to a trailer, trim the drive out to "Lift range" (maximum lift). An automatic stop will cut off the current to the hydraulic pump when the drive has reached its max. lift point. The stop is automatically reset when trimming down.

**NOTE!** Check local legislation for transporting boats on trailers, there are differences between different countries trailer laws.

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



# Maintenance schedule

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


## Warranty inspection


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

## Extended protection for leisure use

Volvo Penta offers extended protection for marine diesel engines, including transmission, if they are only used for leisure purposes. In order for the extended protection to be valid a special service must be carried out at the owners expense by an authorized Volvo Penta distributor, dealer or service workshop before the end of the normal 12 month warranty period. Further instructions are contained in the Warranty and service book.

## MAINTENANCE SCHEDULE

 **WARNING!** Read the "Maintenance" chapter carefully before any maintenance work is carried out. It contains advice on how to carry out work in a safe and proper manner.

 **IMPORTANT!** Maintenance points marked with ☐ must be carried out by a Volvo Penta workshop.

### Daily, before first start:

- Engine and engine bay. General inspection ..... page 51
- Engine oil. Check the level..... page 54
- Sterndrive. Power Trim pump, check oil level..... pages 75 / 78
- Coolant. Check the level..... page 58
- General inspection of sterndrive, propellers, transom shield .....not shown
- Sterndrive, check sacrificial anodes.  
Replace if more than 30% has eroded away ..... pages 72 / 77

### Every two weeks:

- Drive belt. Check for wear.....not shown
- Raw water filter, cleaning..... page 61
- Battery. Check electrolyte level..... page 66
- Reverse gear, check oil level ..... page 70
- Sterndrive Check oil level ..... pages 73 / 79
- Sterndrive. Power steering pump, checking oil level..... pages 75 / 78

### Every 50 hours / at least once per year, included in extended warranty:

- Sterndrive. Check bellows ..... pages 76 / 91

### Every 100 hours / at least once per year, included in extended warranty:

- Sterndrive. Oil change ..... pages 73 / 79
- ☐ U-joints, drive shaft attachment, engine alignment.  
Check wear. Grease. ....not shown
- ☐ Drive shaft splines Check wear. Grease.....not shown
- ☐ EVC-system. Inspection with diagnostic tool.....not shown

**Every 200 hours / at least once per year, included in extended warranty:**

- Air filter. Change ..... page 52
- Exhaust line Check ..... page 52
- Oil filter. Change<sup>2)</sup> ..... page 54
- Engine oil. Change<sup>1)</sup> ..... page 55
- Raw water pump. Check impeller ..... page 59
- Fuel filter / pre filter. Change ..... pages 62-63
- Reverse gear Change oil and filter ..... page 70
- ☐ Check and touch up paintwork as necessary ..... not shown
- ☐ Check the condition of all rubber hoses and tighten the hose clamps ..... not shown

**Every two years:**

- ☐ Sterndrive. Replace U-joint bellows and exhaust bellows ..... not shown
- Coolant. Change ..... page 58

**Every 600 hours / at least once every 5 years:**

- ☐ Reverse gear. Replace propeller shaft seal ..... not shown
- ☐ Turbo. Inspection / cleaning as necessary ..... not shown
- ☐ Trim and steering rams, hoses, hydraulic hoses Leakage checks ..... not shown
- ☐ Sterndrive exterior, check function and wear ..... not shown
  - bushings / shafts in the transom shield and the gimbal ring.
  - propeller shaft seal
  - propeller shaft, check straightness
  - shifting mechanism and cable
  - steering

**Every 1,200 hours / at least once every 5 years:**

- ☐ Heat exchanger Inspection / cleaning ..... not shown
- ☐ Charge air cooler, Inspection / cleaning ..... not shown
- ☐ Control cables and seals Change ..... not shown
- ☐ Coolant pipe Inspection ..... not shown
  - check hoses, connections and hose clamps
- ☐ Safety and function inspection ..... not shown
  - during the safety and function inspection the drive is dismantled for inspection for wear and damage. Any faults to be remedied. Where necessary, the whole drive is replaced.

**Every 1,400 hours:**

- ☐ Cam belt. Change ..... not shown

<sup>1)</sup> Oil change intervals vary, depending on oil grade and sulfur content of the fuel. Refer to "Maintenance: Lubrication system".

<sup>2)</sup> Replace filters at every oil change.



# Maintenance

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

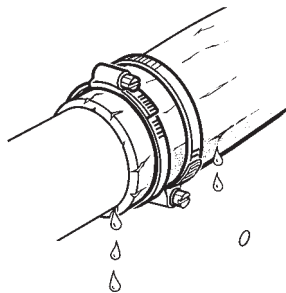
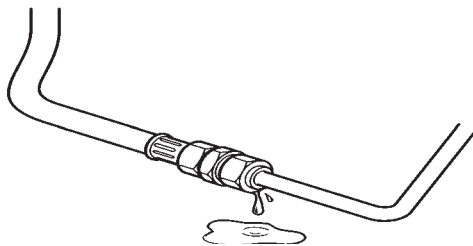
**⚠ WARNING!** Read the safety precautions for maintenance and service in the chapter "Safety Information", before starting work.

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

---

## Engine, general

---



### General inspection

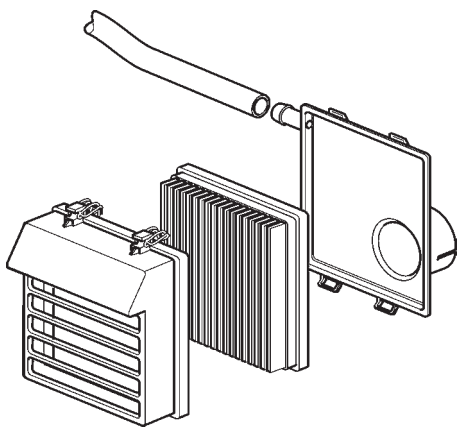
Make a habit of "visually" inspecting the engine and engine room before starting the engine and after stopping when the engine has been turned off. This will help you to quickly detect abnormalities that have occurred or are about to occur.

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

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

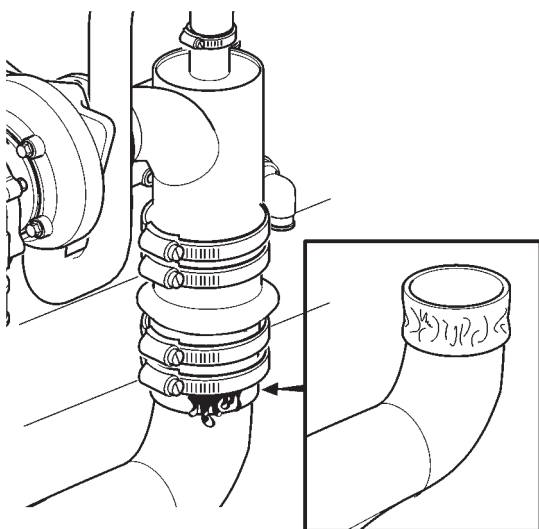
**⚠ IMPORTANT!** If an oil, fuel or coolant leak is detected, the cause must be investigated and the fault rectified before the engine is started.

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



### Air filter. Changing

1. Remove the air filter cover.
2. Remove the old air filter.
3. Clean the air filter cover/housing if necessary. Take care not to allow impurities to enter the engine.
4. Fit the new air filter. The housing must be placed with the holes down, as shown in the picture.



### Exhaust line, sterndrive. Checking

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

**⚠ WARNING!** Risk of water entering. The exhaust line must be inspected while the boat is on land. In case of serious corrosion damage, the pipe must be repaired or replaced with a new one.

1. Undo the clamps and detach the hose.
2. Check the contact surface. In case of serious corrosion damage, the pipe must be repaired or replaced with a new one.

## Lubrication system

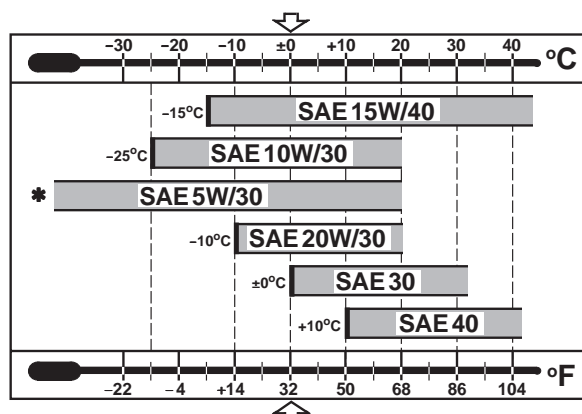
**⚠ IMPORTANT!** With a new or reconditioned engine, the oil and oil filters must be changed after 20–50 hours of operation. Use only the recommended grades of oil, see below.

**⚠ IMPORTANT!** Oil change intervals can vary from 100 to 200 hours, depending on oil grade and sulphur content of the fuel. **Note that oil change intervals must never exceed a period of 12 months.** If you want longer oil change intervals than given in the table below, the condition of the oil must be checked by the oil manufacturers through regular oil testing.

Oilgrade <sup>1)</sup>	Sulfur content in fuel, by wieght	
	<1%	>1% <sup>2)</sup>
	Oil change interval, reached first in operation	
VDS-2 and ACEA E7 <sup>3)</sup> or VDS-2 and Global DHD-1 or VDS-2 and API CH-4 or VDS-2 and API CI-4	200 h. or 12 month	100 h. or 12 month

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

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



### Viscosity

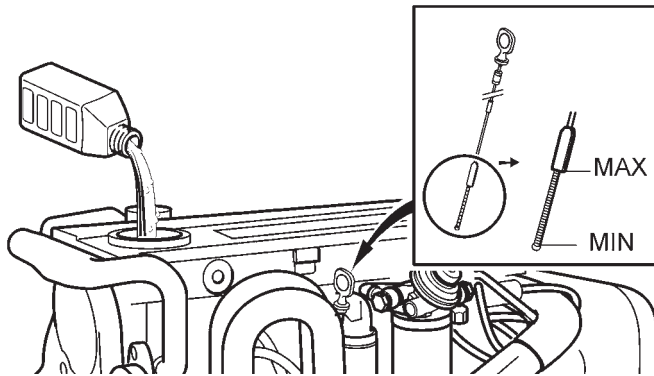
Select the viscosity from the table.

**NOTE!** The temperature values refer to stable ambient temperatures.

\* Refers to synthetic or semi-synthetic oils.

### Oil change volume

Please refer to the “Technical Data” chapter.

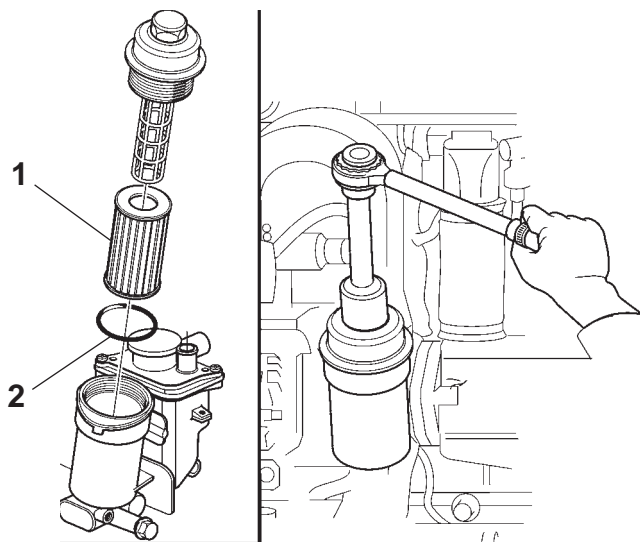


## Oil level. Checking and topping up

The oil level should be within the marked area on the dipstick and should be checked every day before the first time the engine is started.

Topping up is done on the top of the engine. Top up oil slowly. Wait a few minutes before checking the oil level again to give the oil time to run down to the oil pan. Then check the level again. Use only the recommended grades of oil, please refer to previous page.

**⚠ IMPORTANT!** Do not fill the oil above the MAX level.

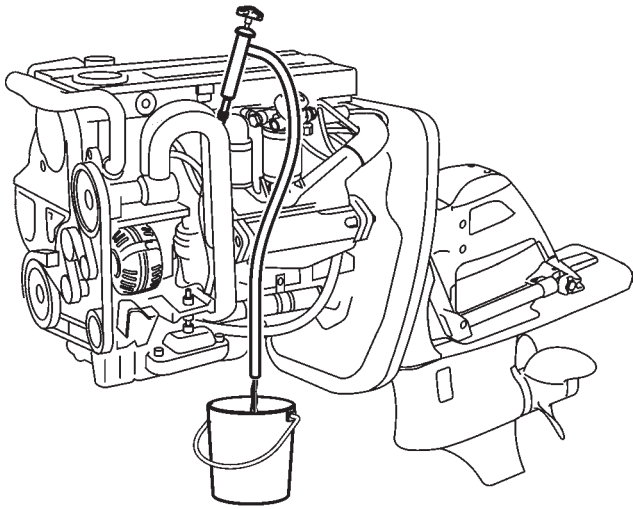


## Oil filter. Changing

**NOTE!** Change the oil filter at each oil change.

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

1. Put a suitable vessel underneath the filters to avoid oil spillage.
2. Unscrew the lid on the oil filter.
3. Wait a few minutes to let the filter drain.
4. Replace the filter insert (1).
5. Place a new o-ring (2) and hand tighten the lid, use a fixed key size 36 mm.
7. Start the engine (low idle) and check that no leakage occurs. Check the oil level once the engine has stopped.



## Engine oil. Change

Always observe the recommended oil change interval.

**⚠ IMPORTANT!** Only use the recommended grade of oil.

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

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

1. Warm up the engine (this makes it easier to suck the oil up from the sump). Let the engine run till operation temperature is reached (temperature gauge indicate a value between 75 – 100°C (167-212°F)).
2. Stop the engine. Wait ten minutes before draining the oil.
3. Connect the oil bilge pump to the drain pipe and pump the oil up.
4. Change the oil filter at each oil change, please refer to “Oil filter. Changing” in this chapter .
5. Fill up with oil to the correct level through the valve cover cap. Please refer to “Technical Data” for oil volume.
6. Start the engine. Let the engine run till operation temperature is reached (temperature gauge indicate a value between 75 – 100°C (167-212°F)).

Check that the low oil pressure warning lamp goes out.

Check that no leakage occurs by the filter.

7. Stop the engine. Wait 1 hour, then check the oil level. Top up if necessary.

**NOTE!** Hand the old oil in to a recycling station.

---

## Freshwater system

---

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

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

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

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

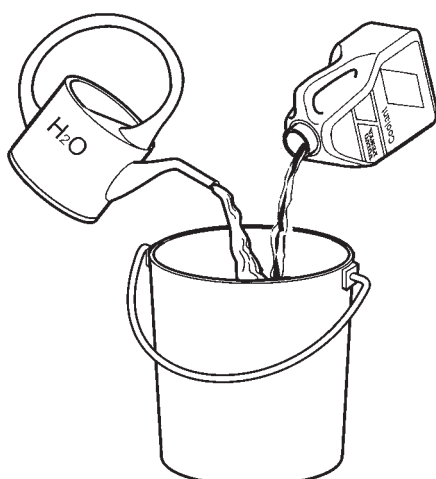
Future warranty claims on the engine and additional equipment may be rejected if an unsuitable coolant has been used or if the instructions concerning coolant mixing have not been followed.

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



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

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



## Coolant. Mixture

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

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

### Mix:

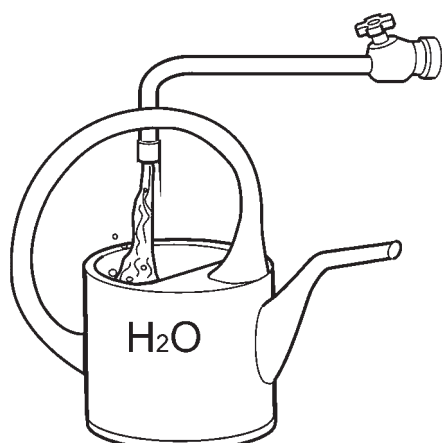
**40 % "Volvo Penta Coolant" (conc. coolant)**

**60 % water**

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

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

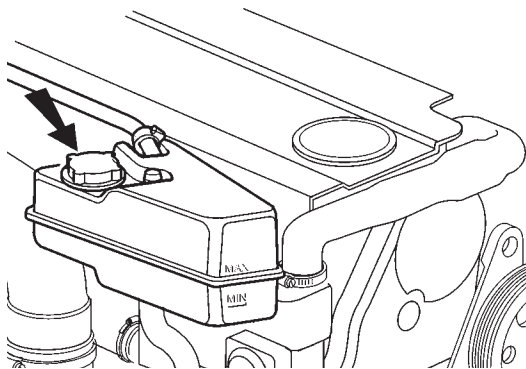
**⚠ IMPORTANT!** It is extremely important that the correct concentration of coolant is added to the system. Mix in a separate, clean vessel before adding into the cooling system. Ensure that the liquids mix properly.



## Water quality

### ASTM D4985:

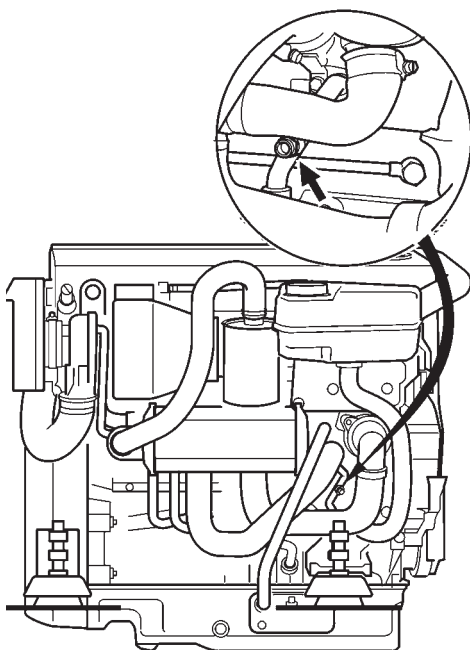
Total solid particles .....	< 340 ppm
Total hardness:.....	< 9.5° dH
Chloride .....	< 40 ppm
Sulfate.....	< 100 ppm
pH value.....	5,5–9
Silica (acc. ASTM D859) .....	< 20 mg SiO <sub>2</sub> /l
Iron (acc. ASTM D1068) .....	< 0.10 ppm
Manganese (acc. ASTM D858).....	< 0.05 ppm
Conductivity (acc. ASTM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



## Checking the coolant level

**⚠ WARNING!** Stop the engine and allow it to cool before opening the filler cap. Steam or hot coolant may spurt out. Hot coolant and hot surfaces can cause burns.

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



## Draining the freshwater system

1. Remove the filler cap on the expansion tank (to allow the coolant to drain off faster).
2. Connect a hose to the draining nipple and open the tap, let the water pour out into a suitable receptacle.

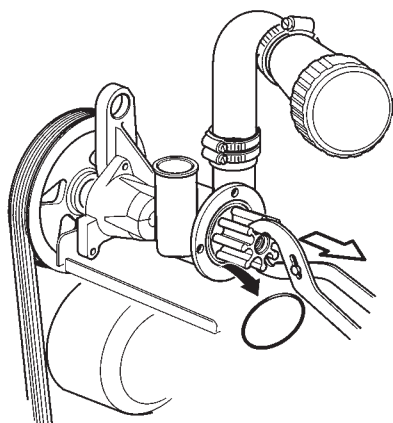
**NOTE!** Leave the old coolant to a facility for destruction.



## Seawater system

The seawater system is the boat's external cooling system. The seawater pump draws in water via the water intake through the oil cooler to the seawater pump, after which the water is pumped through the intercooler and heat exchanger. Finally, the water is pumped into the exhaust pipe elbow, where it is mixed with the exhaust gases.

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

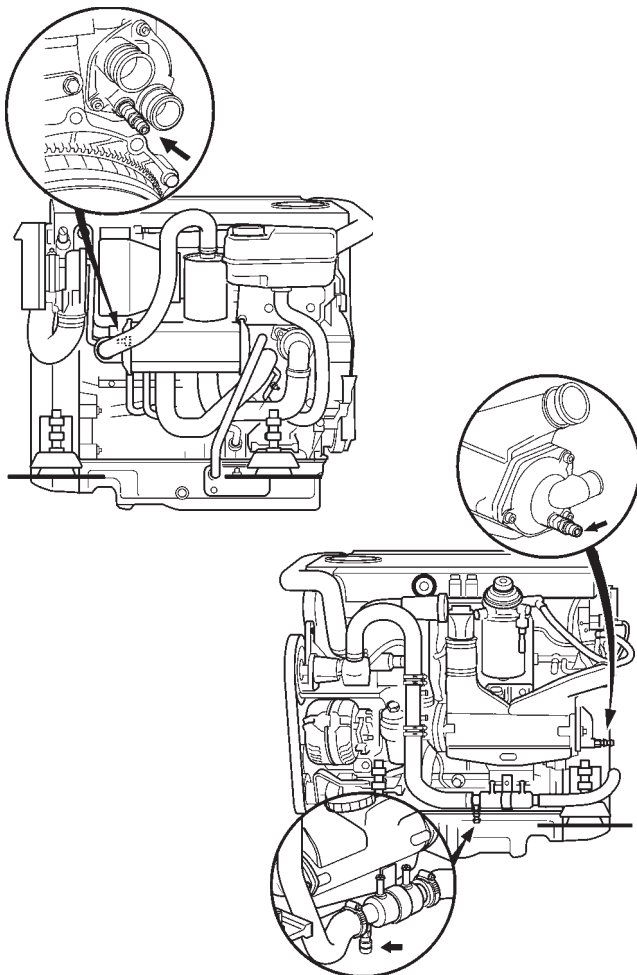


### Checking/Replacing impeller

**⚠ WARNING!** Risk for water penetration.

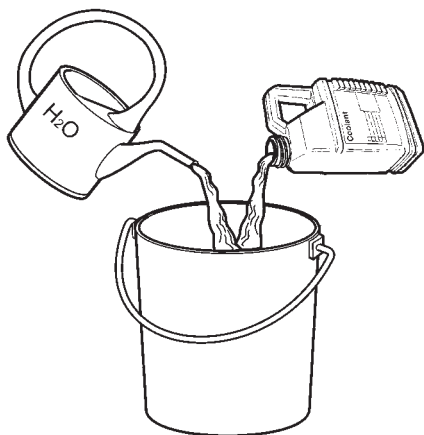
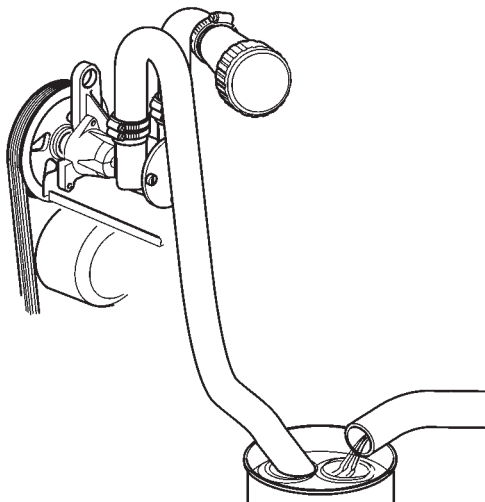
1. Remove the cover from the seawater pump and remove the impeller. If there are cracks or other defects the impeller must be replaced.
2. Lubricate the pump housing and the inside of the cover with a little glycerin.
3. Reinstall the impeller using an anticlockwise rotating movement. Install the cover together with a new o-ring.

**NOTE!** Always clean the seawater filter when replacing the impeller.



### Draining the seawater system

1. Connect a hose to the drain nipple on the heat exchanger, use a suitable receptacle while draining.
2. Move the hose and continue to drain the coolant from the drain nipple on the charge air cooler.
3. Move the hose and drain the coolant from the power steering cooler.



## Seawater system. Cleaning and inhibiting

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

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

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

1. Detach hose from the seawater pump and connect a hose which reaches to a bucket filled with freshwater. Check that there is nothing that will get splashed behind the exhaust outlet.

2. Take care of filling.

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

3. Set the gear control lever in the neutral position. Check that nobody is near the propellers.

Start the engine. Let it run at fast idle a few minutes.

Stop the engine.

4. For inhibiting fill a bucket with antifreeze mixture (40/60 freshwater and antifreeze).

Secure a container by the exhaust outlet.

Repeat step 3.

5. Connect seawater hose.

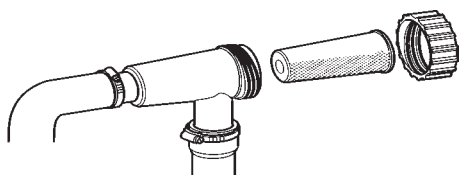
6. The system is now inhibited. The antifreeze mixture should be left in the system while the boat is laid up.

Drain the mixture just before the boat is launched. Deposit the mixture at a properly designated disposal site.

## Cleaning seawater filter

**⚠ WARNING!** Risk for water penetration.

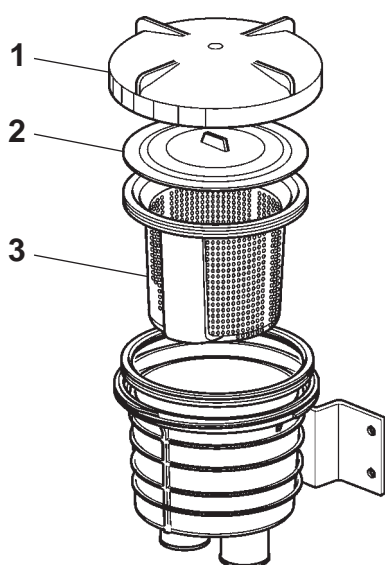
**⚠ IMPORTANT!** If the boat is used in water that has a lot of contaminants, seaweed etc. the filter must be checked more frequently than indicated in the maintenance schedule. Otherwise there is a risk the filter will clog and the engine will over-heat.



### Seawater filter, Aquamatic

To avoid spillage when cleaning the seawater filter the engine has to cool for at least 15 minutes after driving since the seawater system is pressurized.

1. Screw the cover a full turn anti-clock wise and wait another 10 seconds.
2. Screw the cover off entirely.
3. Lift out and clean the inset.



### Seawater filter, inboard, optional extra

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

## Vacuum valve. Cleaning

Some engines have a vacuum valve installed in the seawater piping.

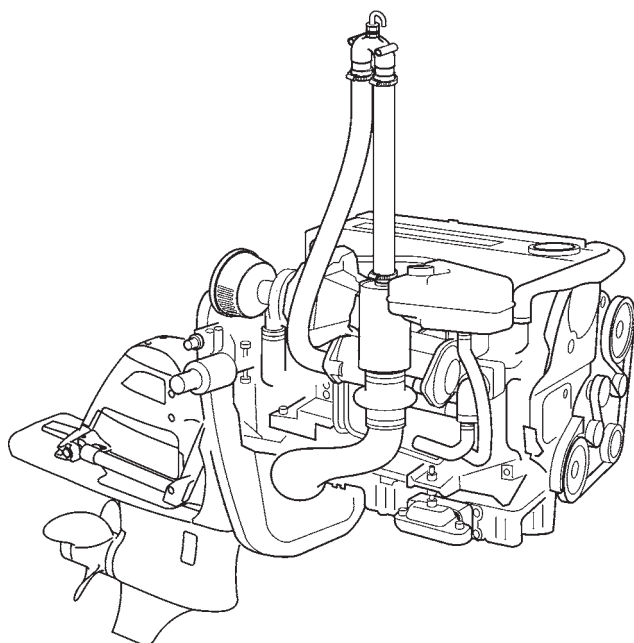
**⚠ WARNING!** Risk for water penetration. Close the sea cock.

For the vacuum valve to work satisfactorily, it must be taken to pieces twice a season, or when leakage occurs.

Remove the entire valve from the bulkhead where it is installed.

Undo the lid of the valve, remove the gasket and diaphragm and remove any deposits. If the diaphragm is distorted, put a new one in.

**Installation must always be done with the valve upside down.** Put the diaphragm in the lid. Make sure that the entire diaphragm rests where it should. The diaphragm must not be pinched by the gasket. Put the gasket on and screw the lid on. Note! Tightening torque (2 Nm). If the lid is tightened too much, the valve stops working.



---

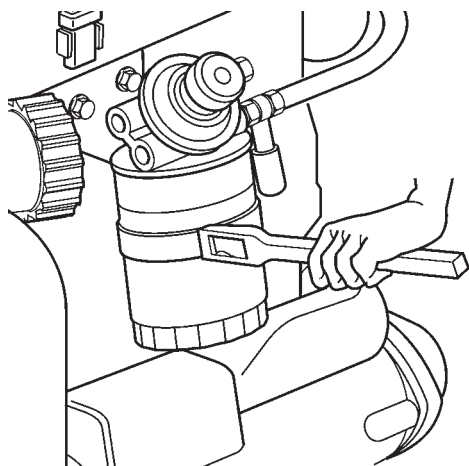
## Fuel system

---

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

All work on the engine common rail-system must be carried out at an authorized workshop. Use only the recommended grade of fuel, please refer to "Technical Data".

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

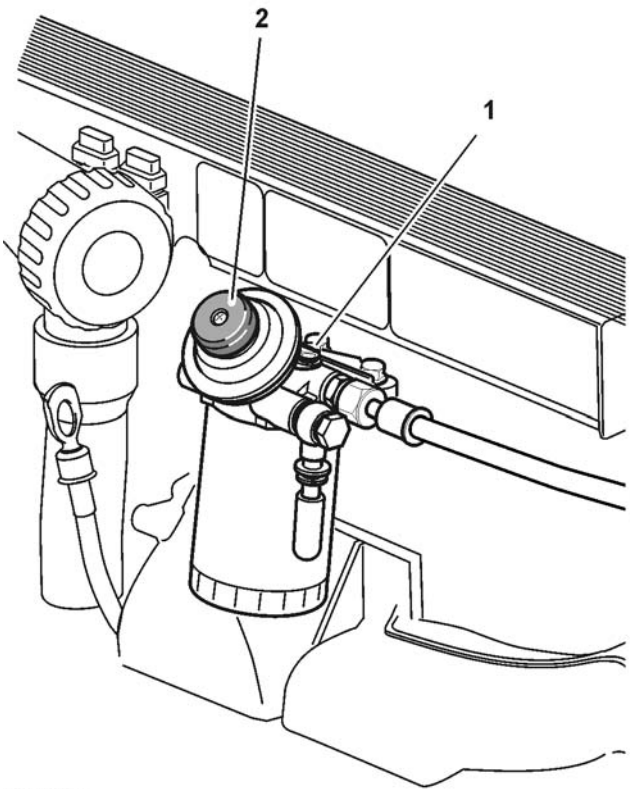


### Fuel filter. Change

1. Close the fuel valve/valves.
2. Clean the filter bracket and put a suitable vessel under the filter.
4. Unscrew the filter, use a filter wrench if needed.
5. Clean the sealing surfaces of the filter bracket. Make sure the filter is absolutely clean and the sealing surfaces are undamaged. Moisten the sealing rings with engine oil.

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

6. Screw the new filter on by hand until the seal just touches the mating surface. Then tighten a further 1/2 turn.
7. Open the fuel valve.
8. Vent the fuel system, see " Bleeding the fuel system" in this chapter.
9. Start the engine and check for leakages.



P0007263

### Bleeding the fuel system , early design (filter bracket with bleeding screw)

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

**⚠ WARNING!** Never detach the pressure pipes.

1. Position a container under the fuel filter.
2. Loosen the bleeding screw on top of the filter bracket (1) 1-2 turns.
3. Pump the fuel using the hand pump (2) on the filter bracket until there are no more air bubbles visible in the fuel. Continue pumping and at the same time tighten the bleeding screw.
4. Pump another 10 strokes with the hand pump. The resistance in the hand pump may seem quite high, this is normal and necessary for bleeding the system.
5. Start the engine and check for leakages.

### Bleeding the fuel system , late design (filter bracket without bleeding screw)

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

**NOTICE!** Do not undo any pipe or hose unions to carry out fuel system bleeding. This may lead to various leakages. Especially air leakage into the system can cause operational faults and generate fault codes.

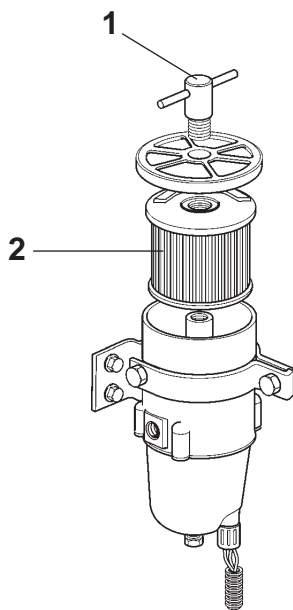
At the first start attempt, the engine may run irregular and perhaps stop after a moment's running when filters have been changed or the fuel system/tank has been emptied.

Bleeding the fuel system:

1. Fill the system by pumping the hand feed pump until resistance in the hand pump becomes heavy (may take up to 3 minutes).
2. Start the engine.
3. If the engine runs irregular or stops, do not increase the throttle but switch off the ignition so that the engine stops.
4. Pressurize the system again with the aid of the hand feed pump; pump until resistance in the hand pump is high.
5. Start the engine.
6. If the engine runs irregular or stops, do not increase the throttle but switch off the ignition so that

the engine stops. Pressurize the system again with the aid of the hand feed pump; pump until resistance in the hand pump is high. Start the engine. If the engine still runs a little irregular, throttle up engine speed to 1000 rpm for around 1 min., after which the system is vented.

7. Make sure the engine is running evenly before getting under way; if not, repeat the procedure from step 2.



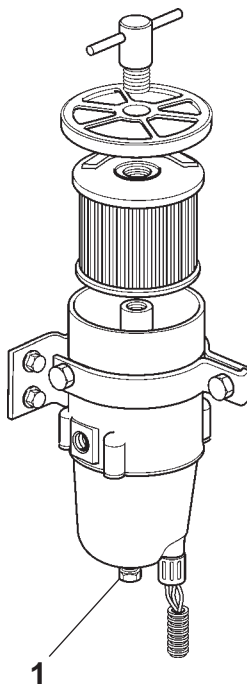
### Fuel pre-filter. Replacing filter insert

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


1. Close fuel cock at the fuel tank. Position a container under the fuel filter.
2. Remove the cover by slackening off the screw (1).
3. Replace the insert (2) and reinstall the cover.

**NOTE!** Deposit the old filter insert at a properly designated disposal site.

4. Open fuel cock and vent fuel system, see "Bleeding the fuel system" in this chapter.
5. Start the engine and check for leaks.



### Water in fuel

If the pop-up "water in fuel" on the tachometer display or the  lamp on the optional alarm display comes on, there is too much water in the water separator on the fuel filter.

**⚠ WARNING!** Do not continue operation if there is water in the fuel trap. This could cause serious engine damage.

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

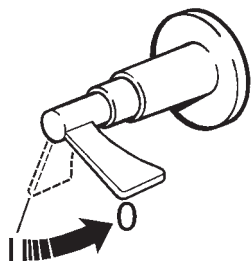
The water sensor is mandatory equipment.

### Draining of fuel pre-filter.

1. Stop the engine and take out the starter key of the starter switch.
2. Place a suitable receptacle under the fuel filter and carefully unscrew the plug (1) enough to allow the water to run out.
3. Screw in the plug until it bottoms against the filter.
4. If the fault remains after the water trap is emptied, contact a Volvo Penta workshop.

## Electrical system

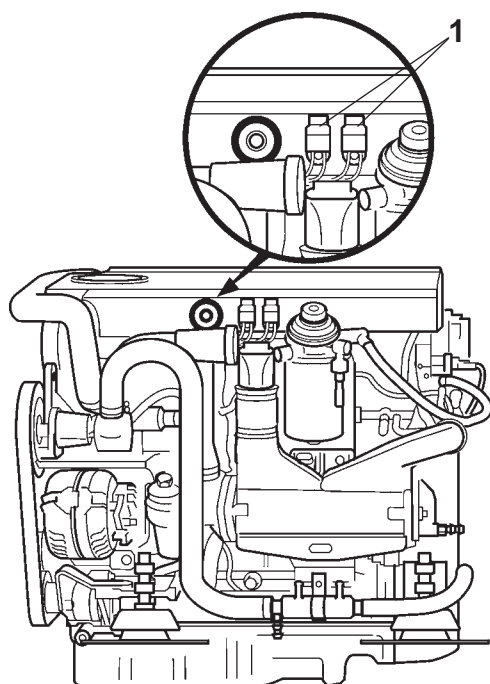
**⚠ WARNING!** Always stop the engine and break the current using the main switches before working on the electrical system. Isolate shore current to the engine block heater, battery charger, or accessories mounted on the engine.



### Main switch

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

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



### Fuses

The engine is fitted with two blade fuses (1) located on the right side of the valve cover. The fuses cut the power if the electrical system is overloaded.

If it is not possible to start the engine or if the instrument stops working while running, a fuse may have tripped. If the fault persists, read out the fault codes and take the necessary measures.

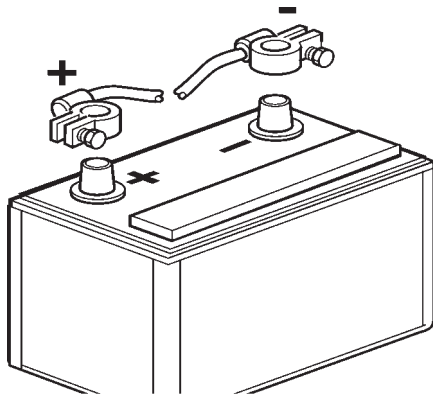
**⚠ IMPORTANT!** Always investigate the cause of the overload!



### Electrical connections

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





## Battery. Maintenance

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

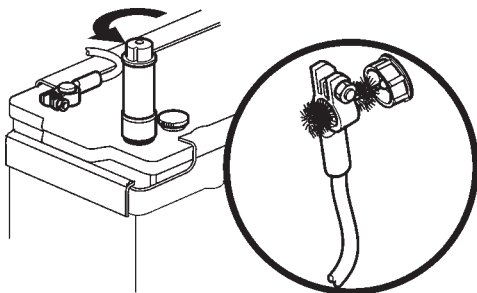
**⚠ WARNING!** Never mix up battery positive and negative terminals. This may cause sparks and an explosion.

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

### Connecting and disconnecting

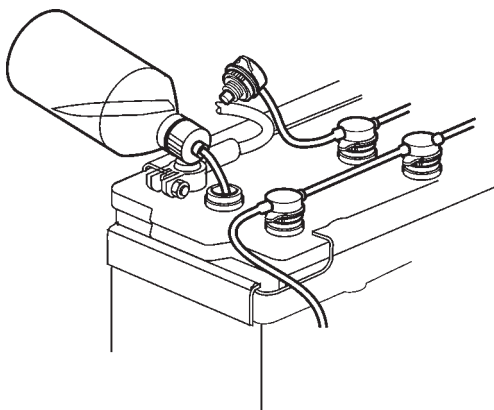
First connect the red battery lead + to the battery + terminal. Then connect the black battery lead – to the battery – terminal.

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



### Cleaning

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

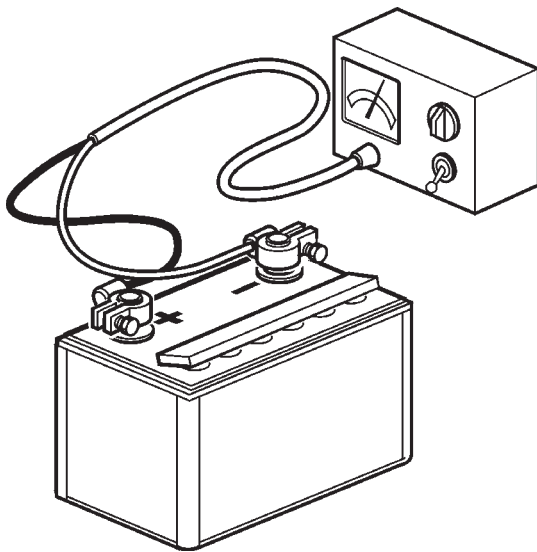


### Topping up

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

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





## Battery. Charging

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

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

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

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

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

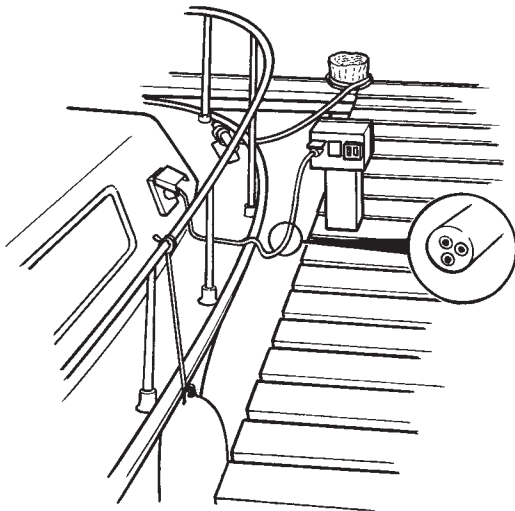
**⚠ WARNING!** Always switch off the charging circuit **before** removing the battery charger connectors. Never mix up battery positive and negative terminals. This may cause sparks and an explosion.

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

## Electrical installations

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

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

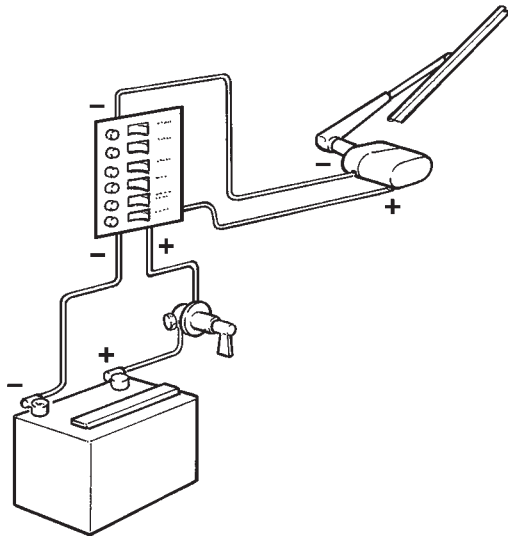


### The following should always be observed:

1. When shore power is connected (120V–230V), the shore safety ground (earth) must not be connected to the engine or any other ground point on the boat. The safety ground must always be connected to the connection cabinet's ground (earth) terminal ashore. The safety ground should not be connected to the negative connection on the output side (12/24V), i.e. it must be galvanically separated.
2. Route and clamp electric cables so that they will not be exposed to rubbing, damp or bilge water in the keelson.
3. Engine or drive must never be used as a ground point.

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

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



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

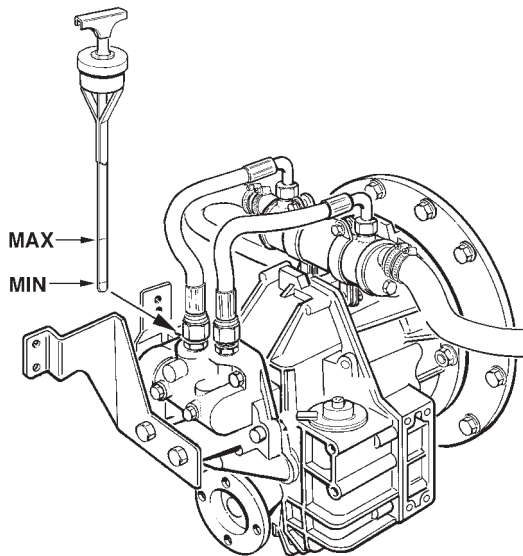
All equipment connected to the auxiliary battery should have separate switches.

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

## Reverse gear

The HS25A/HS45A/HS63IV reverse gear is hydraulic, which means that ahead/astern engagement and disengagement is hydraulically activated. The reverse gear lubrication system has an oil filter and oil cooler. The reverse gears is equipped with solenoid valves for electronically controlled shifting.

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

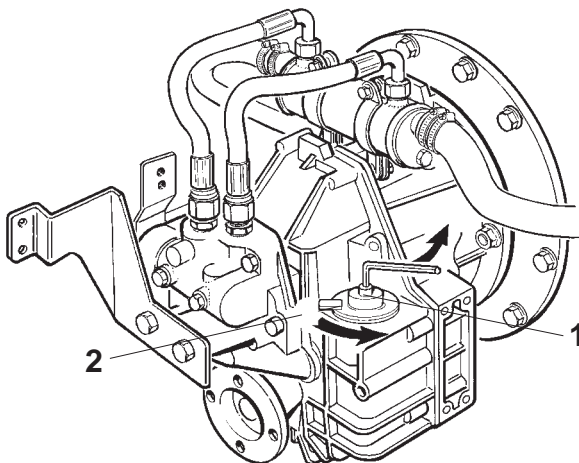


### Oil level

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

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

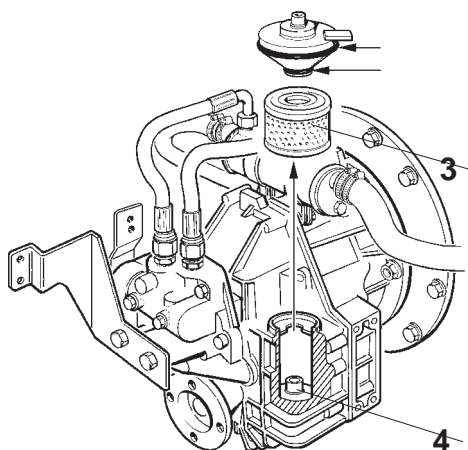
**⚠ IMPORTANT!** Never over-fill the reverse gear. The oil level must always be inside or at the recommended levels.



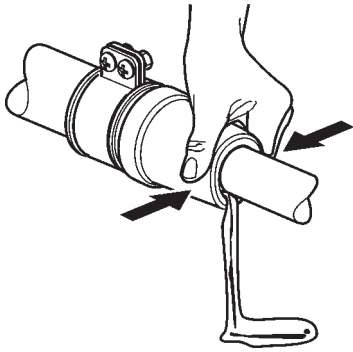
### Oil change and filter change

1. Clean around the lid, so that there is no risk that dirt could fall down into the filter housing.
2. Undo screw (1) with a 6 mm Allen key. Remove lid (2). Replace and oil in the new O-rings in the lid.
3. Lift up the filter (3).
4. Suck up the oil with an oil drain pump, via the oil filter housing. Connect hose to the suction pipe (4) at the bottom of the housing.
5. Measure up the correct quantity of oil and fill the reverse gear with the oil via the oil filter housing. Please refer to the "Technical Data" chapter for oil grades and volume.

**⚠ IMPORTANT!** Never over-fill the reverse gear.



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

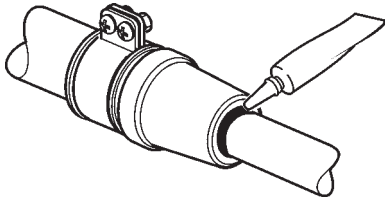


### Propeller shaft seal

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

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

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



## Drive

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

### Sacrificial Anodes

On the SX and DPS drives, sacrificial anodes are attached to the bottom of the gimbal housing and at the front of the gearcase above the anti-ventilation plate.

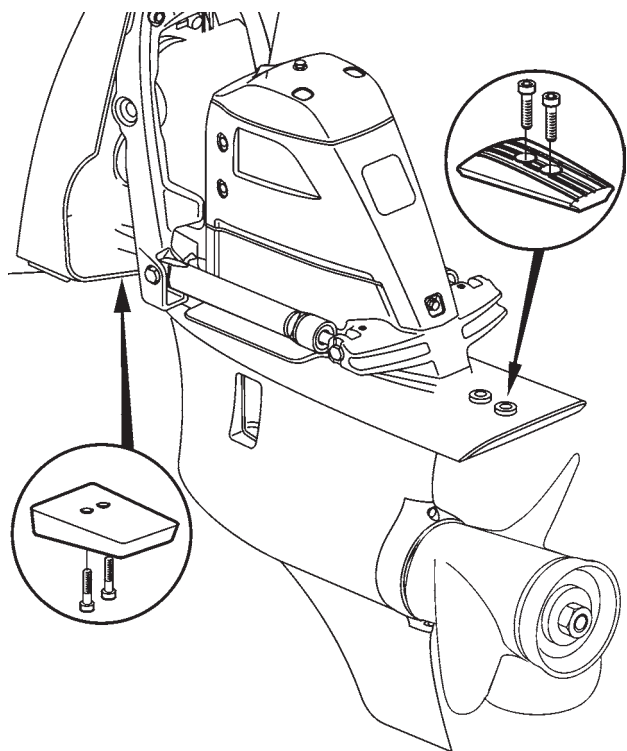
Anodes are slowly eroded away by galvanic action and require inspection. Additionally, anodes that are subjected to frequent wetting and drying require periodic scraping with sandpaper to remove scale and oxidation to maintain their effectiveness.

Do not paint anodes, as this will destroy their effectiveness. When you need to purchase new anodes, see your Volvo Penta dealer. Using aftermarket sterndrive anodes may cause cavitation bubbles due to poor fit, which may lead to propeller erosion.

If additional electronic or electrical equipment is installed, each item should have an individual anode or grounding device and all grounding devices must be interconnected. Follow equipment manufacturers recommendations.

Faulty electrical installation can also cause the break down of the galvanic protection. Damage due to electrolytic corrosion occurs rapidly and is often extensive. For further information see the chapter: “Electrical system”.

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



### Replacing Anodes

1. Inspect anodes at each usage. If an anode is 2/3 its original size (1/3 eroded), replace it.

**NOTE!** The amount of erosion from the drive anode is a good indication of the condition of the transom shield anode.

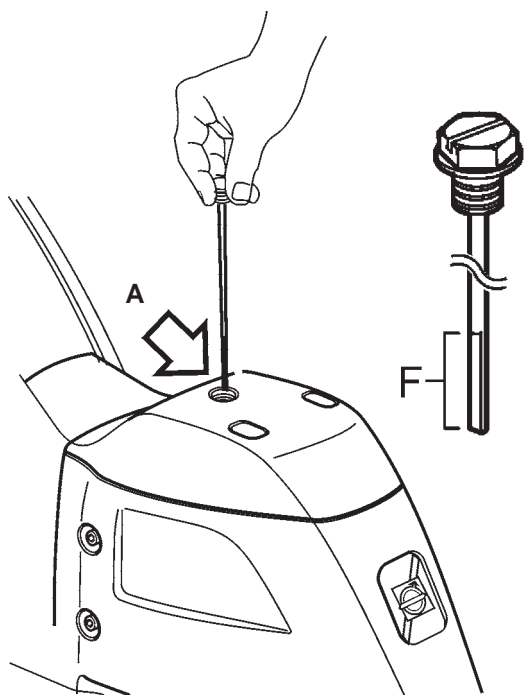
2. Remove the two screws holding the anodes onto the gearcase and/or the gimbal housing. Discard screws.
3. Remove the old anode.
4. Attach new anode and secure with two new screws (provided in kit).
5. Tighten screws.

**⚠ IMPORTANT!** Tighten the new anodes so that there is a good metallic contact is retained.

**⚠ IMPORTANT!** Use zinc sacrificial anodes for salt water and magnesium anodes for freshwater.

The sacrificial anodes oxidize in contact with air, which diminishes the galvanized protection. Even a new anode can be oxidized on the surface. **Therefore always clean the sacrificial anodes before launching the boat.**

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

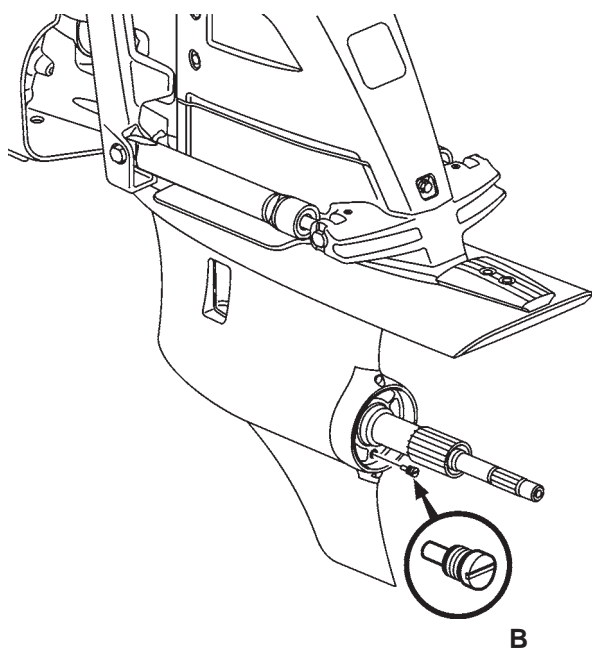


### Oil level check

**⚠ CAUTION!** Improper oil level, under- or over filled, will result in serious internal sterndrive damage.

1. Screw dipstick fully into hole, then remove.
2. Check oil level on dipstick. Oil should show on flat portion F of dipstick. If oil level is low, add small amounts through dipstick opening until oil is at proper level. If level is too high, remove until oil is at proper level. See oil drain procedure.
3. Check O-ring on dipstick for wear or nicks. Replace if needed.

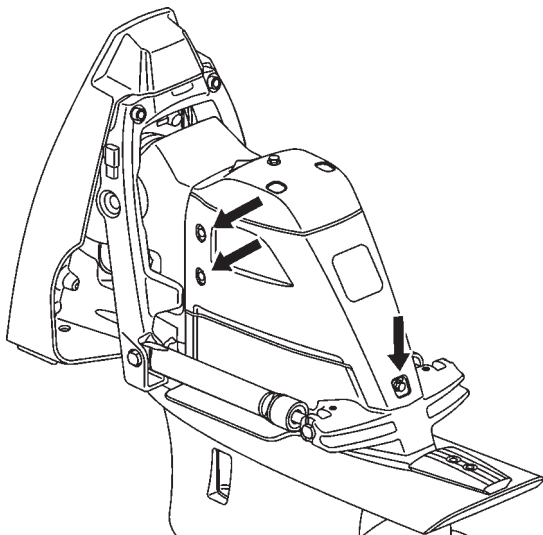
During oil level check, inspect oil for signs of water intrusion. The oil should be amber in color. Milky looking oil indicates water mixed with the oil. Also check for metal or other debris in oil. If moisture or metal flakes appear in the drive unit oil, take the boat to your Volvo Penta dealer.



### Oil draining and filling

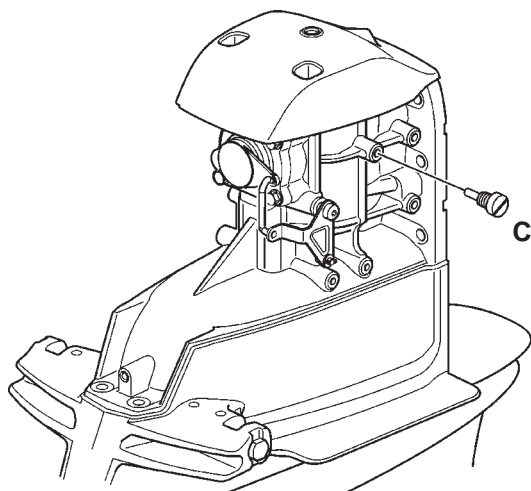
1. Place drive unit in the full down position. Remove propellers. Oil drain plug is located in front of propeller(s), please refer to the "Propellers" chapter.
2. Place a larger drain pan under lower gearcase skeg to catch oil. Remove the oil drain plug (B) and the oil dipstick (A).
3. Allow the drive unit to drain completely. Dispose of used oil in accordance with any applicable environmental regulations.





4. Proper oil level is determined by filling drive until it appears at oil level hole beside shift mechanism. To access oil level hole, remove five screws securing shift cover. Remove oil level plug (C).
5. Check O-rings on both plugs and dipstick for wear or nicks. Replace if needed.
6. Fill drive unit with oil through the oil drain plug location (B). Use a pump with 3/8-16 UNC threaded fitting to fill sterndrive through oil drain plug hole. Fill slowly to purge air. The drive unit is properly filled when the oil appears at the oil level plug hole. For oil quality and capacity: Please refer to the "Technical Data" chapter.

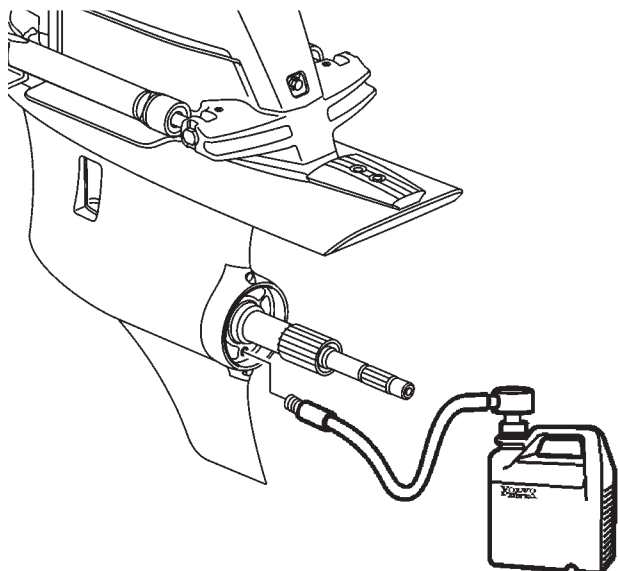
**CAUTION!** Filling sterndrive too quickly may form air pockets that will cause an inaccurate oil level reading. Running the sterndrive with improper oil level will result in serious internal sterndrive damage.



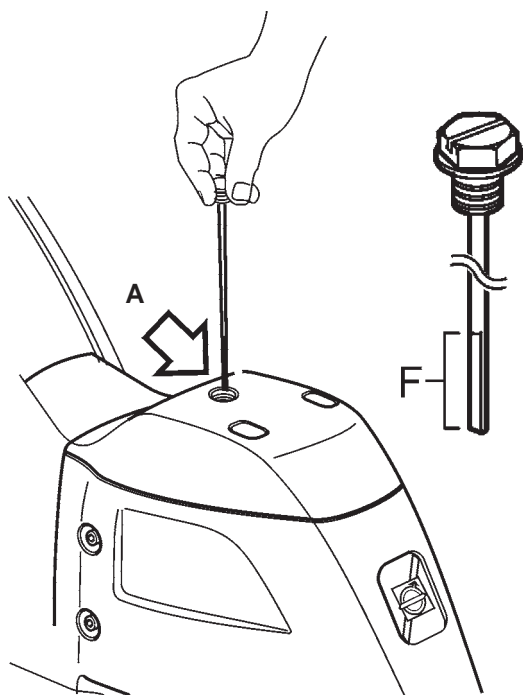
7. When filled to the proper level, install oil level dipstick and oil level plug first to prevent excessive oil loss, then the oil drain plug. Remove pump, then quickly install oil drain plug. Hand tighten drain plug. Make sure O-rings are correctly installed and seated. Tighten oil level and drain plugs securely. Reinstall oil level plug, and place drive in the run (down) position. Remove dipstick (A) and check oil level. Reinstall dipstick and tighten securely.
8. Install shift cover and tighten screws
9. Reinstall propellers. Check oil level with the dipstick, oil must appear on the full range of dipstick. Add oil if required through the dipstick hole.

**NOTE!** If drive unit was filled through the oil level plug (C), wait 15 minutes before checking oil with dipstick. This will help ensure all air is purged from the oil cavity. Leave dipstick (A) loose during waiting period.

10. If lubricant has been completely changed, oil level must be rechecked after unit has been briefly run to purge trapped air. Add oil through dipstick opening to bring oil up to proper level.



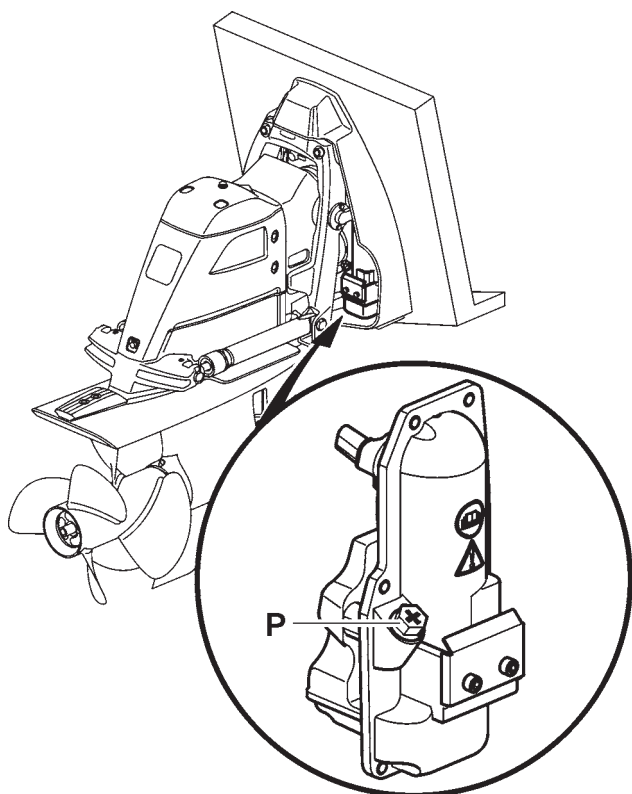




### Alternate oil fill procedure

If you cannot fill drive unit through oil drain plug, you can fill it by trimming the drive up five degrees and adding oil through the oil level plug (A). When oil is at the oil level plug hole, place the drive in down position, then reinstall the oil level plug.

**NOTE!** Be prepared to catch any excess oil dripping out of oil level plug hole. Check the oil level with the dipstick. Oil should show on the flat portion of the dipstick. Add oil if required, through the dipstick hole. See Checking the Drive Unit Lubricant. This alternate fill method is slow and you must be careful not to trap air in the drive. The oil level must be rechecked after the unit has been briefly run to purge trapped air. Several cycles may be needed to obtain the proper oil level.



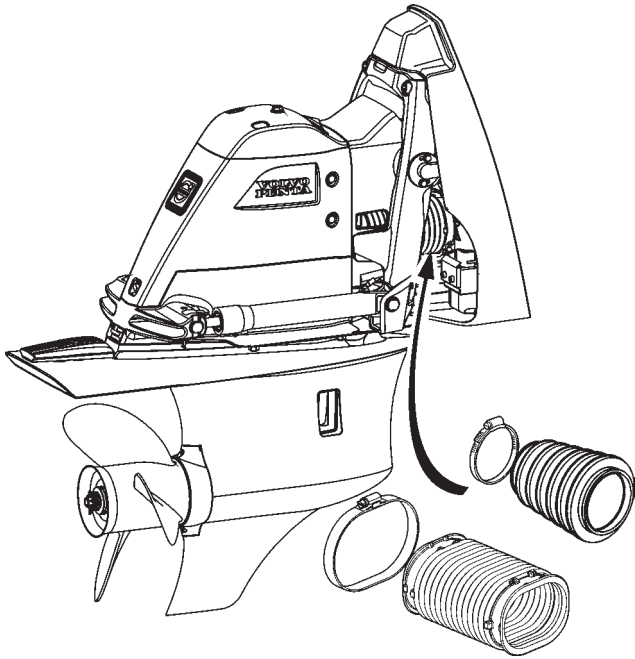
### Power Trim/Tilt-Fluid

The trim/tilt assembly is a closed hydraulic system that includes the trim pump assembly, trim cylinder and hydraulic lines. No regular oil level check is required unless trim system performance is poor. If system performance is poor, check fluid level in pump.

1. Trim drive to full down position.  
**CAUTION!** Failure to trim the drive to full down position when checking and filling the trim pump reservoir will result in an inaccurate fluid level; this may damage the trim system.
2. Turn drive full to port to provide better access to pump.

**⚠ IMPORTANT!** Clean area around cap before removing to check oil level. Debris in oil will damage the trim system.

3. Remove cap in pump P. Oil level should be at top of cap hole. If necessary, add Volvo Penta Power Trim/Tilt and Steering Fluid.
4. Replace cap and tighten to 2–4 Nm (18–35 in. lb).



### Drive Unit Bellows

**⚠ WARNING!** If you work on the drive bellows, secure the drive unit in a raised position in such a way that it cannot fall. A falling drive may cause serious injury.

Check the drive unit bellows for fractures and deterioration. Barnacle build-up on the bellows may cause punctures; keep the surfaces clean.

Check tightness of all hose clamps.

Inspect the inside of the bellows for signs of contact with the u-joint assembly, which indicates the engine was run at an RPM that was too high while the drive was in the tilted position.

Be sure the clamps are installed as shown in the picture.

### Shaft Spline and Bearing Lubrication

The primary shaft and bearings must be lubricated each year and whenever the drive unit is removed. This procedure requires the removal of the drive unit; therefore, your Volvo Penta dealer should do it. An ideal time to have this done is during the winterization process or in the spring when preparing to launch for the first time. Failure to have primary shaft splines and bearings lubricated each year may result in damage to the drive unit or seizure in the engine coupler.

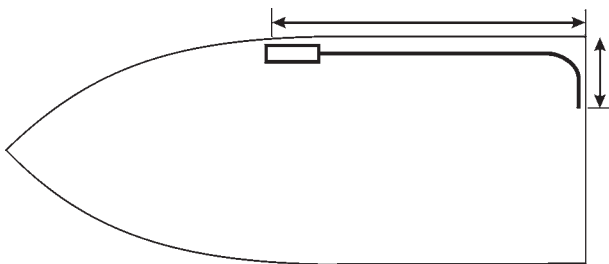
## Steering

The steering system for your Volvo Penta sterndrive is operated by a steering cable connected to the helm. Restricting movement of the steering cable will limit or stop the steering system's hydraulic assist.

**NOTE!** Do not interfere with or restrict steering cable movement through the last 90° of bend at the engine. Do not use cable retainers, clamps or tie straps. Using one or all of these could restrict the cable movement near the engine. Do not tie wiring harnesses or other control cables to the steering cable. Make sure deck combing and bulkheads allow for steering cable movement.

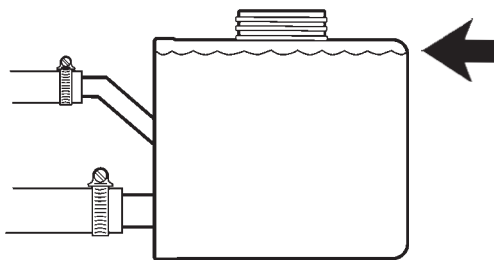
If the power steering system stops working, it will feel harder to steer. If this condition occurs, look for possible causes and fix them if possible. If the power steering system cannot be corrected on board, proceed at a reduced speed. You will be able to steer the boat, but with increased effort. See your authorized Volvo Penta dealer as soon as possible to correct your power steering system.

At slow speeds (no wake), your boat may tend to wander. This is normal and may be overcome by anticipating bow direction and correcting with steering wheel. A slightly higher throttle and trim setting may also lessen the tendency to "wander." Changing weight distribution, aft to forward, can also affect slow speed steering.



### Steering System

1. Check steering and throttle cables for cracks and wear. Check all along the length of the cable, as shown in the diagram. Replace the cables if you suspect that they are not in optimum condition.
2. Check steering system hoses for cracks, leaks, and wear. Replace any hoses that you suspect are not in optimum condition.



### Power steering reservoir fluid level

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

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

Do not allow contaminants to enter the reservoir when checking or filling the oil level.

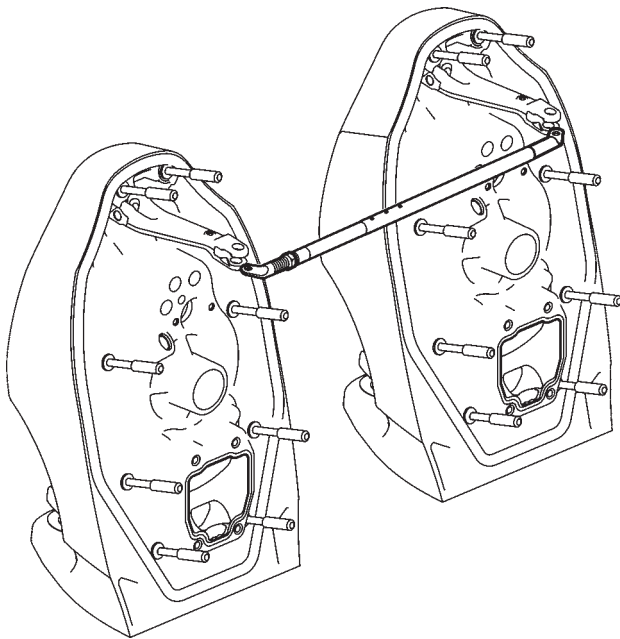
**⚠ WARNING!** Never fill the steering system with an oil of unknown quality. Non recommended oil may cause steering operation impairment or component damage.

## Twin unit steering

Twin engine boats may have only one engine with a fully operational power steering system. That power steering system is on the starboard engine; therefore, when operating on a single engine use the starboard engine.

**NOTE!** Using the port engine that does not have the functional power steering system will cause an increased effort in steering control, due to absence of power assist.

**⚠ CAUTION!** Both engines must be running during close maneuvering or at slow speeds. If only one engine is running, water may be forced back through the underwater exhaust outlet and cause serious engine damage. Do not attempt to plane boat while operating on a single engine; operating with a single engine at full throttle could cause engine or transmission damage.



## Tie Rod (Twin Installations Only)

Check the rod connecting the drive units, particularly if you hit an obstacle. If the tie rod is bent, loose, or damaged, have it serviced immediately by your Volvo Penta dealer. In the meantime, operate your boat at slow speeds only.

**⚠ WARNING!** The tie bar is an integral part of the steering system and is a vital safety part. A damaged tie rod may hinder steering operation or render it completely ineffective. Always replace a damaged tie bar. Never try to straighten or weld a damaged tie rod.

## Propellers

A damaged or unbalanced propeller will cause excessive vibration and a loss of boat speed. Under these conditions, stop the engine and check the propeller for damage. If the propeller appears damaged, have it checked by your Volvo Penta dealer. Always carry a spare propeller and replace the damaged propeller as soon as possible.

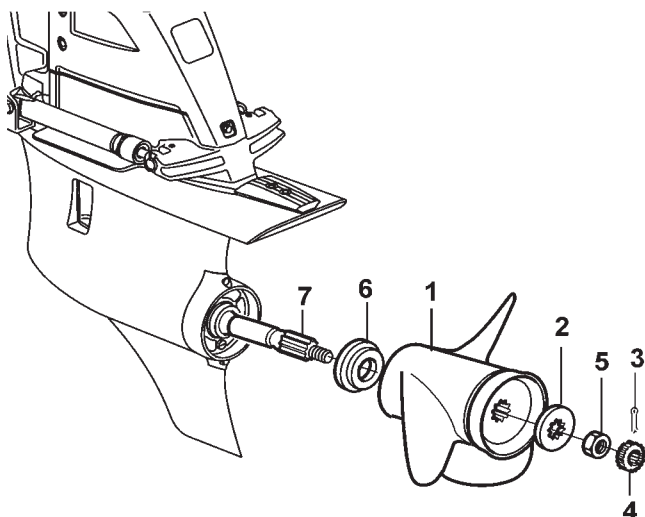
A rubber hub in the propeller is the shock absorber that minimizes damage to drive units and engines. If the rubber hub should begin to slip, it can be easily replaced at an authorized Volvo Penta dealer or propeller service station.

**⚠ WARNING!** Protect your hands from the sharp edges of the propeller blades. Wear gloves whenever you remove or replace a propeller. Do not attempt to hold propellers by hand when you remove or install propellers and propeller nuts. Serious injury could result.

**⚠ CAUTION!** Never continuously run with a damaged propeller. Running with a damaged propeller can result in drive unit and engine damage.

### Removing the SX propeller

1. Ignition switch must be OFF.
2. Make sure the remote control is in NEUTRAL.
3. Remove the cotter pin (3) and keeper (4).
4. Shift the remote control into FORWARD to lock the propeller shaft.
5. Remove the propeller nut (5) using a 1-1/16 wrench.
6. Remove the thrust washer (2), propeller (1), and thrust bushing (6).
7. Wipe the propeller shaft (7) clean. Inspect for fishing line; remove if present.



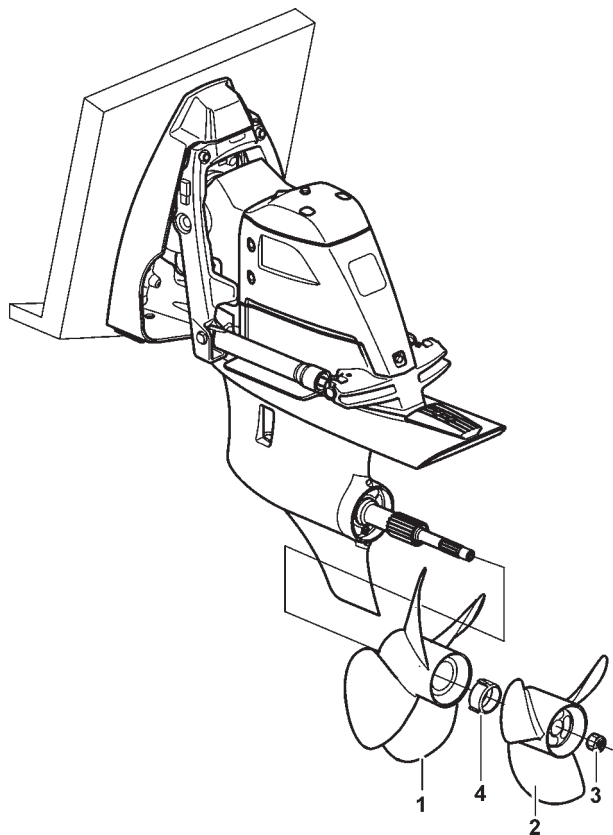
### Installing the SX propeller



**CAUTION!** Failure to install all components could result in loss of propeller and damage to drive unit next time the boat is operated.

1. Ignition switch must be OFF.
2. Make sure the remote control is in NEUTRAL.
3. Coat the full length of the propeller shaft and the inside of the propeller hub with Volvo Penta propeller shaft grease P/N 828250; removal of the propeller will be difficult if this is not done.
4. Place the thrust bushing on the propeller shaft with the inner taper toward the gearcase to match the taper on the propeller shaft.
5. Install the propeller onto the propeller shaft, aligning splines, and push the propeller onto the thrust bushing until the splines are exposed.
6. Install thrust washer on propeller shaft splines.
7. Shift the remote control into REVERSE gear to lock the propeller shaft.
8. Install and tighten the propeller nut until it is seated against the thrust washer.
9. Loosen the nut, then turn it back against the thrust washer until finger tight. Tighten the nut an additional 1/3 to 1/2 turn.
10. Index the keeper on the propeller nut until it is aligned with the cotter pin hole.
11. Install the cotter pin and bend the ends to secure; use a new cotter pin if necessary.
12. Shift the remote control into NEUTRAL. The propeller should turn freely.

Before your next outing, use a torque wrench to tight-en the propeller to 70 – 80 ft. lb. (96 – 108 Nm). The thrust washer, nut, keeper, and cotter pin must be in-stalled as shown.



## Removing the DPS propeller

This procedure requires you to use Volvo Penta special tools.

1. Ignition switch must be OFF.
2. Make sure the remote control is in FORWARD to lock the propeller shaft.
3. Remove the rear propeller nut (3).
4. Remove the rear propeller (2).
5. Change the remote control position to REVERSE to lock the propeller shaft.
6. Remove the front propeller nut (4).
7. Remove the front propeller (1).
8. Wipe the propeller shaft clean. Inspect for fishing line; remove if present.

## Installing the DPS propeller

**⚠ CAUTION!** Failure to install all components could result in loss of the propeller and damage to the drive unit the next time the boat is operated.

1. Ignition switch must be OFF.
2. Make sure the remote control is in FORWARD.
3. Coat the full length of the propeller shaft and the inside of the propeller hub with Volvo Penta propeller shaft grease P/N 828250; removal of the propeller will be difficult if this is not done.
4. Install the front propeller (1).
5. Install the front propeller nut (4) and tighten it to 45 ft. lb. (60 Nm).
6. Shift the remote control into REVERSE to lock the propeller shaft.
7. Install the rear propeller (2).
8. Install the rear propeller nut (3) and tighten it to 50 ft. lb. (70 Nm).
9. Shift the remote control into NEUTRAL. The propeller should turn freely.

# Laying up/Launching

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

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

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

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

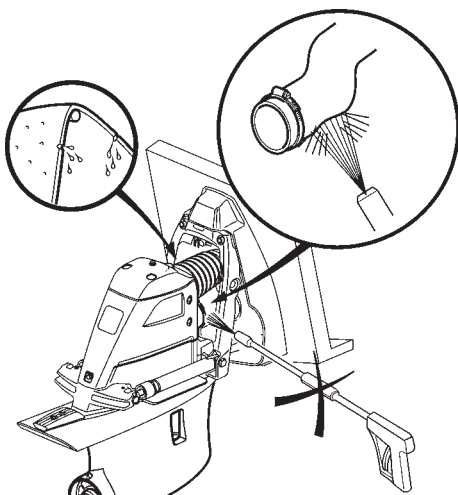
## Inhibiting

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

- Change engine oil and replace oil filter.
- Change oil in the reverse gear.
- Replace fuel filter and fuel pre-filter.
- Run engine to normal operating temperature.

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

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



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

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

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

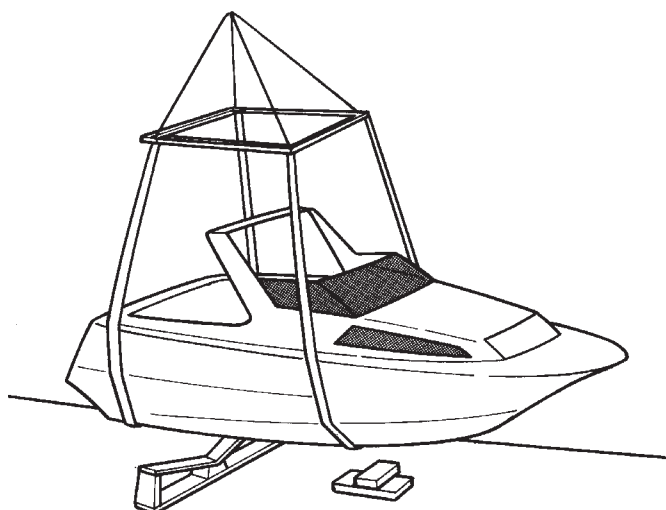
- Drain any water and contaminants from the fuel tank. Fill the tank completely with fuel to avoid condensation.



- Clean the outside of the engine. Do not use a high pressure spray to clean the engine. Touch up any damaged areas of paintwork with Volvo Penta original paint.
  - Check all control cables and treat with rust inhibitor.
  - Repair any damaged areas of paintwork with Volvo Penta original paint.
- NOTE!** Read the special instructions on painting the drive under the heading: "Painting the drive and underwater hull" in this chapter.
- Disconnect battery leads. Clean and charge the batteries.
  - **NOTE!** A poorly charged battery may burst as a result of freezing.
  - Spray electrical system components with moisture repellent spray.
  - Remove propeller for winter storage. Grease the propeller shaft using water repellent grease VP no. 828250.

## Bringing out of storage

- Check oil level in the engine and drive. Top up if necessary. If there is inhibiting oil in the system drain and fill with new oil, change oil filter. For correct oil grade please refer to "Maintenance; Lubrication system".
- Drain the antifreeze from the seawater system.
- Install the impeller in the seawater pump. Replace if the old one looks worn, please refer to "Maintenance; Seawater system".
- Close/tighten drain cocks/plugs.
- Check the tension and condition of the drive belts.
- Check the condition of rubber hoses and tighten hose clamps.
- Check engine coolant level and antifreeze protection. Top up if necessary.
- Connect the fully charged batteries.
- Paint the drive and hull see "Painting the drive and underwater hull" in this chapter.
- Change the sacrificial anode on the drive.
- Install propellers.
- Launch the boat. Check for leaks.
- Start the engine. Check that there are no fuel, engine coolant or exhaust gas leaks and that all control functions are operating.




## Painting the Drive and underwater hull


### Painting the drive

The SX and DPS sterndrives and transom shield use a silicon-alloy aluminum casting process. The process requires a unique paint repair procedure.


#### Preparation

 **WARNING!** Always follow the manufacturers instructions regarding personal protection when handling chemicals. You should always wear eye protection and gloves as a good work habit.

1. Remove all marine growth.
2. Use sandpaper or sandblast to remove loose paint and corrosion. Use a medium grit aluminum oxide sandpaper. If sandblasting use 55 - 25 grit (0.2 - 0.7mm) aluminum oxide blasting media.

 **CAUTION!** Do not use steel wool or emery cloth. Small pieces of steel or iron oxide used to produce steel wool and emery cloth will become embedded in the aluminum and cause severe corrosion.

3. Wash with hot water and detergent to remove all traces of oil and grease.
4. Roughen any painted areas that will be re-coated with a medium synthetic scouring pad or equivalent (i.e. 3M Scotchbrite™).
5. Rinse with water thoroughly and allow to air dry. Do not use a rag to wipe the area as some rags may have silicone.
6. Clean the entire area with an acid cleaner that does not contain fluoride (i.e. DuPont® 5717). Scrub surface with a synthetic scouring pad until it is completely "wetted," where no water beads on the surface. Follow all local laws and regulations when using or disposing of any chemicals used in this process.

 **CAUTION!** Fluorine in a cleaner causes "smut" (a dark discoloration on silicon-alloy aluminum castings), and paint will not stick to "smut". If this happens, sand the surface and start over using a different acid cleaner.

7. Rinse with water thoroughly and allow to air dry.

**Paint Application**

1. Treat any bare aluminum with chromate conversion coating.
2. Rinse thoroughly with water. The area must appear “wetted” or the surface is not clean and the paint will not adhere.
3. While the surface is still wet from rinsing, treat all bare aluminum with conversion solution. Brush the chromate solution on the surface. Add additional solution as necessary for 2 to 5 minutes to prevent it from drying on the surface. Rinse the surface thoroughly with water and allow to air dry. Follow the manufacturers instructions exactly.
  - If the chromate is allowed to dry anywhere on the bare aluminum surface, chromic acid salts will form which will prevent paint adhesion and promote corrosion. Sand the surface to bare metal.
  - Do not blow dry the part with compressed air unless it is completely free of dirt, oil and water.
  - Do not heat the part above 60°C (140°F) before painting.
  - Do not touch the treated surface with bare hands before painting.
  - The part should be primed soon after it dries, or at least within 24 hours.
  - It is best to let the part air dry, but if you must wipe the surface to speed up drying, use a lint free wipe not treated with anything that may contaminate the surface. Do not scrub the surface—wipe very lightly.
4. Where the primer coat is thin or where the surface is unpainted, prime with Volvo Penta primer P/N 11415627 or an equivalent epoxy primer (i.e. PPG® Super Koropon). Do not apply primer over a glossy hard finish coat without roughening. Primer solvents must be allowed to evaporate and the primer must harden before applying the finish coat. Follow the label instructions for method applications, drying times, and proper disposal of residual product.
5. Apply finish coat. Volvo Penta Parts Catalogs and the Volvo Penta Parts and Accessories Catalog list part numbers for the finishing products that apply to your Volvo Penta product.

## Painting the underwater hull

All types of paints with antifouling properties are poisonous and cause damage to the marine environment. Avoid the use of such agents. Most countries have introduced legislation controlling the use of antifouling agents. **Always abide by these regulations.** In many cases it is completely forbidden to use them on pleasure boats, for example in freshwater. For boats that are relatively easy to get out of the water we recommend only Teflon treatment combined with mechanical cleaning several times per season.

For larger craft this is not practicable. If the boat is in an area where the water quickly produces fouling then antifouling paints must probably be used. If this is the case use a copper-based paint containing copper cyanide and **not copper oxide**.



**IMPORTANT!** Leave an area of 10 mm (0.39") around the drive unpainted.

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

# In case of emergency

Despite regular maintenance according to the maintenance schedule and perfect operation, it may occur that a fault occurs 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
- Reverse gear in neutral and engine speed is limited to 1000-1200 rpm, depending on engine.
- The engine stops

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



## Starting with auxiliary batteries

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

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

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

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

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


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

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

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


## Running aground

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

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

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

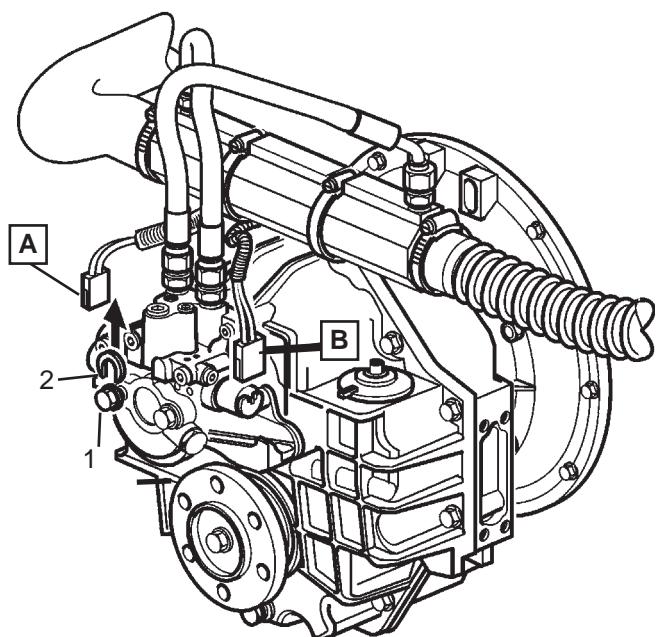
Take the boat out of the water. Check the oil level in the drive. If it is colored gray then water has entered the drive. If this is the case or if other damage has occurred to the drive it must be inspected at an authorized Volvo Penta workshop. If only the propeller has been damaged it must be replaced.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

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

## Re-start after crash-stop

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

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



## Emergency shifting

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

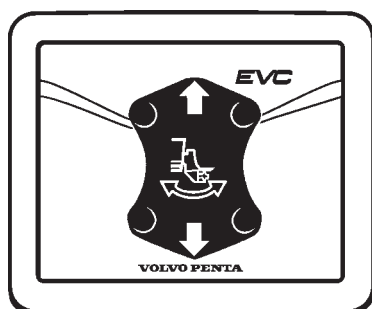
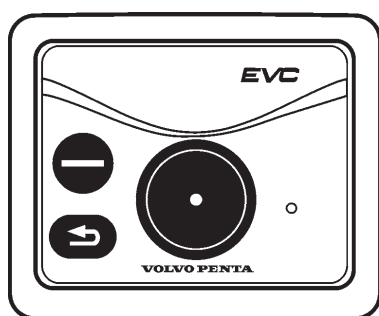
### Reverse gear

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

**Note.** The descriptions refer to electrically shifted reverse gear.

#### Manual engagement of the reverse gear:

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




## Emergency trimming

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



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

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

## Fault-tracing

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

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

Symptom and possible cause	
Starter motor not turning (or slow)	1, 2, 3
Engine does not start	4, 5, 6, 7
Engine starts but stops again	6, 7
Engine difficult to start	4, 5, 6, 7
Engine does not reach correct speed at wide open throttle (WOT)	5, 6, 7, 8, 9, 10, 11, 15, 18, 19, 20, 21
Engine knocks	4, 5, 6, 7
Engine runs unevenly	4, 5, 6, 7, 10, 11
Engine vibrates	15, 16
High fuel consumption	8, 9, 10, 12, 15
Black exhaust smoke	10
Blue or white exhaust smoke	12, 22
Low oil pressure	13, 14
Engine coolant temperature too high	17, 18, 19, 20, 21
None or poor charging	2, 23

- |                                     |   |  |
|-------------------------------------|---|--|
| 1. Discharged battery               | 9. Fouling on underwater hull/drive/propeller | 17. Too little coolant                   |
| 2. Loose connection/open-circuit    | 10. Insufficient air supply                   | 18. Blocked seawater intake/pipe/filter  |
| 3. Fuse tripped                     | 11. Engine coolant temperature too high       | 19. Circulation pump drive belt slipping |
| 4. Lack of fuel                     | 12. Engine coolant temperature is too low     | 20. Defective impeller                   |
| 5. Fouled fuel filter.              | 13. Lubricating oil level too low.            | 21. Defective/incorrect thermostat       |
| 6. Air in the fuel injection system | 14. Blocked oil filter                        | 22. Lubricating oil level too high       |
| 7. Water/contaminants in the fuel   | 15. Defective/incorrect propeller             | 23. Alternator drive belt slipping       |
| 8. Boat abnormally loaded           | 16. Defective engine mounting                 |  |



## Diagnostic function

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

### The diagnostic function has the following tasks:

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

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

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

## Malfunction message engine and EVC-system

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

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

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



### Danger pop-up

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

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

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

### Warning pop-up

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

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

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

### Caution pop-up

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

Acknowledge the alarm.

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



Faults are stored and malfunctions have been registered

### Faults list

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

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

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

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

### Erasing faults in faults list

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

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

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

This implies that:

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

# Fault code register

When a function fault occurs the helmsman is warned by an audible signal at the same time as a pop-up window with a fault message is shown in the display. The fault message provides information on the cause of the fault and the action to be taken.

In this chapter faults and remedies are described in more detail.

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

## Fault code list explanation

- A. Description of the fault, its effect on the system and actions to take.
- B. A lamp on the alarm monitor flashes. O means the flashing lamp is orange, and R means the lamp is red.  
Description of
- C. Audible alarm.
- D. The pop-up window shown in the EVC tachometer window.

A.	B.	C.
Water in fuel	 R	

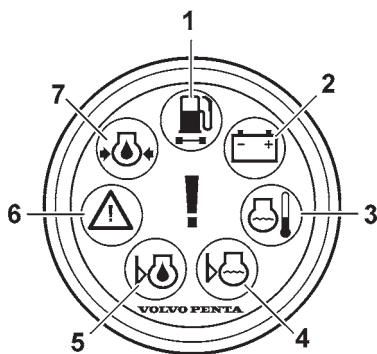
**Explanation:** Water in fuel filter water separator.

**Symptoms:** None.

**Remedy:**

- Empty the water separator under the fuel filter, refer to “Maintenance: Fuel system”.
- Contact a Volvo Penta workshop if the fault remains.

D.



P0004761

### Alarm monitor, optional equipment

The warning lamps must never burn during operations. The lamps will flash if a fault has been registered. When the fault has been acknowledged the lamp will burn constantly.

- 1 If the orange “water in fuel” lamp lights up, up there is too much water in the fuel pre filter water separator.
- 2 The charging lamp is lit if the alternator stops charging.
- 3 The coolant temperature lamp is lit if the coolant temperature is too high.
- 4 This function is not available.
- 5 This function is not available.
- 6 If the red (R) warning lamp lights up during operation a serious fault has occurred. If the orange (O) warning lamp lights up during operation a fault has occurred.
- 7 If the red oil pressure lamp lights up during operations, the engine oil pressure is too low.

### Engine speed



**Explanation:** Engine speed too high.

**Symptoms:** Reduced engine power.

**Remedy:**

- Contact a Volvo Penta workshop.



### Water in fuel



**Explanation:** Water in fuel filter water separator.

**Symptoms:** None

**Remedy:**

- Empty the water separator under the fuel filter, refer to “Maintenance: Fuel system”.
- Contact a Volvo Penta workshop if the fault remains.



### Air temperature



**Explanation:** Excessive charge air temperature.

**Symptom:** Reduced engine power.

**Remedy:**

- Contact a Volvo Penta workshop.



### Air temperature



**Explanation:** Faulty sensor.

**Symptom:** Reduced engine power.

**Remedy:**

- Contact a Volvo Penta workshop.



### Coolant temperature



**Explanation:** Excessive coolant temperature.

**Symptom:** Reduced engine power.

**Remedy:**

- Check coolant level. Refer to the chapter “Care: Freshwater system”
- Check that oil filter is not blocked. Refer to the chapter “Care: Raw water system”.
- Check the impeller in the sea water pump. Refer to the chapter “Care: Raw water system”.
- Check that there are no leaks.
- If coolant flow ceases the exhaust hose must be inspected internally and be replaced if the hose shows signs of damage.
- Contact a Volvo Penta workshop if the fault remains.



### Coolant temperature



**Explanation:** Faulty sensor.

**Symptom:** Reduced engine power.

**Remedy:**

- Contact a Volvo Penta workshop.



### Battery charge



**Explanation:** Battery charge to low.

**Symptom:** None

**Remedy:**

- Check the battery electrolyte level.
- Check the belt tension.
- Contact a Volvo Penta workshop if the fault remains.

### Fuel pressure



**Explanation:** Fuel system fault.

**Symptom:** Reduced engine power.

**Remedy:**

- Check the fuel level.
- Open the fuel taps and check carefully that no leakage occurs.
- Check that fuel filter is not blocked. Refer to the chapter "Care: Fuel system".
- Contact a Volvo Penta workshop if the fault remains.



### Fuel pressure



**Explanation:** Faulty sensor.

**Symptom:** Reduced engine power.

**Remedy:**

- Contact a Volvo Penta workshop.



### Lubrication oil pressure



**Explanation:** Too low oil pressure.

**Symptom:** Reduced engine power.

**Remedy:**

- Check the engine oil level. Refer to the chapter "Care: Lubrication" for checking and filling oil.
- Check that the oil filters are not blocked.
- Check that there are no leaks.
- Contact a Volvo Penta workshop if the fault remains.



**VNT valve**

**Explanation:** Discrepancy between actual turbo pressure value and the nominal value.

**Symptom:** Limitation of engine rpm.

**Remedy:**

- Contact a Volvo Penta workshop.

**ECM main relay**

**Explanation:** Fault in main relay or main relay circuit.

**Symptom:** Limitation of engine rpm.

**Remedy:**

- Change the main relay.
- Contact a Volvo Penta workshop if the fault remains

**Data Set, EEPROM memory**

**Explanation:** Fault in engine control unit.

**Symptom:** None

**Remedy:**

- Contact a Volvo Penta workshop.

**Communication fault**

**Explanation:** Fault in engine control unit.

**Symptom:** None

**Remedy:**

- Contact a Volvo Penta workshop.

**5 Volt DC supply**

**Explanation:** Fault in engine control unit.

**Symptom:**

**Remedy:**

- Contact a Volvo Penta workshop.



### Engine control unit



**Explanation:** Fault in engine control unit.

**Symptom:** Engine stops.

**Remedy:**

- Attempt to close the system (turn start key to position 0) and try to start the engine again.
- Contact a Volvo Penta workshop if the fault remains



### Fuel pressure monitoring



**Explanation:** Fault in circuit.

**Symptom:** Limitation of engine rpm.

**Remedy:**

- Contact a Volvo Penta workshop.



### Fuel pressure monitoring 1



**Explanation:** Fuel pressure fault.

**Symptom:** The engine stops or engine rpm is limited.

**Remedy:**

- Check the fuel level, check hoses and fuel filter for leaks.
- Change the fuel filter.
- Contact a Volvo Penta workshop if the fault remains



### Fuel pressure monitoring 2



**Explanation:** Fuel pressure fault.

**Symptom:** The engine stops or engine rpm is limited.

**Remedy:**

- Check the fuel level, check hoses and fuel filter for leaks.
- Check that the hoses are not blocked, check the return pipe.
- Change the fuel filter
- Contact a Volvo Penta workshop if the fault remains



### High bank 1\*



**Explanation:** Abnormally high voltage or short circuit.

**Symptom:** Engine stops.

**Remedy:**

- Contact a Volvo Penta workshop if the fault remains





**High bank 2\***

**Explanation:** Abnormally low voltage or short circuit.

**Symptom:** Engine stops.

**Remedy:**

- Check the power supply to the engine control unit.
- Contact a Volvo Penta workshop if the fault remains

**Rpm sensor, flywheel**

**Explanation:** Faulty flywheel / faulty sensor.

**Symptom:** Limitation of engine rpm. Engine does not start.

**Remedy:**

- Check rpm sensor.
- Contact a Volvo Penta workshop if the fault remains

**Rpm sensor, camshaft**

**Explanation:** Faulty camshaft signal.

**Symptom:** Limitation of engine rpm. Hard to start engine.

**Remedy:**

- Check the wiring between the sensor and the engine control unit.
- Contact a Volvo Penta workshop if the fault remains

**Injector fault**

**Explanation:** Short circuit in one of the injector cables. Faulty injector.

**Symptom:**

**Remedy:**

- Check that the cables to the injectors and connectors are correctly connected to the injector.
- Contact a Volvo Penta workshop if the fault remains

**Start lock status**

















**Explanation:** A fault has occurred under "ignition on" when the engine control unit receives the initiation signal.

**Symptom:** Engine does not start.

**Remedy:**

- Turn off the power, first at the start lock and then at the main switch. Re-start the system.
- Contact a Volvo Penta workshop if the fault remains



<b>Throttle control</b>	 R		
<p><b>Explanation:</b> Sensor fault</p> <p><b>Symptom:</b> Limitation of engine rpm.</p> <p><b>Remedy:</b></p> <ul style="list-style-type: none"> <li>• Contact a Volvo Penta workshop.</li> </ul>			
<b>Charge air pressure</b>	 R		
<p><b>Explanation:</b> Faulty sensor / Faulty sensor circuit</p> <p><b>Symptom:</b> Limitation of engine rpm.</p> <p><b>Remedy:</b></p> <ul style="list-style-type: none"> <li>• Check cables between the sensor and engine control unit.</li> <li>• Contact a Volvo Penta workshop if the fault remains</li> </ul>			
<b>Fuel level</b>	 O		
<p><b>Explanation:</b> Faulty sensor.</p> <p><b>Symptom:</b> Invalid reading of fuel level on display or gauge.</p> <p><b>Remedy:</b></p> <ul style="list-style-type: none"> <li>• Check the fuel level.</li> <li>• Contact a Volvo Penta workshop if the fault remains</li> </ul>			
<b>PowerTrim button</b>	 O		
<p><b>Explanation:</b> Faulty Power Trim button</p> <p><b>Symptom:</b> Power Trim cannot be adjusted.</p> <p><b>Remedy:</b></p> <ul style="list-style-type: none"> <li>• Attempt to use another Power Trim panel.</li> <li>• Contact a Volvo Penta workshop if the fault remains</li> </ul>			
<b>Power Trim limited function</b>	 O		
<p><b>Explanation:</b> The input signal cannot be read.</p> <p><b>Symptom:</b> Data cannot be read.</p> <p><b>Remedy:</b></p> <ul style="list-style-type: none"> <li>• Check the cables to the trim pump.</li> <li>• Contact a Volvo Penta workshop if the fault remains</li> </ul>			

**Depth alarm**

**Explanation:** The system has a sensor that reports depth.

**Symptom:** The depth alarm is active (depth warning).

**Remedy:**

- The water is shallower than the set draught
- Contact a Volvo Penta workshop if the fault remains

**J1939 Communication warning**

**Explanation:** The unit has discovered too many communications faults and has shut down the interface.

**Symptom:** The engine is still running but no data is available from the instruments.

**Remedy:**

- Check the flat pin breaker for EDC15.
- Check that the auxiliary stop button is not stuck.
- Check battery charge.
- Check main relay.
- Check cables between the engine control unit and the HIU unit.
- Contact a Volvo Penta workshop if the fault remains.

**Calibration memory fault**

**Explanation:** Faulty data checksum.

**Symptom:** The unit will use standard calibration data.

**Remedy:**

- Contact a Volvo Penta workshop.

**Internal CPU fault**

**Explanation:** Defective unit or component.

**Symptom:** Cannot attain normal operational mode.

**Remedy:**

- Contact a Volvo Penta workshop.

**Power Trim motor**

**Explanation:** Fault in Power Trim step up.

**Symptom:** Power Trim cannot be moved up or down.

**Remedy:**

- Check the trim pump cables.
- Check the trim pump relay.
- Contact a Volvo Penta workshop if the fault remains



### Auxiliary bus supply



**Explanation:** No voltage to the keypad.

**Symptom:** Key pad does not work.

**Remedy:**

- Contact a Volvo Penta workshop.



### Communication fault, main panel



**Explanation:** Fault in main panel.

**Symptom:** Main panel pad does not work.

**Remedy:**

- Contact a Volvo Penta workshop.



### System fault



**Explanation:** Various faults.

**Symptom:**

**Remedy:**

- Restart the engine
- Contact a Volvo Penta workshop if the fault remains.

### Timing sensor crank



**Explanation:**

**Symptom:** Hard to start engine. Reduced engine power. Limitation of engine rpm.

**Remedy:**

- Contact a Volvo Penta workshop.



# Technical Data

## Engine model

Engine model.....	<b>D3-110i</b>	<b>D3-130i</b> <b>D3-130A</b>	<b>D3-160i</b> <b>D3-160A</b>	<b>D3-190i</b> <b>D3-190A</b>
Crankshaft power, kW (hp) .....	81(110)	96 (130)	120 (163)	140 (190)
Propellershaft power, kW (hp) .....	78 (106)	92 (125)	115 (156)	134 (183)
Engine speed, rpm .....	3000	4000	4000	4000
Propeller selection range.....	2700-3000	3900-4100	3800-4100	3800-4100

## General

After market designation .....	D3i-C, D3A-C
Number of cylinders.....	5
Bore/stroke .....	81/93,2 mm (3.19/3.67 in.)
Displacement.....	2.4 l (146 in <sup>3</sup> )
Compression ratio .....	17.3:1
Dry weight bobtail.....	227 kg (500 lb)
Dry weight with reverse gear HS25A.....	264 kg (582 lb)
Idling speed .....	700 rpm

Technical data according to ISO 8665.

## Lubrication system

Oil volume, max (incl. oil filter) .....	6.5 liters (6.9 US quarts)
Oil volume, min (incl. oil filter) .....	4.8 liters (5.1 US quarts)
Oil grade .....	Please refer to specification on page 59
Viscosity .....	SAE 15W/40

## Cooling system

Thermostat open/fully open .....	80°C/95°C (176°/203°F)
Freshwater system volume, app. ....	8.2 liters (8.7 US quarts)
Volume between min and max .....	0.75 liters (0.79 US quarts)

## Electrical system

System voltage .....	12V
Starter motor battery, capacity .....	1 x 88Ah 800cca
Alternator, rated power, max.....	14V/140A
Starter motor, rated power.....	2.2 kW

## Fuel specification

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

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

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

**JIS KK 2204**

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

## SX drive

Type designation.....	<b>SX-A</b>
Gear ratio.....	1.66:1 ; 1.51:1
Oil grade .....	API GL5
Viscosity .....	SAE 75W/90 (synthetic)
Oil volume.....	2.4 liters (2.58 US quarts)
Weight (including shield) .....	91 kg

## DPS drive

Type designation.....	<b>DPS-A</b>
Gear ratio.....	1.95:1 ; 2.11:1
Viscosity .....	SAE 75W/90 (synthetic)
Oil volume.....	2.2 liters (2.38 US quarts)

## Reverse gear (excluding oil cooler)

Type designation.....	<b>HS25A</b>	<b>HS45A</b>
Gear ratio.....	1.92:1 ; 2.48	2.43:1 ; 2.03:1
Angle (output shaft) .....	8°	8°
Oil volume, approx. ....	1.8 liters (1.9 US quarts)	2.5 liters (2.6 US quarts)
Oil grade .....	ATF (Dexron II, III)	ATF (Dexron II, III)
Weight .....	32 kg (70 lbs)	37 kg (81 lbs)

Type designation.....	<b>HS63IV</b>
Gear ratio.....	1.99:1 ; 2.48:1
Angle (output shaft) .....	12°
Oil volume, approx. ....	4.8 liters (5.1 US quarts)
Oil grade .....	ATF (Dexron II, III)
Weight .....	66 kg (145 lbs)

## Power Trim

Oil volume.....	1.6 liters (1.7 US quarts)
Oil grade .....	ATF Dexron II, III

## Steering

### Power steering

Oil grade .....	ATF Dexron II, III
-----------------	--------------------

## Notes

[illegible]





**NOTICE:** The free-of-charge Operator's Manual offer is valid for 12 months after delivery. Fill in your name, postal address, email address and desired language.

**Publication Reference: 47700545**

Name:

[illegible]

**Address:**

[illegible][illegible][illegible]

Country:

[illegible]

**E-mail:**

[illegible]

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| <input type="checkbox"/> English    | <input type="checkbox"/> Dansk     |
| <input type="checkbox"/> Svenska    | <input type="checkbox"/> Suomi     |
| <input type="checkbox"/> Deutsch    | <input type="checkbox"/> Português |
| <input type="checkbox"/> Français   | <input type="checkbox"/> Ελληνικά  |
| <input type="checkbox"/> Español    | <input type="checkbox"/> Русский   |
| <input type="checkbox"/> Italiano   | <input type="checkbox"/> Türkçe    |
| <input type="checkbox"/> Nederlands |                                    |

<http://vppneuapps.volvo.com/manual/coupon/>

Elanders Sverige AB  
Order Office  
Arendals Skans 6, ARU1  
418 79 GÖTEBORG  
Sweden

**Fax:** +46 31 545 772





