INSTRUCTION BOOK

31, 32, 41, 42, 43 Series

VOLVO
PENTA

⚠ California

Proposition 65 Warning

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

Welcome aboard

Congratulations on your new boat and your choice of a Volvo Penta marine engine. A choice that will give you many years of boating pleasure.

Your new marine engine is the result of more than 90 years experience in marine engine design, coupled with revolutionary new ideas and concern for the environment, where traditional Volvo Penta qualities such as first class performance, reliability and durability have been upheld. We believe that this also reflects what you require and expect from your new marine engine.

To help you fulfil your expectations, we want you to read through this instruction manual carefully, and take our advice about operating and maintaining the engine, before you cast off on your maiden voyage.

Best regards

AB VOLVO PENTA

Contents

Safety Precautions

Read this chapter carefully. It concerns your safety. This section describes how safety information is presented in the Instruction 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 Instruction 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 Instruction 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 Instruction 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 Instruction 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 Instruction 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 and 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. There is a risk that someone aboard will fall down 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 Instruction 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.

⚠ Safety breaker

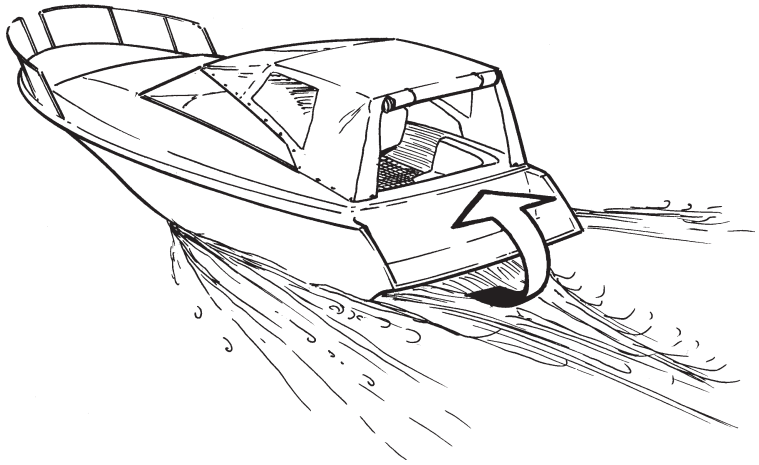
We recommend that you install and use a safety breaker (accessory), especially if you boat can travel at high speeds. The safety breaker stops the engine if the driver falls down and loses control over the boat.

⚠ Carbon monoxide poisoning

When a boat is moving forward backwash is caused behind the boat. Sometimes this backwash can be so powerful that exhaust gases can be sucked into the cabin or seating well on the boat with the resulting risk of carbon monoxide poisoning for those on board.

The backwash problem is greatest with high, broad boats with a squared stern. But other types of boat can also have backwash problems under certain conditions, for example when running with an awning rigged. Among other factors that can increase the backwash effect are wind conditions, load distribution, the sea running, trim, open hatches and valves.

Most modern boats are designed in such a way that problems with backwash are extremely unusual. Should a backwash problem occur do not open hatches or valves in the forward part of the boat. This will only increase backwash. Try changing speed, trim or load distribution in the boat instead. In addition take down, open or change the rigging of the awning in some other way if an awning is rigged. Contact the dealer where the boat was purchased to get more information on how to solve this problem should it occur on 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 Owner'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 switch and lock it in the OFF position before starting work. Put up a warning sign in the control position that work on the engine is being carried out.

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

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

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

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

⚠ Fire and explosion

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

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

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

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

Use of components other than Volvo Original replacement parts
Components used in the fuel and ignition system (gasoline engines) and electrical systems on Volvo Penta products are designed and constructed to minimize the risk of fire and explosion.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Introduction

This Instruction 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 Instruction Manual carefully and learn how to operate the engine, controls and other equipment safely.

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

Responsibility for the environment

We all want to live in a clean environment. Where we can breathe clean air, see healthy trees, have clean water in our lakes and oceans and enjoy the sunshine without worrying about our health. Unfortunately this is no longer something we can take for granted, we must work hard together for the environment.

As a manufacturer of marine engines Volvo Penta has a particular responsibility. This is why concern for the environment is one of the cornerstones of our product development. Today great advances have been made in reducing exhaust emissions, fuel consumption and engine noise in Volvo Penta's wide range of engines.

We hope that you will take care to maintain these properties. Always follow the advice in the Instruction Manual about fuel grades, operation and maintenance and you will avoid unnecessary negative impact on the environment. If you notice changes such as increased fuel consumption or exhaust smoke, please contact your Volvo Penta dealer.

Adapt speed and distance so that swell and noise generated by the boat do not disturb or harm wildlife, moored boats, landing stages etc. Leave islands and harbors in the same condition you would like to find them. Always dispose of environmentally harmful waste such as engine and transmission oil, coolant, old paint, degreasing agents, paint and cleaning residue and old batteries at designated disposal areas for destruction.

Together we can work to make a valuable contribution to preserving the 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 engines and are designed for maximum service life and reliability. They are built to survive in a tough marine environment, but also to cause as little environmental impact as possible. Regular service and the use of Volvo Penta Genuine parts will maintain these properties.

Volvo Penta have built up a world wide network of authorized dealers. They specialize in Volvo Penta products and can help you to maintain your engine in top condition. They have the accessories, genuine replacement parts, test equipment and special tools necessary to provide high-quality service and repair work.

Always follow the maintenance intervals contained in the Instruction Manual. Remember to state the engine/transmission identification number when ordering service and replacement parts.

Certificated engines

If you own an engine certificated for any area where exhaust emissions are regulated by law, the following is important:

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

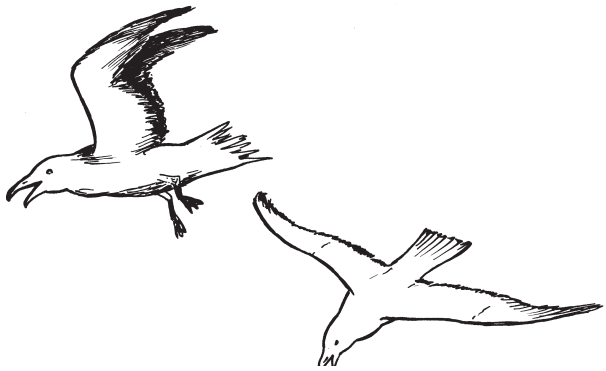
This places special requirements for maintenance and service as follows:

- The maintenance and service intervals recommended by Volvo Penta must be observed.
- Only genuine Volvo Penta replacement parts may be used.
- The service of injection pumps and injectors or pump settings must always be carried out by an authorized Volvo Penta workshop.
- The engine must not be modified in any way except with accessories and service kits approved by Volvo Penta.
- No modifications to the exhaust pipes and air supply ducts for the engine may be undertaken.
- Seals may only be broken by authorized personnel.

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

⚠ **IMPORTANT!** Late or inadequate maintenance/ service or the use of spare parts other than Volvo Penta original spare parts will invalidate AB Volvo Penta's responsibility for the engine specification being in accordance with the certificated variant.

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



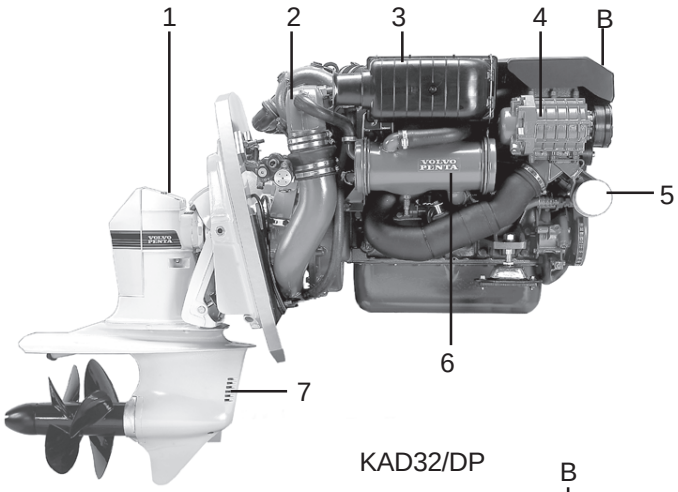
Warranty

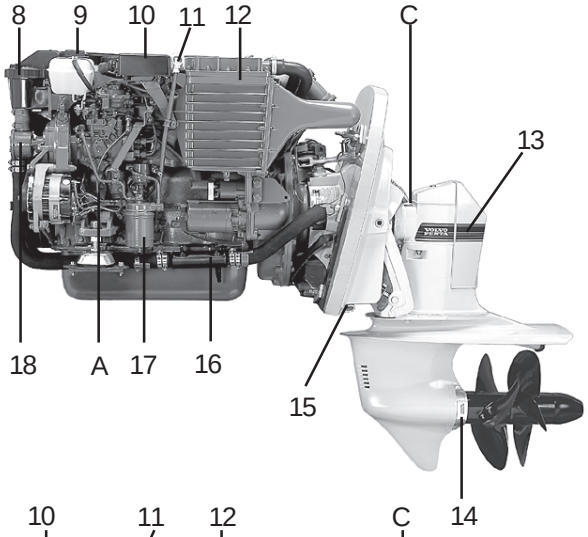
Your new Volvo Penta marine engine is covered by a limited warranty according to the conditions and instructions contained in the Warranty and Service book.

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

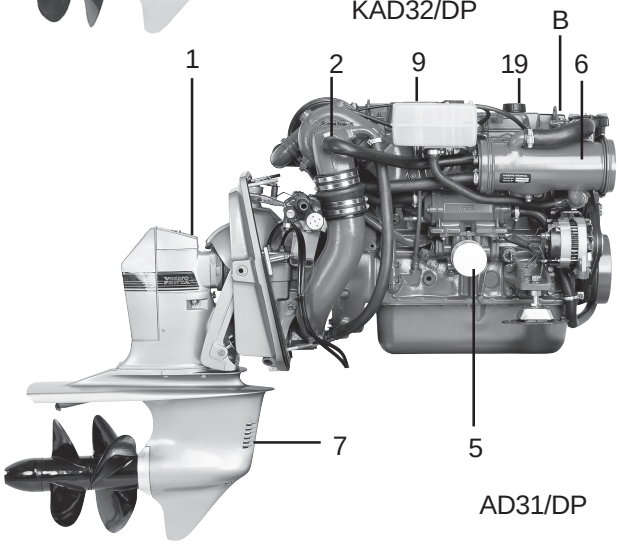
* Contact your Volvo Penta dealer if you have not received a Warranty and Service Book.

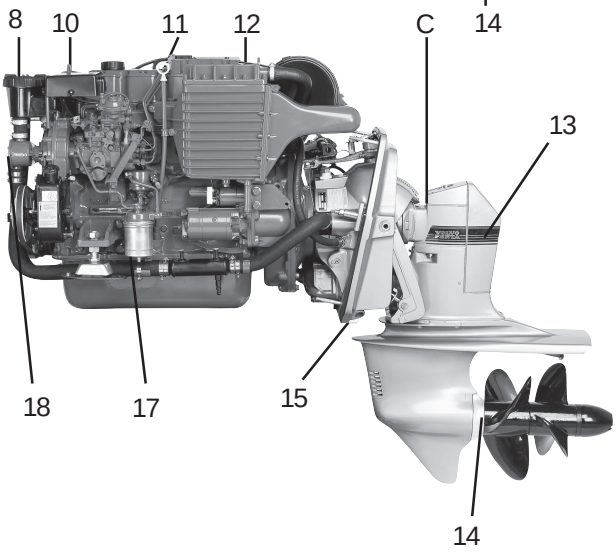
Presentation



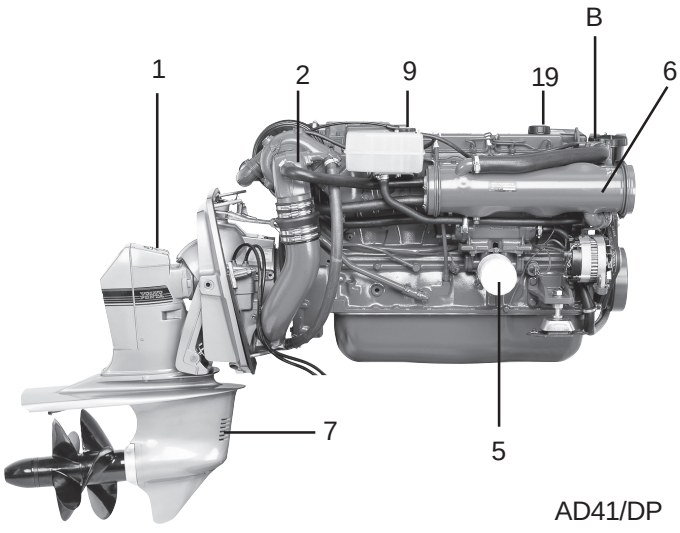


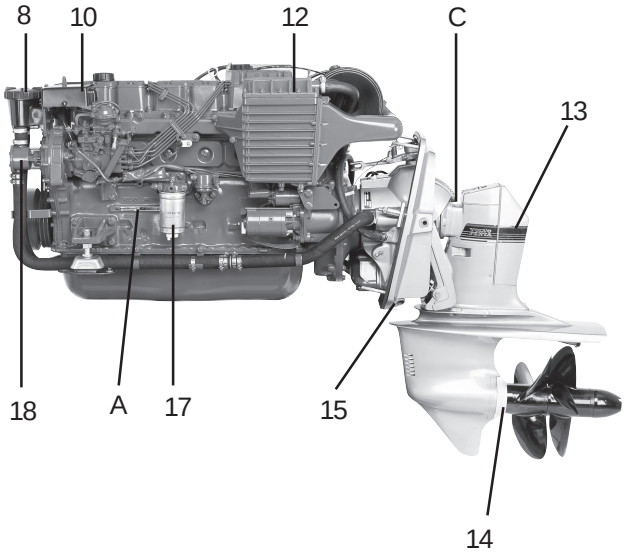
KAD32/DP



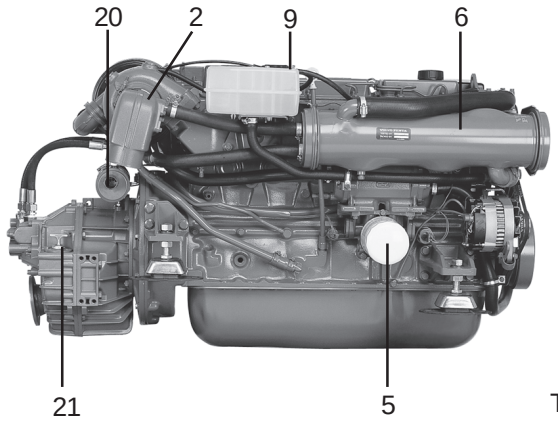


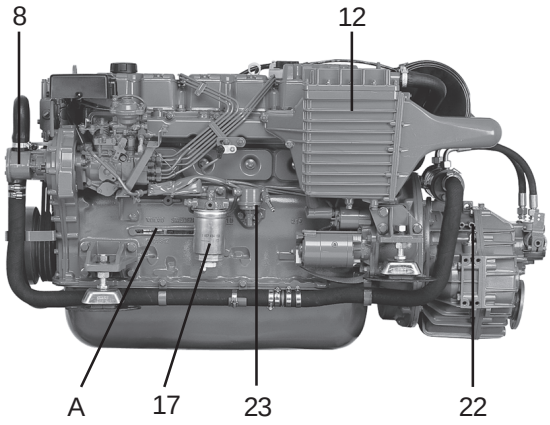
AD31/DP



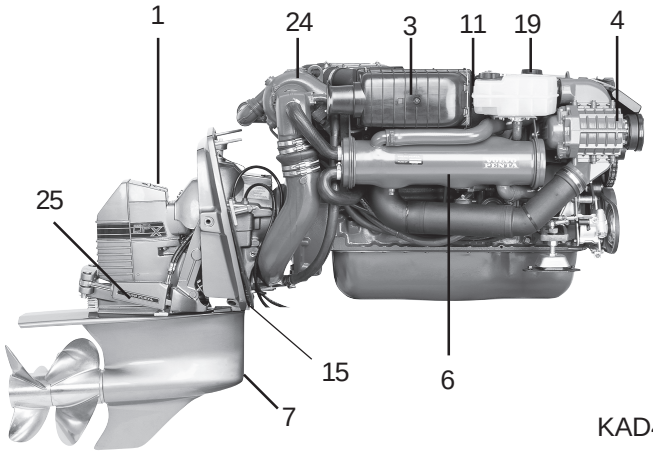


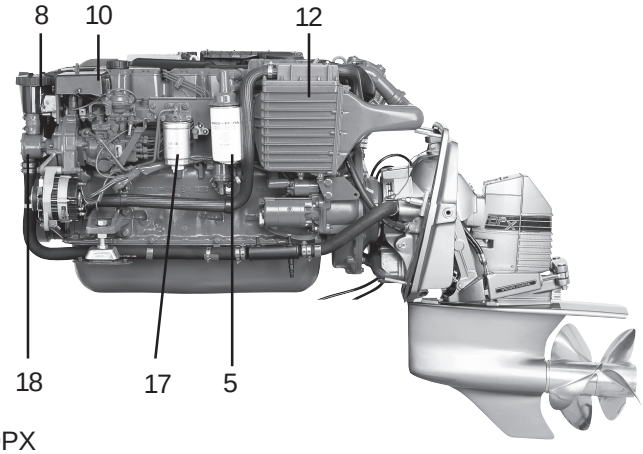
AD41/DP



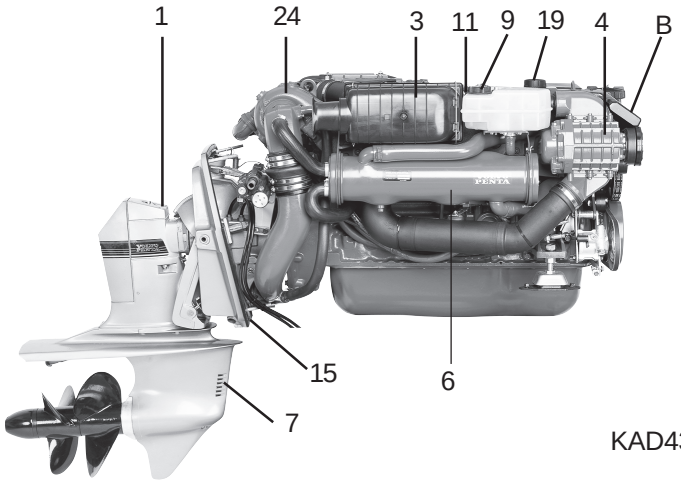


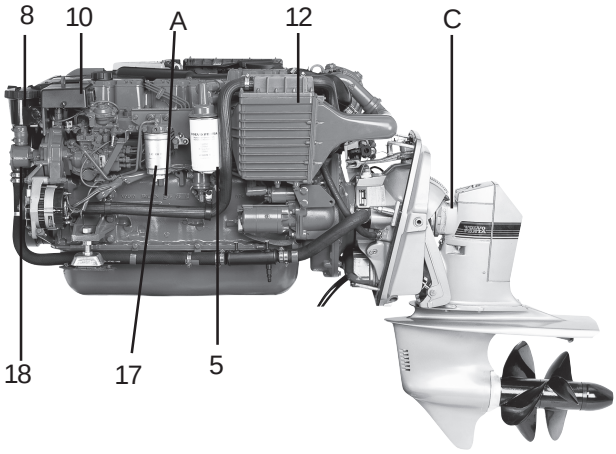
TAMD41/HS63A





KAD43/DPX





KAD43/DP

1. Dipstick, drive
2. Water cooled exhaust elbow
3. Air cleaner
4. Compressor
5. Oilfilter
6. Heat exchanger
7. Cooling water inlet
8. Seawater filter
9. Filling engine coolant
10. Terminal box
11. Dipstick, engine
12. Charge air cooler
13. Topping up oil, drive
14. Corrosion protection
15. Corrosion protection
16. Oil cooler, Power Steering
17. Fuel filter
18. Seawater pump
19. Oil filler, engine
20. Oil cooler, reverse gear
21. Oil filter, reverse gear
22. Dipstick, reverse gear
23. Fuel pump
24. Turbo
25. Steering cylinders

Identification number

Your engine and transmission has identification plates with identification numbers. This information should always be quoted when ordering service and replacement parts. There are probably similar plates on your boat and its equipment. Make a note of the details below, make a copy of the page and keep it so that you have a copy should the boat be stolen.

An example of an identification plate is shown below. The figures in brackets refer to the location of the identification numbers on the identification plate. For plate locations, refer to illustrations “A”, “B”, “C”.

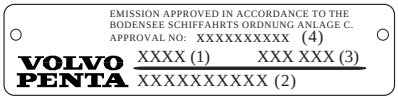
Engine

Product designation (1) .....

Serial number (2).. .....

Product number (3) .....

Certification number (4) .....



Engine plate (A)

Engine and transmission decal (B)

Key code

The key code is on a disc secured to the ignition keys. This code is used when ordering extra keys and should **not** be available to unauthorized persons.

Drive/Reverse gear

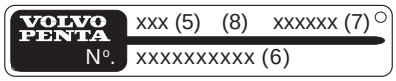
Product designation (5) .....

Serial number (6) .....

Product number (7) .....

Gear ratio (8) .....

Propeller designation .....

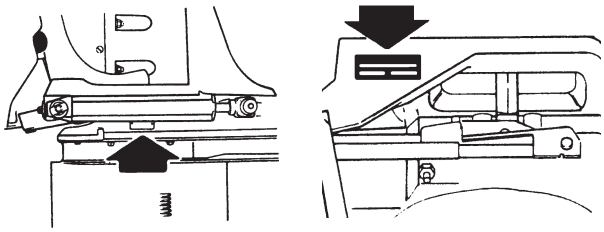


Drive and reverse gear plate (C)

Location of drive/shield type plate DP-S

The drive type plate is located on the drive unit behind the port trim/tilt cylinder.

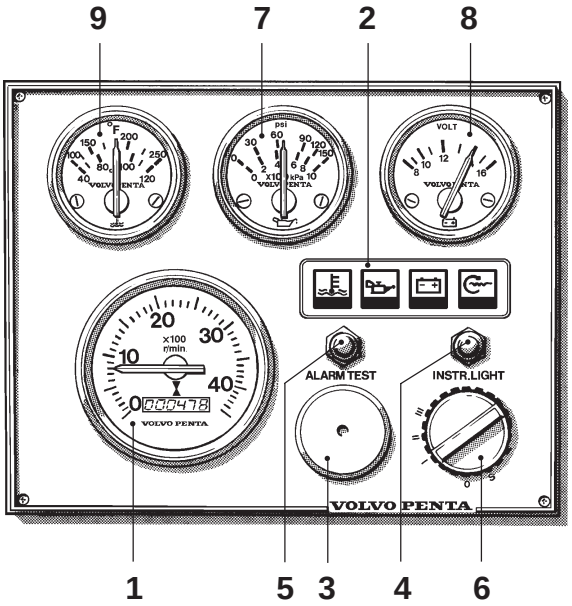
The shield type plate is located on the top of the inner transom shield.



Instrument

This section contains descriptions of the instrument panels and panels available from Volvo Penta for your engine, with the exception of the Power Trim instrument, which is described in the section Power Trim. Note that the tachometer, oil pressure gauge, temperature gauge, charge indicator, ignition switch etc. which are shown here installed in the instrument panels can be installed in other positions on some boats.

If you want to install additional instrumentation, or your boat is equipped with instruments not described here, please contact your Volvo Penta dealer.

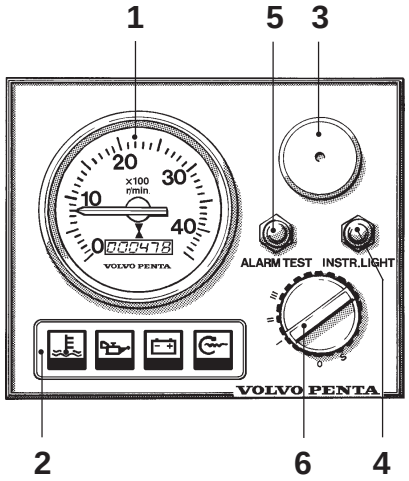


Main panel

Master control position panel

1. Tachometer and hour counter.
2. Warning display*
3. Siren for acoustic alarm.
4. Switch for instrument lighting.
5. Alarm test/acknowledgment switch.*
6. Ignition switch*.
7. Oil pressure gauge. Displays the oil pressure in the engine.
8. Voltmeter. Displays the charge voltage from the generator.
9. Temperature gauge. Displays the engine coolant temperature.

* See description on page 14

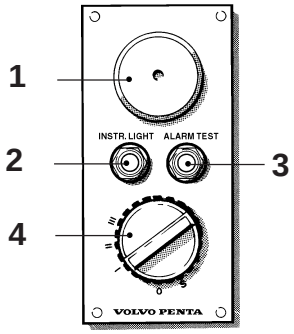


Extra panel

Panel for Flying Bridge (alternative operating position).

1. Tachometer and hour counter.
2. Warning display*
3. Siren for acoustic alarm.
4. Switch for instrument lighting.
5. Alarm test/acknowledgment switch.*
6. Ignition switch*.

* See description on page 14

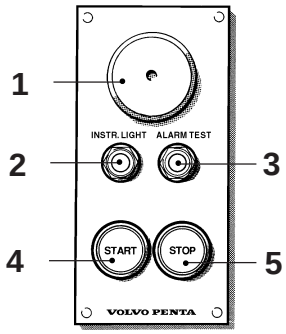


Control panel with ignition switch

Master control position panel

1. Siren for acoustic alarm.
2. Switch for instrument lighting.
3. Alarm test/acknowledgment switch.*
4. Ignition switch*.

* See description on page 15



Control panel without ignition switch

Panel for Flying Bridge (alternative operating position).

To start the engine from this panel the ignition key in the master panel must be in the operating position (I). The glow plug function (option) cannot be activated from this panel.

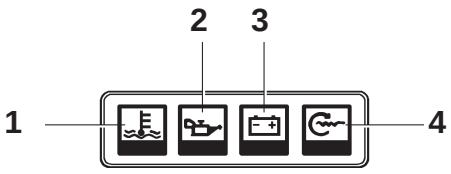
1. Siren for acoustic alarm.
2. Switch for instrument lighting.
3. Alarm test/acknowledgment switch.*
4. Starter button. Release the button as soon as the engine has started.
5. Stop button.

* See description on page 15

Warning display

Display for mounting independently.*

* See description on page 15



Warning display

If the acoustic alarm sounds, one of the three warning lamps (1–3) on the instrument panel starts to flash to indicate the source of the alarm.

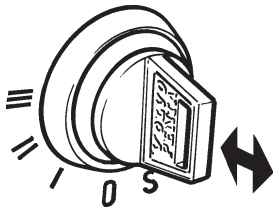
1. Engine coolant temperature too high.
2. Low oil pressure.
3. Generator not charging.
4. Indicator lamp Lights when the glow plugs are operated (option).

Alarm test/acknowledgment switch

Make a habit of checking that the warning lamps and the acoustic alarm are operating correctly before starting the engine.

Testing the alarm
Press the switch. All warning lights light and the acoustic alarm sounds.

Alarm acknowledge
Press the switch if there is an alarm. The acoustic alarm stops but the relevant warning lamp continues to flash until the malfunction is corrected.



Ignition switch

S = Stop position

0 = The key can be inserted and removed.

I = Operating position.

II = Glow plug position. The glow plugs (option) are connected and pre-heating the engine.

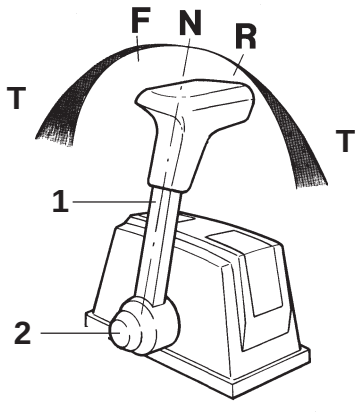
III = Start position.

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

Controls

The shift function and engine speed control are combined in one lever. If necessary the shift function can be easily disengaged so that only the engine speed (rpm) is affected by the lever. The control lever has an adjustable friction brake.

A neutral position switch is available as an accessory, this will only permit the engine to be started with the drive/reverse gear disengaged.



Top-mounted control

Maneuvering

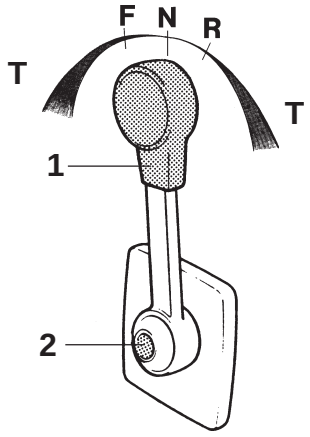
Shifting and engine speed are controlled with the same lever (**1**).

N = Neutral position. Drive/reverse gear disengaged.

F = Drive/reverse gear engaged for movement ahead.

R = Drive/reverse gear engaged for movement astern.

T = Engine speed control



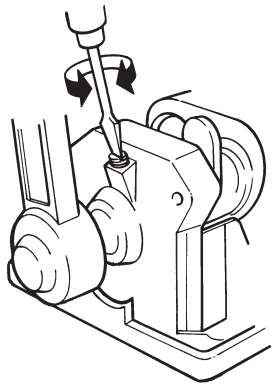
Side-mounted control

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/reverse gear by mistake.



Adjusting the friction brake

The friction brake only affects the engine speed control movements.

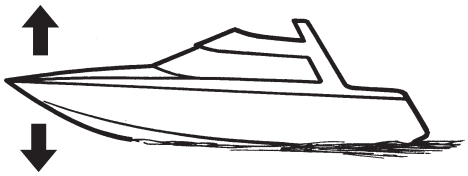
- Lift the cover over the control. For side-mounted controls the lever must first be removed.
- Set the lever to the half-open throttle/reverse position.
- Adjust the friction brake. Turning the screw clockwise (**+**) makes the lever movement stiffer, while turning counterclockwise (**–**) makes it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

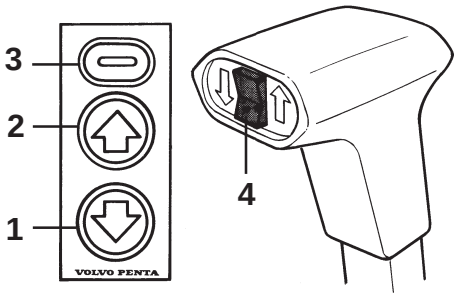
Power Trim

Your Volvo Penta propulsion system is equipped with a Power Trim hydraulic trim system which makes it possible to adjust the angle of the drive in relation to the stern of the boat. This adjusts the boat's trim to obtain maximum comfort and fuel economy in different operating conditions.

Power Trim settings and adjustment are controlled from the helm position using the controls and instruments described in this chapter. The section on Operation provides more information on use of the Power Trim system when operating the boat.

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





Trim controls

The drive is trimmed using the separate control panel or the button on the control lever (option). The current trim position of the drive is shown on the separate trim instrument.

Trimming the drive away from the stern of the boat raises the bow in relation to the horizontal, while moving it towards the stern will lower the bows.

Button 1: Press button to lower the bow of the boat (drive is trimmed inward).

Button 2: Press button to raise the bow of the boat (drive is trimmed out).

Button 3: Press the button* while simultaneously pressing button (2) or (4) is pressed up to raise or trim the drive out to Beach range.

Button 4: Press button up to raise bows. Press button down to lower bows.

* Applies only to DP. This button has no function on the DPX, DP-S drive.

Trim instrument. General

To be able to make use of the information provided by the trim instrument it important to know about the significance of the trim ranges and their application. There are three ranges:

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

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

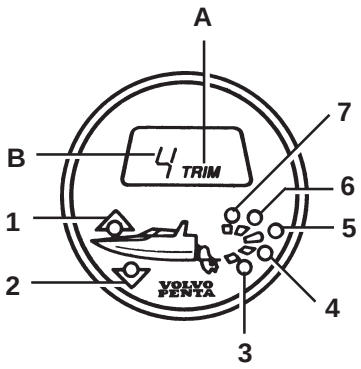
⚠ **WARNING!** The maximum permitted engine speed in the Beach range is 1,000 rpm. Always check that the cooling water intake is below the surface of the water.

Lift range
The lift range is used for lifting the drive to its maximum angle, **however this cannot be used during normal operation of the boat**. The range is used mainly for trailer transport of the boat. The Power Trim has an automatic stop which cuts off the current when the stop position is reached. The stop is automatically reset when trimming down.

⚠ **WARNING!** The engine must not be run with the drive in the "Lift" range.

Digital trim instrument (DP, DP-S)

The display shows the current trim range and drive position. The same information can be obtained from the LEDs which also indicate the up or down movement of the bows.



A. Shows the current trim range (TRIM: trim range, BEACH: beach range, no text on display: lift range).

B. Shows the current drive position* in the range -9 to 42

1. Yellow light indicates that the bows are above the horizontal line. Flashes when the drive moves and the bow is raised. Otherwise no indication.

2. Yellow light indicates that the bows are below the horizontal line. Flashes when the drive moves and the bow is lowered. Otherwise no indication.

3. Green light comes on in the trim range (-9 to 0). Otherwise no indication.

4. Green light comes on in the trim range (0 to 2). Otherwise no indication.

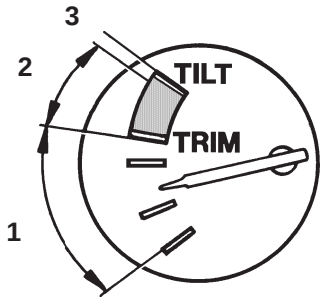
5. Green light comes on in the trim range (2 to 5). Otherwise no indication.

6. Red light in the beach range (6 to 40). Otherwise no indication.

7. Red light flashes to warn that the drive is in the lift range (over 40). Otherwise no indication.

Note. A diagnostics program is initiated automatically every time the instrument is activated (using the ignition key); all the LCD segments light up and the display shows A-BEACH. The instrument then returns to displaying the current drive angle.

* This figure is the angle of the drive to perpendicular (stationary boat). The lowest value shows that the drive is trimmed to maximum and the highest value shows that the drive is at maximum lift. Note that the lowest value can vary from boat to boat depending on the angle of the boat's stern.



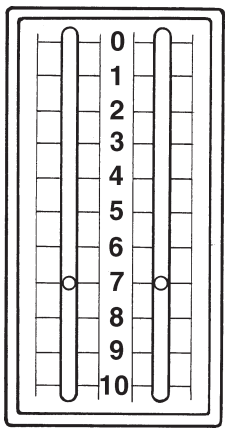
Analogue trim instrument (DP, DP-S)

The trim instrument indicates the current trim position of the drive. The scale has five calibration points with the Beach and Lift range marked in red.

1. Trim range.

2. Beach range (red).

3. Lift range (red)



Trim instrument (DPX)

The instrument shows the current position of the drive within the Trim range and the beginning of the Beach range. The position is indicate by the scale as follows:

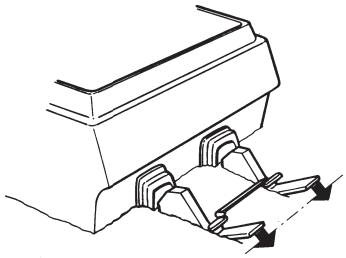
0–7 = Trim range.

7–10 = Beach range.

⚠ **IMPORTANT!** There is no automatic lockout between the Trim and Beach ranges. Take care to observe the instrument when trimming the drive out so that the drive does not enter the Beach range.

Twin and triple installations

In twin and triple installations the drives may be trimmed individually within the permitted trim range.

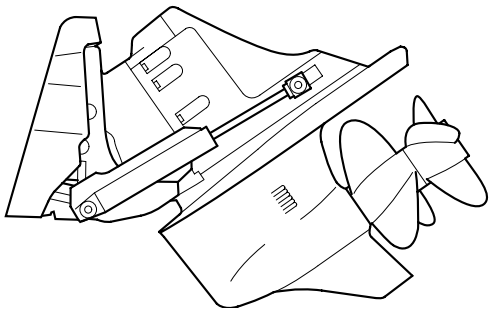


⚠ **WARNING!** When lifting drives within the Beach range both drives must be **always** lifted at the same time – in parallel – so as not to place an undue strain on the parallel strut between the drives.

When lifting in parallel the drive must be first trimmed to its foremost position (0). Start the lift from this position.

When lowering the drives it is important that they are lowered in parallel to avoid snapping the parallel strut.

Trim/tilt motor protection DP-S



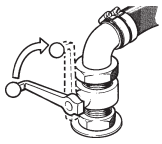
⚠ **IMPORTANT!** Always allow the trim/tilt switch to return to its center position when the drive unit reaches the maximum raised or lowered position. This will prevent your trim/tilt motor from overheating.

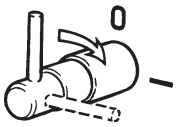
The trim/tilt motor is protected from overheating by an internal thermal overload switch. Should the electric motor stop while tilting, release the switch and allow the overload switch to cool and automatically reset itself. When the overload switch has reset, tilting may be resumed. Make sure the drive unit is not being restrained, causing the motor to overheat. If the trim motor still does not function, check the circuit breaker on the pump/pump bracket (10 A), the in-line fuse (5A) in the Power Trim switch cabling (if mounted). Also check the circuit breaker on the fuse box (55 A). Please refer to ***Electric system*** for more information.

Starting the engine

Make a habit of checking the engine and engine compartment visually before operating the boat. This will help you to quickly detect anything unusual that has or is about to happen. Also check that instruments and the warning display are indicating normal values when you have started the engine.

⚠ **WARNING!** Never use start spray or similar to start the engine. Danger of explosion!



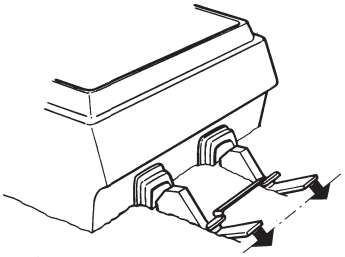


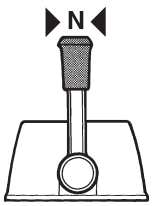
Before starting

- Open the cooling water intake sea cock (reverse gear).
- Open fuel cock.
- Check that there are no fuel, engine coolant or oil leaks.
- Check oil and engine coolant levels (see the section Care).
- Switch on the main switch.

  ⚠ **IMPORTANT!** Never break the circuit with the main switch while the engine is running. This could damage the generator.
- Start the engine compartment fan if one is fitted and let it run for at least four minutes.
- Check there is sufficient fuel for the planned journey
- Lower the drive(s) if raised.

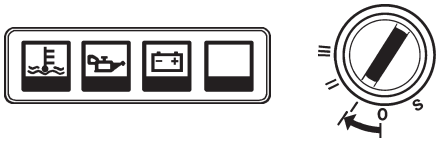
  ⚠ **WARNING!** Twin and triple installations (DPX): the drives must be trimmed at the same time/parallel.





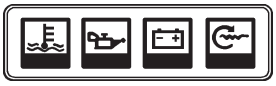
Starting the engine

1. Move the control lever to the neutral/idle position.

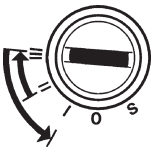


2. Insert the key in the ignition switch. Turn key to the "I" position. The three warning lamps come on and can be checked (after approximately 20 seconds the high coolant temperature warning light will go out).

Check that the acoustic alarm is operating by pressing the "Alarm Test" button.

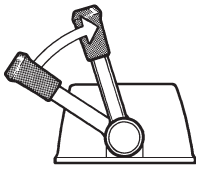


3. If the engine has glow plugs installed (option) turn the key to position "**II**". The indicator light comes on and the glow plugs are connected to pre-heat the engine. Let the glow plugs remain activated for approximately 30 seconds.



4. Turn the key to position "**III**" to start. Release the key as soon as the engine has started, the key will automatically spring back to the "**I**" position. If the engine did not start the key must first be turned to the "**0**" position before trying again.

⚠ **IMPORTANT!** If the starter motor is engaged for its maximum engagement time (20–30 seconds) let it cool down for five minutes before trying to start the engine again.



5. Warm up the engine at low speed and low load.

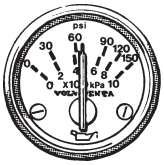
⚠ **IMPORTANT!** Do not race the engine while it is cold.

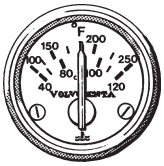
Operation

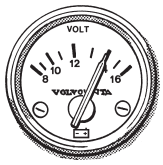
It is important to learn how to operate the engine, controls and other equipment safely and properly before setting off on a maiden voyage. Avoid violent and unexpected changes in course and gear engagement. There is a risk that someone aboard will fall over or overboard.

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

Checking instruments







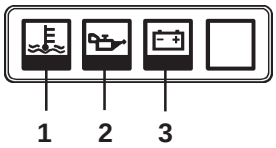
Check the instruments directly after starting the engine and then at regular intervals while operating the boat. Normal readings during operation:

Oil pressure: 150–500 kPa (engine warm)
At engine idle this reading is normally lower. The acoustic alarm will automatically go off if the oil pressure is too low.

Engine coolant temperature: 75–90°C
The acoustic alarm will automatically go off if the engine coolant temperature is too high.

Charging: approximately 14 V
When the engine is stopped the voltage is approximately 12 V. The acoustic alarm will go off automatically if the charging system malfunctions.

Alarm



When the acoustic alarm sounds one of the four warning lamps starts to flash to indicate the source of the alarm. High engine coolant temperature (1), low oil pressure (2) and power-out (3).

⚠ **IMPORTANT!** In the event of a low oil pressure alarm: Stop the engine immediately. Investigate and correct the malfunction.

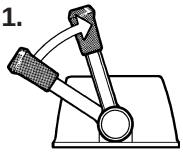
In the event of a high engine coolant temperature alarm: Reduce engine speed to idle (neutral). Stop the engine if the temperature does not drop. Investigate and correct the malfunction.

For more information on fault-tracing see section: Fault-tracing

Manovering

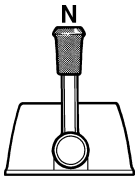
Only shift between forward and astern at engine idle speed as shifting at higher engine speeds can cause discomfort for those on board and unnecessary strain on the drive/reverse gear or the engine to stop.

Always follow this procedure when carrying out forward/reverse manovering:

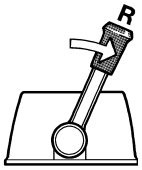
1.


1. Reduce engine speed to idling and let the boat lose most of its speed.

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

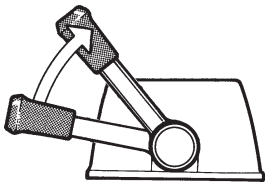
2.


2. Move the control lever quickly and firmly into the neutral position. Wait for a moment.

3.


3. Move the gear control lever quickly and firmly into astern, then increase the speed.

⚠ **IMPORTANT!** If the boat has two engines, it is important that they are both running during maneuvers astern (rearward movement), otherwise water might get into the exhaust of the engine which is not running.

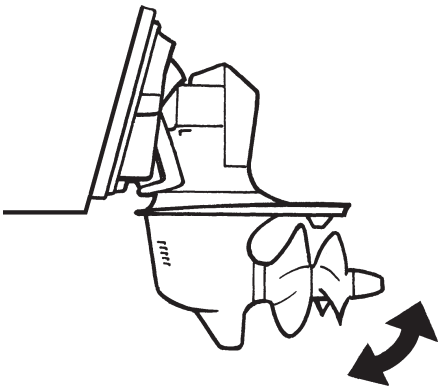


Cruising speed

Operating the engine at wide open throttle should be avoided since it is both uneconomical and uncomfortable. Volvo Penta recommends a cruising speed approximately 200 rpm lower than maximum rpm at wide open throttle. Depending on hull type, choice of propeller, load and conditions etc. the maximum engine speed at top speed can vary, but it should be within the wide open throttle range.

Wide open throttle range

AD31L/DP	3700-3900	TAMD31M	3150-3350
AD31P/DP	3900-4100	TAMD31P	3900-4100
KAD32P/DP/DP-S	3700-3900	TAMD41H	2500-2700
AD41P/DP	3700-3900	TAMD41M.	3150-3350
KAD43P/DP	3700-3900	TAMD41P	3700-3900
KAD43P/DPX	3700-3900	TAMD42/WJ	3700-3900
TAMD31L	3700-3900	KAMD43P	3700-3900



Power Trim while running

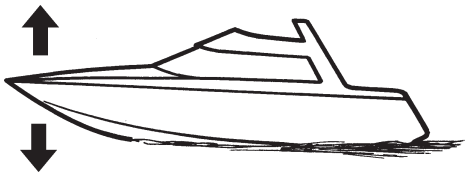
The Power Trim adjusts the drive angle to the stern of the boat to obtain maximum comfort and fuel economy at different speeds, with varying loads, and in a range of wind and sea conditions.

Power Trim settings and adjustment are controlled from the helm position using the controls and instruments described in the Power Trim section.

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

The engine must not be run with the drive in the “Lift” range.

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



Operating with the drive in the Trim range

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

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

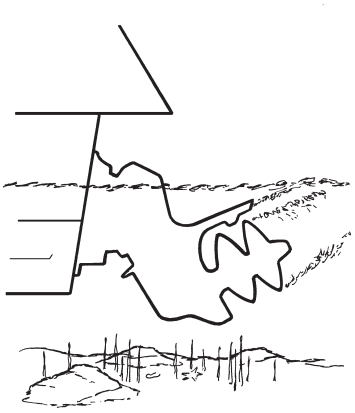
When starting
Trim the drive. The bow will be pressed down and the boat accelerates faster. This gives improved running and steering characteristics at speeds below the planing threshold.

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

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

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

In choppy seas or running against a heavy sea
Trim drive so the bows drop. This will provide more comfortable running.



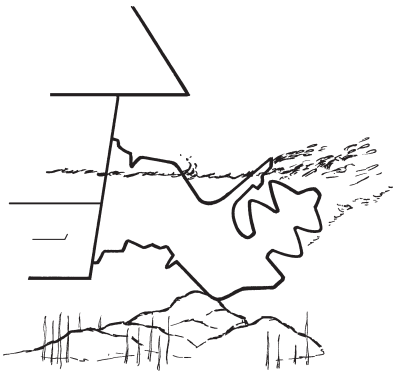
Operating with the drive in the Beach range

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

⚠ **IMPORTANT!** Max. permitted engine speed (rpm) when running in the “Beach range” is 1,000 rpm. Check that drive is never trimmed so that the cooling water intake is out of the water.

⚠ **WARNING!** Twin and triple installations (DPX): When lifting multiple drives installations within the beach range both drives must **always** be lifted at the same time – in parallel, so as not to place an undue strain on the parallel strut between the drives.

Drives must also be lowered simultaneously/parallel.



Running aground

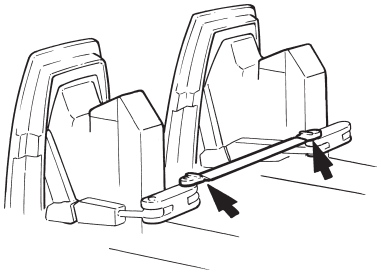
The automatic Kick-up function releases the drive if it grounds or hits an object in the water. If the function has been tripped and the drive released it must be trimmed back to the original position using the control buttons.

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

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

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

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



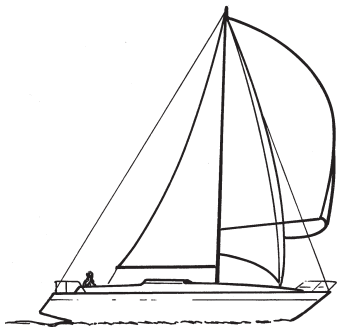
DPX twin and triple installations:

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

Trolling operation valve

The reverse gear can be equipped with a trolling operation valve which makes it possible to steplessly reduce the boats lowest speed by 1-80% at **engine speeds up to 1200 rpm.**

⚠ **IMPORTANT!** At higher speed the reverse gear may overheat.



When sailing

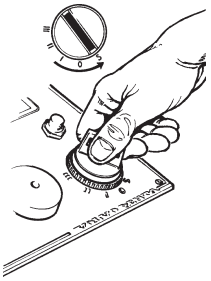
The propeller can cause the propeller shaft to rotate when sailing the boat. This rotation can damage the reverse gear if it continues for an extended period because of there is not lubrication or cooling supplied when the engine is stopped.

⚠ **IMPORTANT! During long voyages under sail the engine must be started and run at least once every 24 hours. Run the engine for two minutes at approximately 1500 rpm (with reverse gear engaged).**

If the above conditions cannot be met a propeller shaft brake must be installed.

Stopping the engine

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



Stopping

Turn the key to stop position "**S**". Keep the key turned until the engine stops. The key will automatically spring back to the "**0**" position when it is released and can then be removed.

If the engine cannot be stopped with the ignition key there is an emergency stop on the injection pump: Refer to the section on the fuel system in the section on maintenance.

After stopping the engine

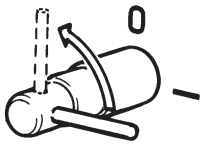
- Close the fuel cock and sea cock (reverse gear) for the cooling water intake.

⚠ **IMPORTANT!** Do not forget to open the cocks before the engine is started again.

- Inspect the engine and engine compartment for any leaks.
- Boats with drives: The drive must be trimmed in to its maximum to protect the trim cylinders untreated surfaces from fouling.

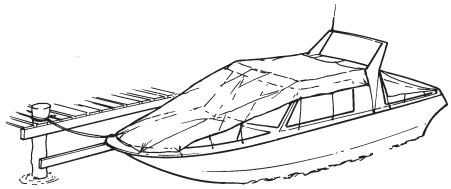
⚠ **IMPORTANT!** If there is a risk that the drive can run aground, it must instead be trimmed out to its maximum lift position.

⚠ **WARNING!** Twin and triple installations DPX: The drives must be lifted at the same time/parallel.



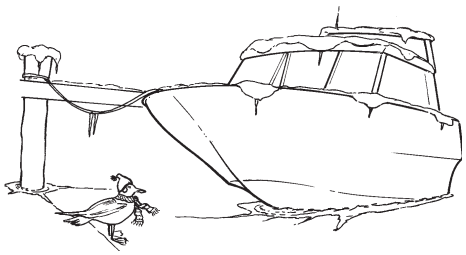
- Switch off the main switch if the boat is not to be used for some time.

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



Laying up

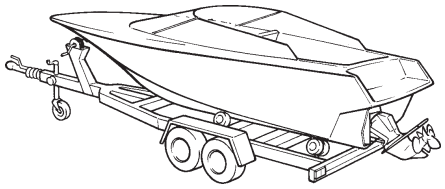
If the boat is not going to be used for some time but is being left in the water, the engine must be run to operating temperature at least once every 14 days. This prevents the corrosion in the engine. If the boat will not be used for more than two months then inhibiting should be carried out: Refer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



Cold weather precautions

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

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



Transporting on a trailer

Before pulling boats with 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.

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

Laying up 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.

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

Maintenance schedule

Your Volvo Penta engine and its transmission is designed for maximum service life and reliability. They are built to survive in a tough marine environment, but also to cause as little environmental impact as possible. Regular maintenance according to the following schedule is necessary if the engine and transmission are to operate without problems.

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

⚠ **IMPORTANT!** Service operations marked ☐ must be carried out by an authorized Volvo Penta Service workshop.

First Service inspection:

☐ A first Service Inspection must be carried out in accordance with the instructions in the Warranty and Service Book.

Daily before starting first time:

- Engine oil. Checking level
- Coolant. Checking level

Every 14 days:

- Fuel filters/Fuel pre-filters Drain water
- Drive belts. Check
- Seawater filter. Clean
- Battery. Check electrolyte level
- Reverse gear. Check oil level
- Drive. Check corrosion protection
- Power Trim pump. Check oil level
- Steering. Check oil level

Every 50 operating hours/At least once a year:

- DP drive. Steering bearing lubrication

Every 100 operating hours/At least once a year:

- Engine oil and oil filter. Replace
- Compressor. Check oil level
- Drive. Oil change (DP-S)

Every 200 operating hours or at least once a year:

- Air Cleaner. Replace
- Drive belts. Check
- Crankcase ventilation filter. Replace
- Fuel filters/Fuel pre-filters Replace
- Coolant. Replace*
- Exhaust system. Check
- Seawater pump. Check impeller
- Reverse gear. Oil change, filter change
- Drive. Oil change (DP, DPX)
- Drive. Checking CV joint and exhaust bellows
- DP drive. Check torques on steering cap bolts

Every 200 operating hours:

☐ Valve clearance. Adjustment

☐ Turbo. Check

Every other year:

- Coolant. Replace*

☐ Drive. Replace universal joint and exhaust bellows

Every 500 operating hours or at least every fifth year:

☐ Reverse gear. Replacing propeller shaft seal

* If the freshwater system is filled with an anti-corrosion agent mixture it must be changed every year. If the freshwater system is filled with an antifreeze (glycol) mixture it must be changed every other year.

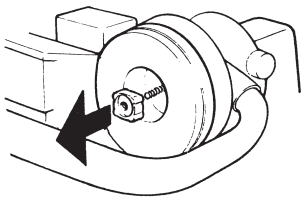
Maintenance

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

⚠ **WARNING!** Read the safety precautions for maintenance and service in the chapter: Safety Precautions, 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 and locking it in the OFF position.

Engine, general



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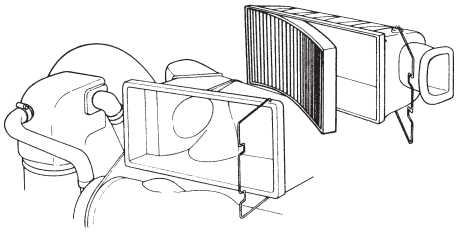

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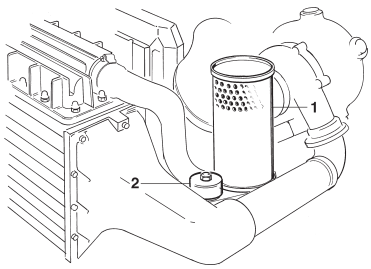

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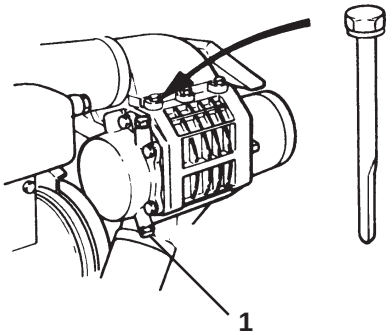


Air Cleaner. Replacement

Remove air cleaner cover. Remove the old air filter. Clean the air cleaner cover/housing as required. Take care that no contaminants enter the engine. Install the new air filter and air cleaner cover.

Crankcase ventilation filter (32). Replacement

Remove the old filter (1) by unscrewing counterclockwise. Screw on the new filter by hand.

2= Relief valve

Compressor (32, 43) Checking oil

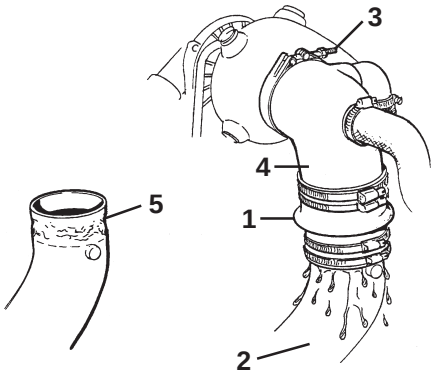
Checking and topping up

Unscrew (counter clockwise) and remove the dipstick. Wipe off oil. Reinstall oil dip stick **do not screw it down.** Remove again and check that the oil level is between the MAX and MIN markings on the dipstick. Top up oil as required (use the dip stick tube to fill). For oil grades and capacity: See the chapter “Technical Data”.

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

Oil change

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



Exhaust system. Check

The exhaust system in the drive installations must be checked every year for corrosion damage between hose (**1**) and the pipe (**2**).

⚠ **WARNING!** Risk of water penetration. Checking the exhaust system should be carried out with the boat on land.

If there is heavy corrosion the pipe should be repaired or replaced with a new one.

To check: Undo the clamp (**3**) and the two lower clamps holding the hose (**1**). Raise the elbow (**4**) so the hose frees off from the pipe. Check the mating surface (**5**). If there is heavy corrosion the pipe should be repaired or replaced with a new one.

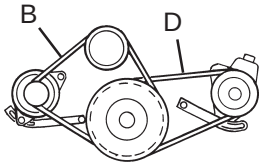
Drive belts. Check and adjust

⚠ **WARNING!** Always turn the engine off before starting maintenance work.

The coolant pump and generator can be damaged if the drive belts are too tight, and slip if they are too loose.

Check the drive belt tension regularly by pressing down the belts using thumb pressure at the check points (A, B, C and D) as shown below for the different belts. Adjust as required. **Check and adjust as necessary after operating the engine when the belts are warm.**

Check that the belts are not cracked or damaged. Worn belts must be replaced.



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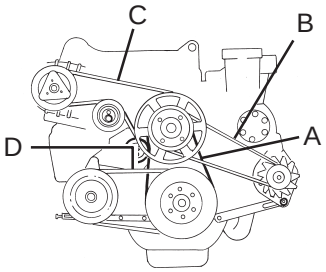

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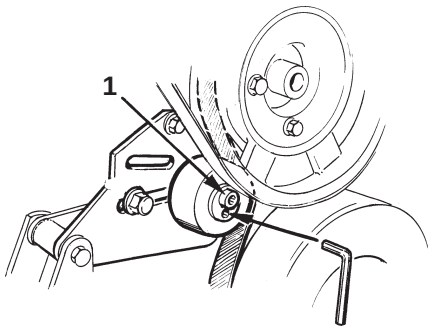
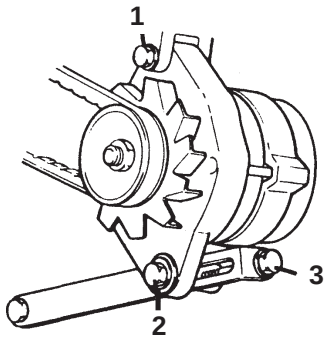
Adjusting and replacing

⚠ **IMPORTANT!** Tighten the belts as described below to avoid unequal stress on the units.

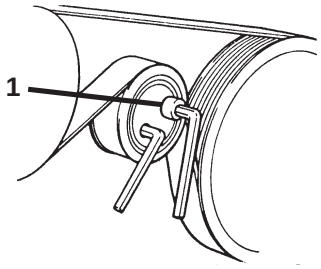


1. Circulation pump

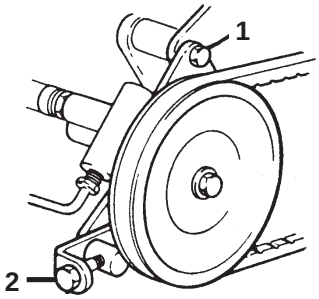
Undo the bolt (1) enough so the belt slackens off. Insert an Allen key in the hole and turn the belt tensioner counter clockwise so the belt is correctly tensioned. Tighten bolt (1). At the correct belt tension it should be possible to depress the belt approximately 5 mm at (A).



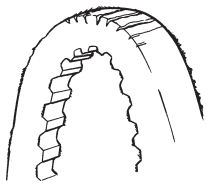
2. Generator belt
Undo the generator mounting bolts (1) and (2). Tighten belt using the adjuster screw (3) so the belt can be depressed approximately 10 mm between the belt pulleys at (B). Tighten bolts (1) and (2).



3. Compressor belt (32, 43)
Remove the belt cover. Undo the bolt (1) enough so the belt slackens off. Insert an Allen key in the hole and turn the belt tensioner counter clockwise so the belt is correctly tensioned. At the correct belt tension it should be possible to press the belt in 5 mm at (C).



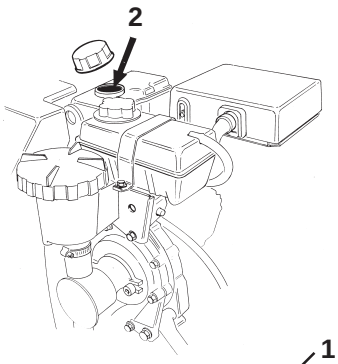
4. Servo pump belt
Undo the retaining bolt (1). Tighten belt using the adjuster screw (2) so the belt can be depressed approximately 10 mm between the belt pulleys at (D). Tighten bolt (1).



Replacement
Slacken belt off so that it can be removed. Clean off the pulley grooves. Install the new belt. Adjust as above. Check belt tension again after a few hours' operation.

Lubrication system

⚠ **IMPORTANT!** With a new or reconditioned engine, the oil and oil filters must be changed after 20–50 hours of operation. After that they should be changed every 100 operating hours or at least once a year. Use only the recommended grades of oil: See the chapter “Technical Data”.



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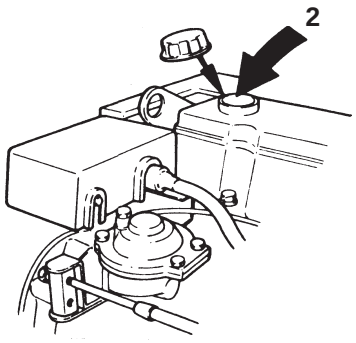

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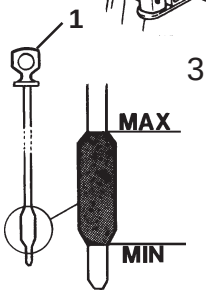
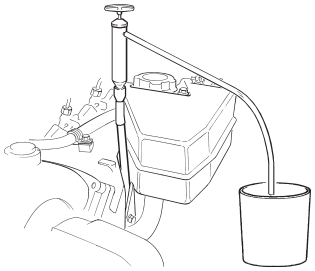


Oil level. Checking and topping up

The oil level should be within the marked area on the dipstick (**1**) and should be checked every day the first time the engine is started. Topping up is done through the valve cover (**2**). 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: See the chapter “Technical Data”.

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



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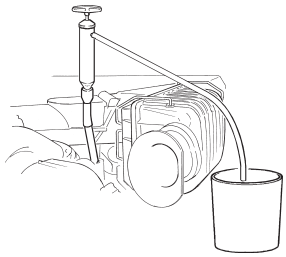

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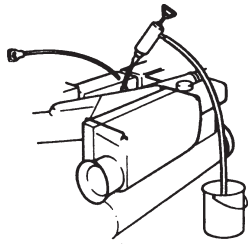

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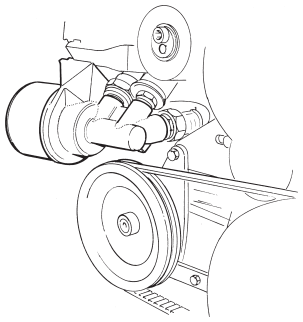
Oil and oil filters. Changing

Run the engine to operating temperature so that the oil is easier to suck out. Stop the engine. Suck up oil using an oil scavenging pump through the hole for the dipstick.

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



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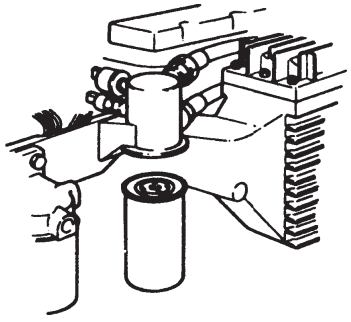

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Unscrew the old filter. (To avoid oil spills put a plastic bag over the filter before it is unscrewed). Check that the engine mating surface is clean. Moisten the filter rubber gasket with a little oil. Screw on the new filter by hand until it is in contact with the mating surface. And then a further half turn **but no more!**

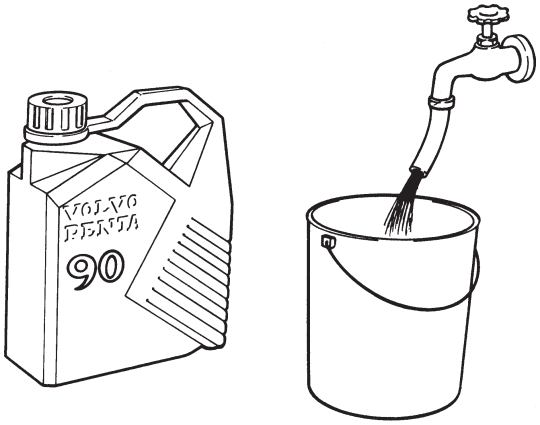
Top up oil to correct level. Start the engine and let it idle. Check that the warning lamp for low oil pressure goes out. Stop the engine. Check the oil level and top up if necessary. Check that there are no leaks round the oil filter.

Collect up the old oil and filter for deposit at a proper disposal site.

Cooling system

The cooling system is divided into a freshwater and a seawater system. The seawater pump sucks water into the seawater system through the drive/reverse gear. The seawater is then pumped through the charge air cooler oil cooler, heat exchanger and then into the exhaust elbow pipe where it is mixed with the exhaust gases. The freshwater system is the internal engine coolant system. It is a closed system driven by the circulation pump. The freshwater system engine coolant is cooled in the heat exchanger by the seawater.

⚠ **WARNING!** Risk for water penetration when working with the cooling system. Close the sea cock (does not apply to drive).



Coolant. General

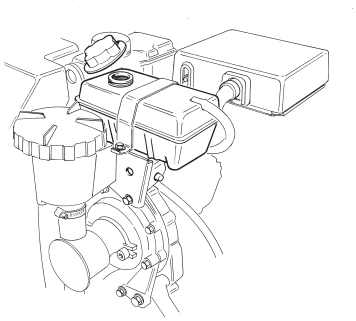
The freshwater system must be filled with a coolant that protects the engine against internal corrosion and from freezing (if the climate requires it). **Never use freshwater alone.**

⚠ **WARNING!** Anti-corrosive agents and anti-freeze products are harmful to health (do not drink!)

If there is a risk for freezing at any time of year, the engine coolant system must be filled with a mixture of 50% Volvo Penta antifreeze and 50% clean water (as neutral pH as possible). This mixture prevents corrosion and protects against freezing down to approx. –40°C. It should be used all year round.
NOTE! There should be at least 40% antifreeze in the system for complete protection against corrosion.

Where there is **no** risk of damage from freezing the engine coolant can be fresh water with of Volvo Penta anti-corrosion fluid added. Mix according to the instructions on the packaging.

⚠ **IMPORTANT!** Never mix antifreeze (glycol) and anti-corrosive agents. The two combined can produce foam and drastically reduce the coolant's effectiveness.



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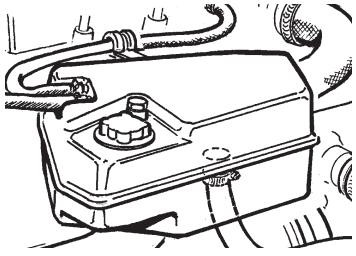

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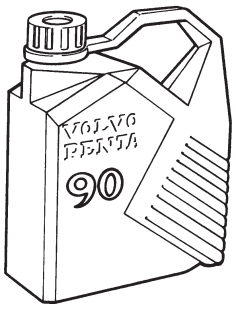
Coolant. Filling

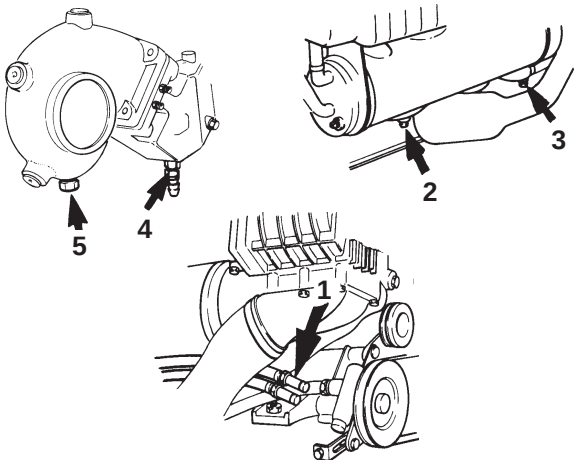
⚠ **WARNING!** Do not open the engine coolant system filler cap when the engine is still hot except in an emergency. Steam or hot coolant may spray out.

Turn the filler cap to the first stop and let any pressure escape from the system before removing the cap. Top up coolant if necessary. The coolant level should be between the MAX and MIN marking on the expansion tank when the engine is at normal operating temperature. The level is normally lower when the engine is cold. Reinstall the filler cap.



Coolant. Changing

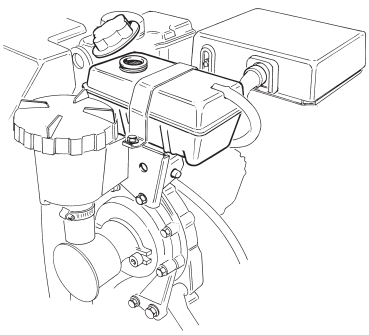
The corrosion-proofing additives become less effective with time and the coolant must be changed. If the freshwater system is filled with antifreeze mixture it must be changed every other year. If the system is filled with anti-corrosion agent mixture it must be changed every year.



Coolant. Draining

Remove the filler cap on the expansion tank (this lets the coolant run out faster). Put a container under the drain cock on the hose **without** a blue marking (1). Open the drain cock and drain coolant. Then continue by draining the coolant from the other drain cocks (2–5). Flush out the heat exchanger as follows before filling coolant.

NOTE! Deposit old coolant at a properly designated disposal site.



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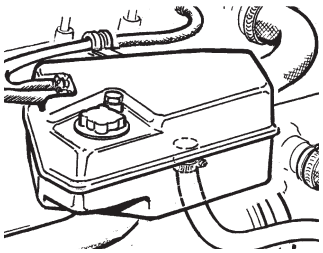

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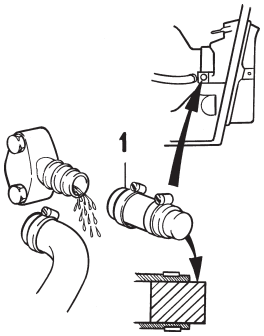
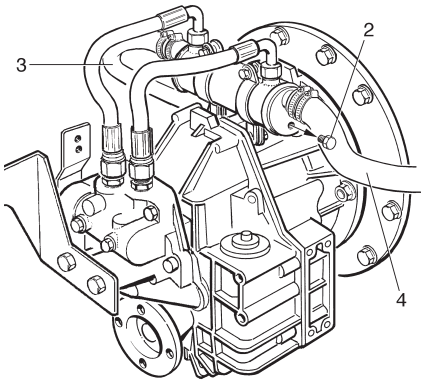
Heat exchanger. Flushing out

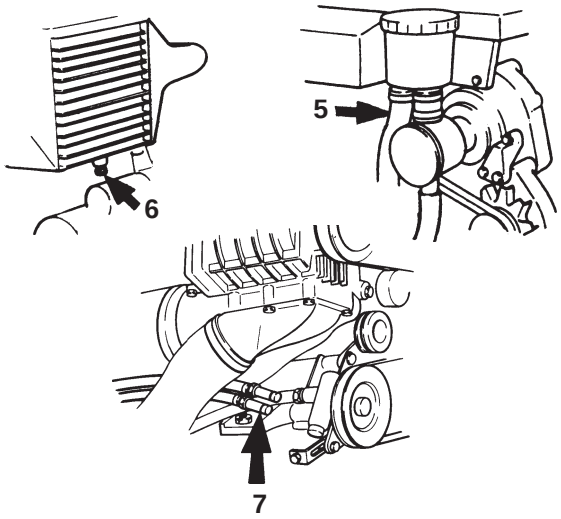
Cooling performance is reduced by scaling in the heat exchanger. It should therefore be flushed when the coolant is changed.

1. Drain the coolant as above.
2. Insert a hose into the filler pipe on the expansion tank. Flush with fresh water until the water which runs out of the drain cocks is clean. Allow all the water to run out.
3. Close the drain cocks. Fill with new coolant to correct level. Reinstall the filler cap.

⚠ **IMPORTANT!** If there is a danger of freezing never top up with plain water, always add antifreeze mixture.







Seawater system. Draining

To prevent freezing damage the seawater system must be drained in cold weather where there is a risk of frost.

⚠ **WARNING!** If the boat is left in the water, the seawater intake to the engine must be turned off with a seawater cock (non-standard equipment) or other method before draining the engine. If the water is not drained properly the boat may fill with water and sink. Pump out the boat and ensure that there are no leaks before you leave the boat.

1. **Engine with drive DP:** Remove the seawater hose from the shield and close the intake with a plug **(1)*** tightened with a hose clamp. Water will flow in immediately the seawater hose is removed. Have tools, plug and hose clamp ready. Bend seawater hose down so the water runs out.

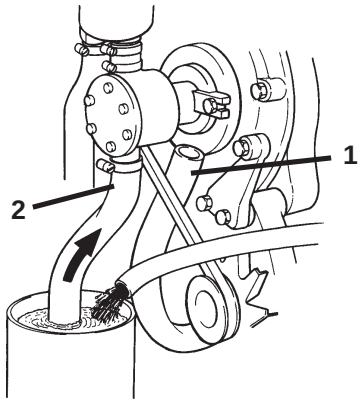
⚠ **WARNING!** To prevent freezing of the water remaining in the drive water galleries, the drive must be completely trimmed down in the water.

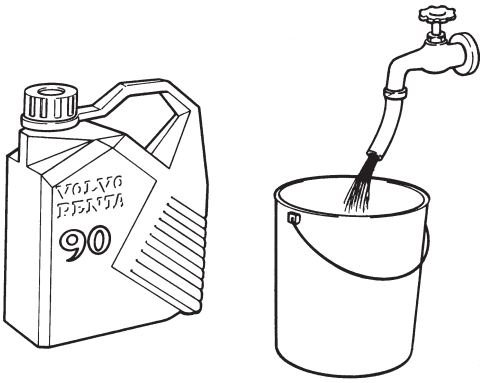
* Make this plug from a 100 mm long piece of 30 mm diameter hose. Plug one end of the hose with a piece of dowel or similar and hold the dowel in place with a hose clamp.

Engine with reverse gear Close the sea cock. Drain oil cooler by opening the plug (**2**). Disconnect hose (**3**) and bend down so that the water runs out. Disconnect hose (**4**) by the sea cock and empty it of water.

2. Detach the hose (**5**) and drain water out of heat exchanger. Drain charge air cooler by opening the plug (**6**) and oil cooler by opening plug on the blue marked hose (**7**).
3. Remove the cover from the seawater pump and let the water run out.
4. Connect and tighten all hoses. Reinstall the cover on the seawater pump and the cover plate on the seawater filter.

   When laying up the boat, remove the impeller from the seawater pump and store it in a cool place in a plastic bag. Reinstall the impeller when bringing the boat out of storage.





Seawater system. Cleaning and inhibiting

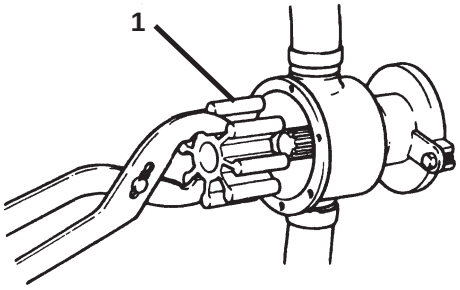
To prevent the build up of deposits and salt crystals in the seawater system it must be flushed with freshwater. When the boat is laid up it must also be inhibited.

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

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

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

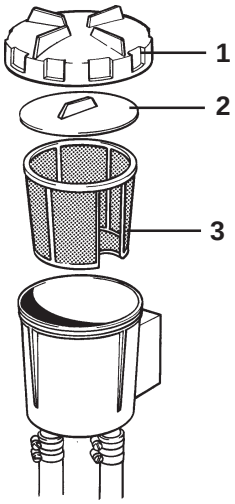
   ⚠ **IMPORTANT!** The impeller will be damaged if it runs dry.
4. Set the gear control lever in the neutral position. Check that nobody is near the propellers. Start the engine. Let it run at fast idle a few minutes. Stop the engine.
5. For inhibiting fill a bucket with antifreeze mixture (50/50 freshwater and antifreeze). Secure a container by the exhaust outlet. Repeat step 4.
6. Connect seawater hose (1).
7. The system is now inhibited. The antifreeze mixture should be left in the system while the boat is laid up. Drain the mixture just before the boat is launched. Reuse the antifreeze mixture next season or deposit it at a properly designated disposal site.



Impeller. Checking/Replacing

⚠ **WARNING!** Risk for water penetration. If the boat is in the water the following measures should be carried out before starting work: Reverse gear: Close the sea cock.

Remove the cover from the seawater pump and remove the impeller (**1**). If there are cracks or other defects the impeller must be replaced. Lubricate the pump housing and the inside of the cover with a little waterproof grease **for rubber**. Reinstall the impeller using a clockwise rotating movement. Install the seal washers on the shaft center. Install the cover together with a new gasket. Open the sea cock.



Seawater filter. Cleaning

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

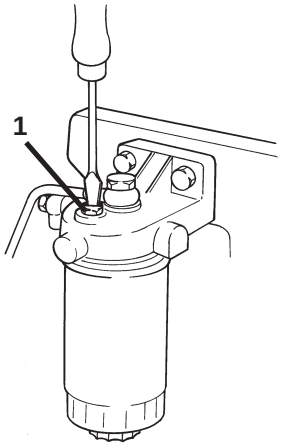
⚠ **WARNING!** Risk for water penetration.

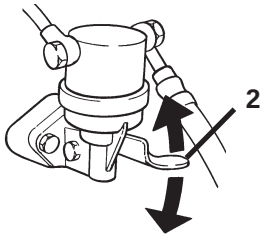
⚠ **IMPORTANT!** If the boat is used in water that has a lot of contaminants, seaweed etc. the filter must be checked more frequently than indicated in the maintenance schedule. Otherwise there is a risk the filter will clog and the engine will overheat.

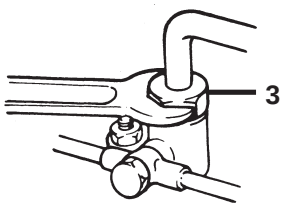
Fuel system

All work on the engine injection pump or injectors must be carried out at an authorized workshop. Use only the recommended grade of fuel: See the chapter “Technical Data”.

⚠ **WARNING!** Fire risk. When carrying out work on the fuel system 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 and other flammable material in fireproof conditions.







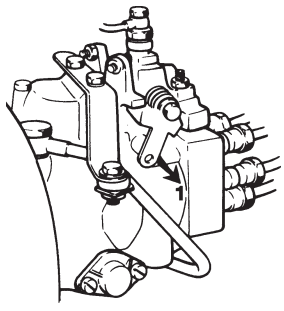
Venting the fuel system

The fuel system must be vented after the fuel filters have been replaced or after refilling the fuel tank after it has been run dry.

1. Open vent screw (**1**) on the filter mounting approximately four turns. Avoid fuel spillage. Use rags around the venting point.
2. Pump the fuel using hand pump (**2**) until there are no more air bubbles visible in the fuel. Continue pumping and at the same time tighten the venting screw. If the pump effect is poor, turn the engine over slightly so that the pump drive cam changes position.

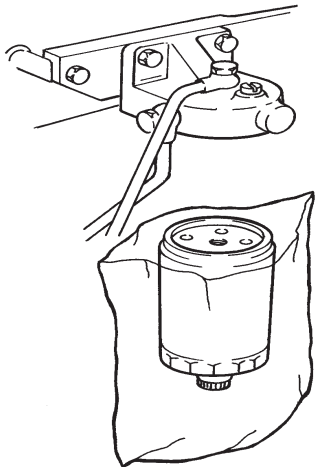
   If the engine does not start continue venting as follows:
3. Use the handpump (**2**) and pump for about half a minute to automatically vent the fuel injection pump.
4. Slacken off the injector delivery line nuts and set the engine speed control to wide open throttle (WOT). Turn the engine over with the starter motor until fuel comes out of the delivery lines. Avoid fuel spillage. Tighten delivery line nuts.
5. Start the engine and check for leaks.

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



Emergency stop

Should the normal stop function not operate the engine can be stopped by pulling the fuel injection pump lever (1) to the rear.

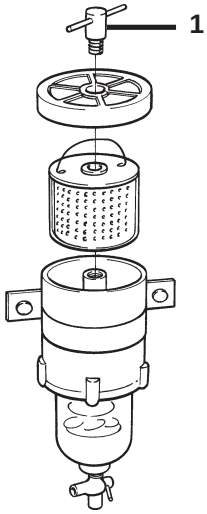


Fuel filter. Replacement

Clean the filter mounting. To avoid fuel spills put a plastic bag over the filter before it is unscrewed. Unscrew the filter. Moisten the filter rubber gasket with a little oil. Screw on the new filter by hand until it is in contact with the mating surface. And then a further half turn **but no more!** Vent fuel system. **Deposit the old filter at a properly designated disposal site.**

Start the engine and check for leaks.

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



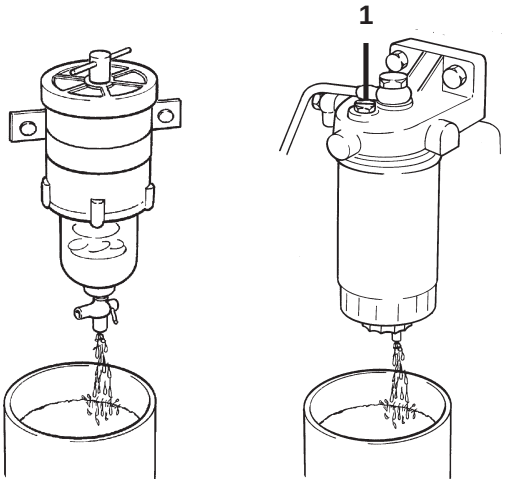
Fuel pre-filter. Replacing filter insert

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

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

Start the engine and check for leaks.

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



Fuel filter and fuel pre-filter. Draining

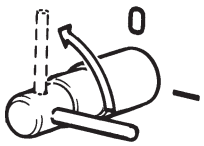
The fuel pre-filter is an accessory.

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

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

Electrical system

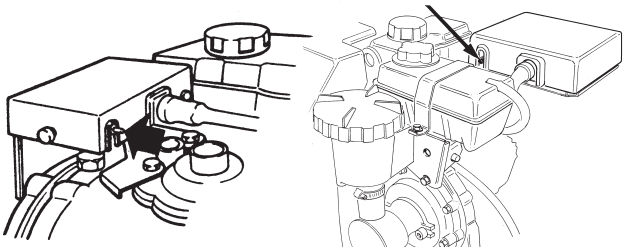
⚠ **WARNING!** Always stop the engine and break the current using the main switches before working on the electrical system. Isolate shore current to the engine block heater, battery charger, or accessories mounted on the engine.



Main switch

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

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



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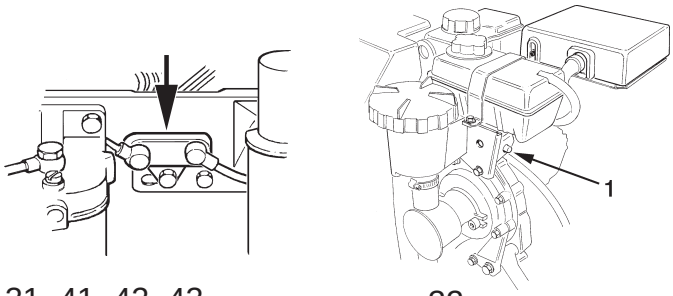
Fuses.

The engine has an automatic fuse located in the junction box. The fuse breaks the current when there is an overload in the electrical system.

If the engine cannot be started or the instrumjents stop operating during running the fuse can have tripped. Reset the fuse by pressing on the button on the junction box.

⚠ **IMPORTANT!** Always investigate the cause of an overload before resetting the fuse!



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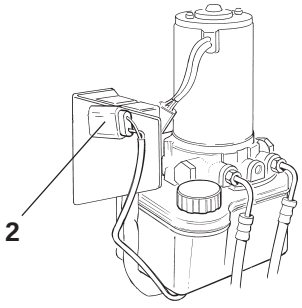
Fuses. Power Trim

The electrical system for Power Trim (31, 41, 42, 43 engines) has a 55A fuse at the oil filter.

The electrical system for Power Trim (32 engines) has a automatic fuse located at the expansion tank. Reset the fuse by pressing the button (1).

On the trim pump motor (32 engines) there is a fuse holder with a 10A blade fuse (2).

⚠ **IMPORTANT!** Always carry extra fuses on board.



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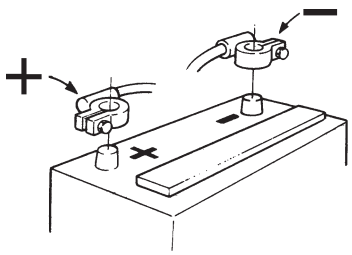
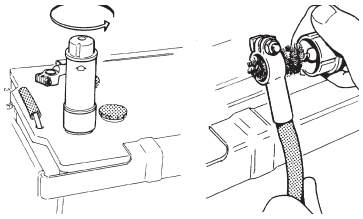
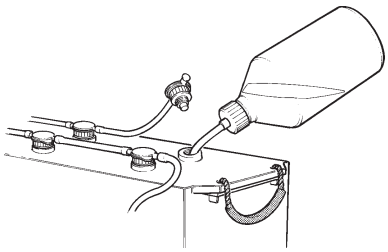
Electrical connections

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







Battery. Maintenance

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

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

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

Connecting and disconnecting

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

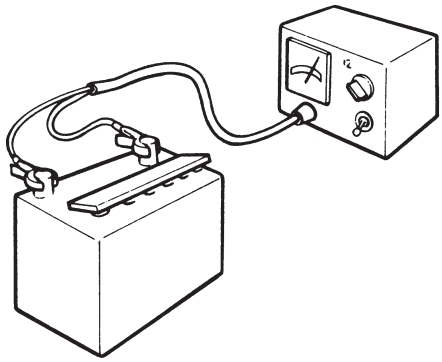
When disconnecting the battery, disconnect the – lead (black) first and then the + lead (red).

Cleaning

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

Topping up

The electrolyte should be 5–10 mm over the plates in the battery. Top up using **distilled water** if necessary. Charge the battery after topping up for at least 30 minutes by running the engine at fast idle. NOTE! Certain maintenance-free batteries have special instructions which must be followed.



Battery. Charging

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

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

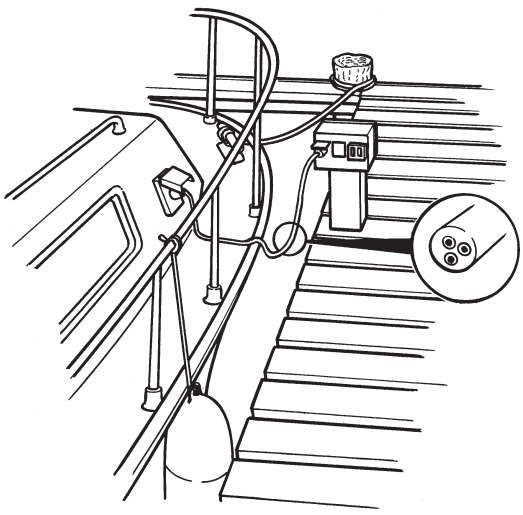
If the battery has discharged it must be charged. f the boat has not been used for some time charge the battery and then trickle charge it (see manufacturer's recommendations). A poorly charged battery will be damaged and may burst in cold weather.

⚠ **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. If shore power is connected, the protector ground should be ashore, never in the boat. Shore power should always have a ground fault circuit breaker.

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

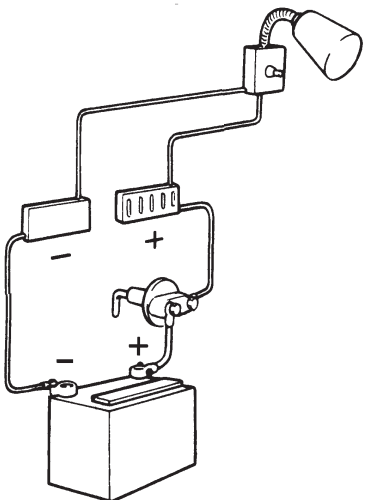
2. Route and clamp electric cables so that they will not be exposed to rubbing, damp or bilge water in the keelson.

3. Engine or drive/reverse gear must never be used as a ground point.

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

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

4. There must be a main switch connected to the starter battery positive (**+**) terminal. The main switch should cut off power to all power consuming equipment and should be switched off when the boat is not in use.



5. If an auxiliary battery is in use, a main switch should be connected between its **+** terminal and the fuse block, and the (**+**) terminal and the terminal block for the boat's electrical equipment. The main switch for the auxiliary battery must cut off all power consuming equipment connected to that battery and be turned off when power is no longer needed.

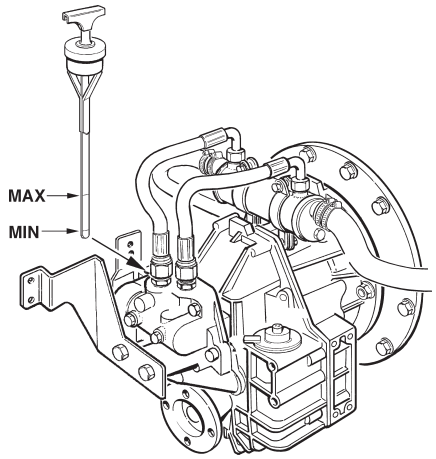
All equipment connected to the auxiliary battery should have separate switches.

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

Reverse gear

The HS63/45 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.

⚠ **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.

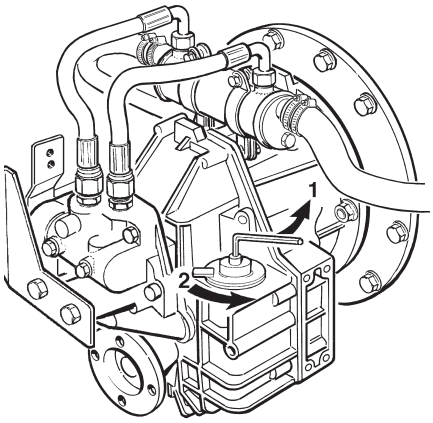


Oil level HS45 and HS63

Undo the dipstick by turning it anti-clockwise. Dry the dipstick and put it back in the reversing gear. Take the dipstick out 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.

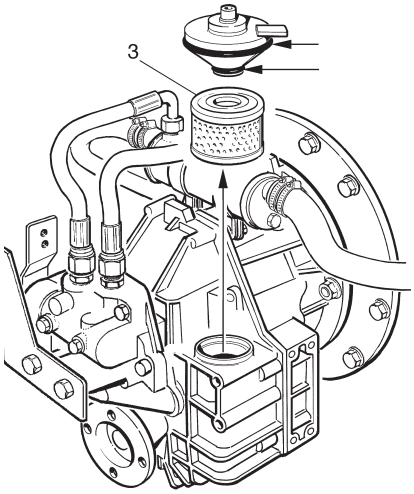
⚠ **IMPORTANT!** Never over-fill the reversing gear. The oil level must always be inside or at the recommended levels.

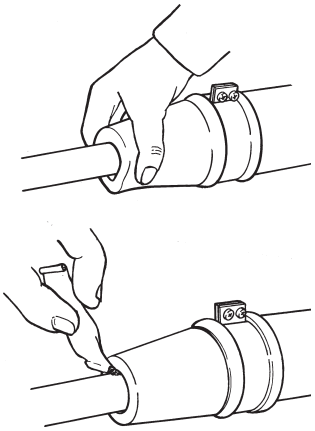


Oil change and filter change, HS45 and HS63

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.
5. Measure up the correct quantity of oil and fill the reversing gear with the oil. Please refer to the “Technical Data” chapter for oil grades and volume.

   ⚠ **IMPORTANT!** Never over-fill the reversing 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 reversing 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 replaced every 500 running hours or every 5th year.

Drive DP, DPX

Your drive is protected against galvanic corrosion. This protection consists of five layers of paint, sacrificial anodes and ground braids. The ground braids maintain a connection between the different components of the drive. A broken connection can result in the rapid corrosion of an individual component even though the protection is otherwise effective. Check ground braids every year. Faulty electrical installation can also cause the break down of the galvanic protection. Damage due to this type of 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.

Corrosion protection. Checking/ Replacing

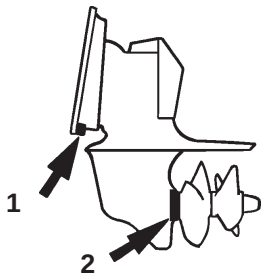
Check the sacrificial anodes regularly. Replace with new anodes when approximately 1/3 of the anode has been eroded. Tighten the new anode so that there is a good electrical contact.

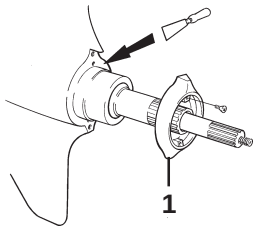
Where boats are kept laid up on land when not in use there is a lower level of galvanic corrosion protection due to the oxidation on the sacrificial anodes. Even a new anode can be oxidized on the surface. Before launching the sacrificial anodes must be cleaned/ground using an emery cloth.

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

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

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

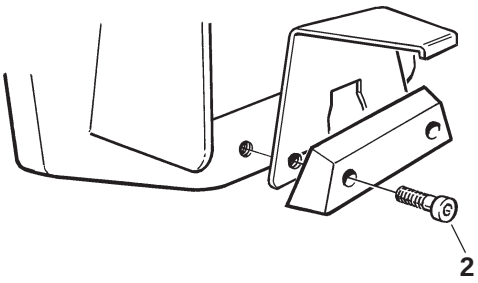




DP drive

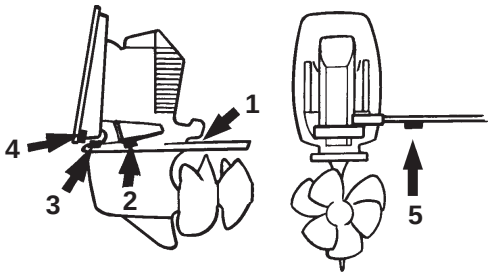
The sacrificial anodes can be found at the lower edge of the shield (2) and on the gear housing in front of the propellers (1).

Remove the propellers. Undo the two screws holding the anode (**1**). Remove the anode. Scrape mating surface on the drive clean. Install new anode.



Undo the two screws holding the anode (**2**). Remove the anode and the support plate under the anode. Clean the mating surface. Reinstall support plate and the new anode.

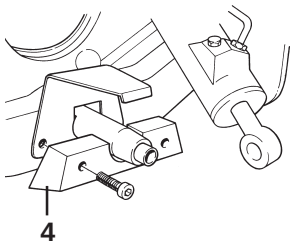
⚠ **IMPORTANT!** DP drives equipped with stainless steel propellers must be equipped with two sacrificial anodes on the shield.



DPX drive

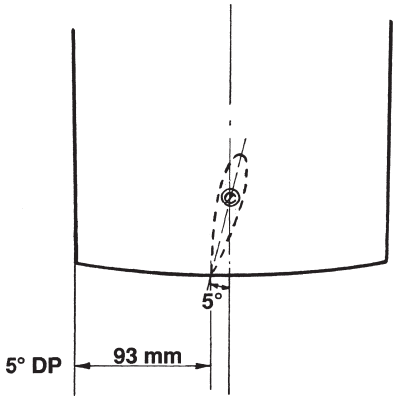
The sacrificial anodes can be found on the upper side of the cavitation plate (**1**), on the guide cylinders (**2**), at the stern end of the upper gear housing (**3**) and the bottom edge of the shield (**4**). Twin and triple installations also have anodes on the parallel brace (**5**).

All anodes are screw mounted. Note that there is a ground cable mounted on one of the screws. Undo the screws holding the anode. Clean the mating surface and install the new anode.



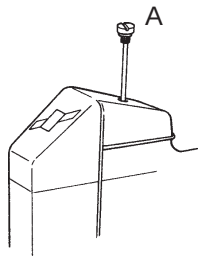
Inside the anode (**4**) is a support plate holding the trim sensor in place. Check carefully that the plate locks the trim sensor in place before the zinc anode is installed and screws are tightened.

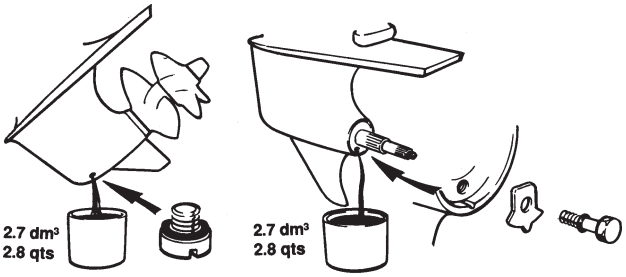
⚠ **WARNING!** Risk of water penetration. Check carefully that the support plate locks the trim sensor in place before the zinc anode is installed and screws are tightened.



Trim fin DP. Adjustment

There are two versions of the DP drive. One with a Trim fin and one without. The Trim fin is factory-fitted. This setting applies to all installations, even twin drives. If the trim fin needs to be reset, undo it from the underside of the cavitation plate. Turn the fin in accordance with the measurements in the figure and tighten it.

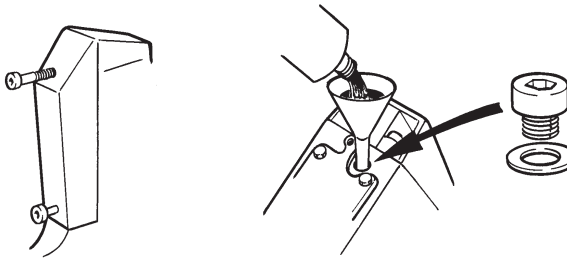




DP DPX

Oil change

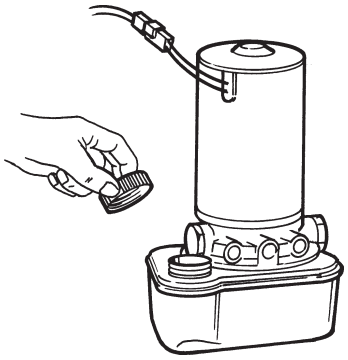
Remove the oil dipstick (A). Trim the DP drive up as far as possible, trim the DPX drive in (forward) as far as possible. Remove the plug on the gear housing and let the oil run out. If oil is discolored, contact an authorized Volvo Penta workshop. Reinstall plug and O ring. Always replace a damaged O ring with a new one. **Deposit the used engine oil at a properly designated disposal site.**



Remove cover and remove oil filler plug and o-ring. Fill with oil. See “Technical Data” for grades and quantity. Let down the drive.

After a while check the oil level with the dipstick. The dipstick should **not** be screwed down when checking the level. If the level is too high oil must be drained off. If the level is too low top up with oil through the dipstick hole.

Check the tightening of the dipstick and bottom plug. Reinstall the cover.



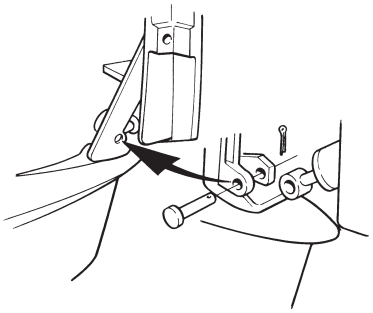
Oil level Power Trim

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

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

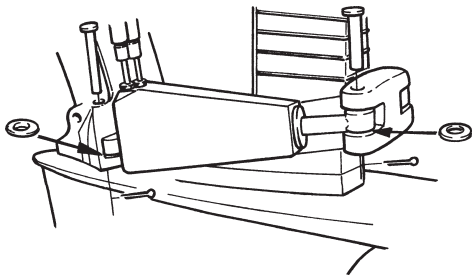
Bellows. Replacement

Check the condition on the universal joint and the exhaust bellows every year. If there are cracks or other defects they must be replaced. Otherwise replace every other year. The drive may need to be removed from the support fork to replace the bellows. Removal of the drive requires special knowledge and tools. If in doubt contact your Volvo Penta workshop for assistance.



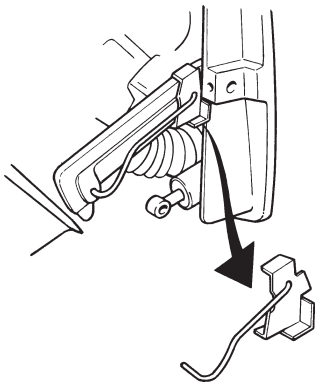
⚠ **WARNING!** Never work on the drive bellows or hydraulic system without locking the drive in its raised position so that it cannot fall down. A falling drive can cause serious personal injury.

Tool 885143-8, when properly installed, prevents the drive falling. Install the tool as follows: Trim the drive down to 0. Remove cotter pins and knock out trim cylinder bolts.

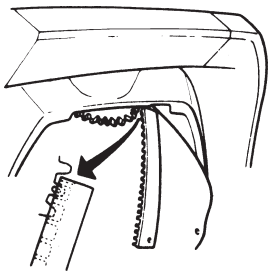


DPX: Also remove steering cylinders by removing pins. Tie up the steering cylinder so that they do not hang in the way.

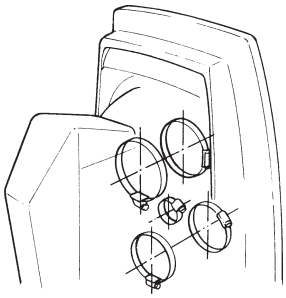
The drive can now be lifted by hand to its raised position. Hold the drive steady in this position and install the tool on the starboard side as illustrated. Carefully check the bellows for damage. The exhaust bellows can be replaced without removing the drive.



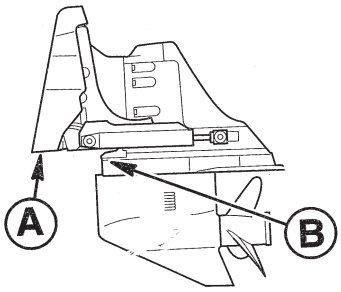
⚠ **WARNING!** Do not overload the tool by standing on the raised drive.

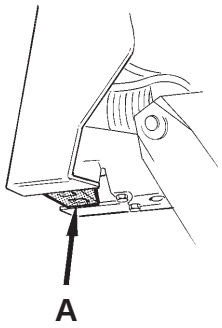


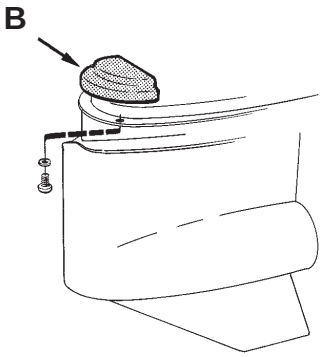
DP: If the drive has been removed the steering rack and drive controlling the trim sensor may have come out of position. Turn the cog until the notched tooth is visible. Install the steering rack so that the first cog position meshes with the marked tooth.

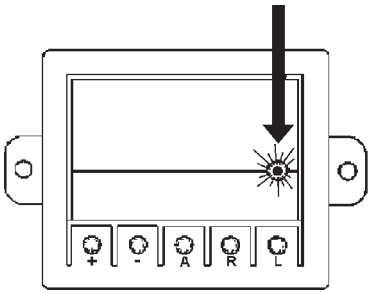


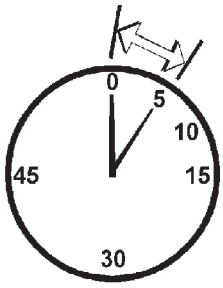
DP, DPX: Hose clamp screws should be located as illustrated when tightened.











Corrosion protection

Anodes

Sacrificial anodes are attached to the bottom of the gimbal housing (**A**), at the front (**B**) of the gearcase above the anti-ventilation plate. Anodes are slowly eroded away by galvanic action and require inspection. Anodes subjected to frequent wetting and drying require periodic scraping to remove scale and oxidation to maintain their effectiveness. Magnesium anodes are to be installed if the boat is to be used mainly in a fresh water enviroment.

Checking corrosion protection

Inspect gimbal housing and front gearcase anodes (**A** and **B**) every 14 days, or more frequently if used in extremely salty water. If an anode is 2/3 its original size (1/3 eroded), it should be replaced. If a stainless steel propeller is used, additional sacrificial anodes may be required to handle the added corrosion potential.

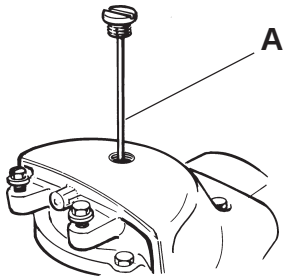
Active Corrosion-Protection

Most boats are equipped with a Volvo Penta Active Corrosion Protection System as standard equipment. The system greatly improves the protection and life of the drive unit from corrosion. If your boat does not have this system as standard you can buy it as an accessory. It is available from your Volvo Penta dealer. This system operates with very little current drain from the boat's electrical system.

The Volvo Penta Active Corrosion-Protection System control box has a small LED indicator light that blinks to show the system is operating properly. The LED indicator light should blink once every one to five seconds to indicate proper operation. The light will blink at the once every five second rate if the demand for protection is very low. If the light is flashing once per second, the demand is high and the system is operating at maximum capacity. The Volvo Penta Active Corrosion-Protection System is designed to adequately protect one drive unit from galvanic corrosion.

The system works by keeping the voltage potential in the area around the drive unit in a range that is not corrosive to aluminum. This is accomplished by changing the charge of water molecules so that they do not remove electrons from the drive unit's metal parts that cause corrosion.

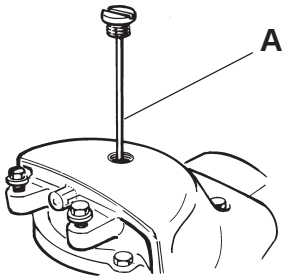
⚠ **IMPORTANT!** This system will not provide protection from stray currents emitted by a malfunctioning AC power source on either your boat, the pier, or other boats in close proximity to yours. Although the zinc sacrificial anodes will last much longer with this system, they must still be cleaned and checked for material condition periodically.



Oil level. Check

Trim the drive to it's normal running position. Remove the dipstick (**A**) and check the oil level covers the entire marked area. Add oil if required through the dipstick hole. If oil level is low, add only enough lubricant to bring the oil level within the full range of dipstick.

⚠ **IMPORTANT!** Always screw the dipstick all the way home in dipstick tube before reading of the oil level.



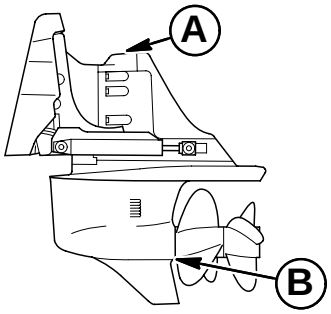
Oil. Replacement DP-S drive

Place drive unit in the run (down) position. Remove propellers and mounting hardware. See chapter ***Propellers.***

NOTE! Removing DuoProp propellers require the use of special tools.

Remove the oil drain plug (**B**) (below propeller shaft) and the oil level dipstick (**A**). Allow the drive unit to drain completely. Dispose of used oil in accordance with any applicable environmental regulations.

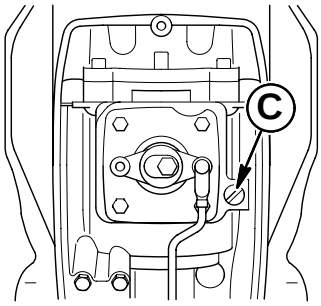
To fill the drive unit, remove the three screws securing the rear cover to access the oil level plug (**C**). Remove oil level plug.



Fill drive unit with oil through the oil drain plug location (**B**). 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: See chapter ***Technical Data***.

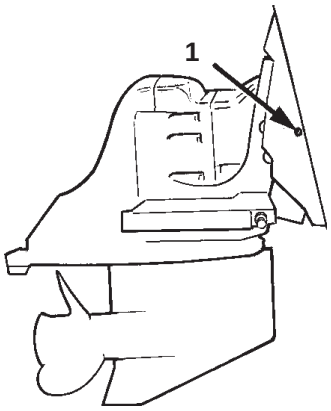
NOTE! If unable to fill the drive unit through oil drain plug (**B**), the drive can be filled by trimming it up a few degrees and filling through the oil level plug (**C**).

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. 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.



Install propellers. Install rear cover and tighten screws securely. 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.

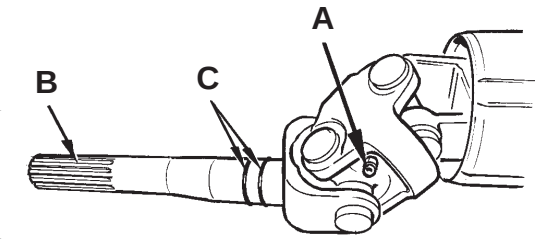


Lubrication. Primary shaft bearings

Remove the drive from the mounting fork. Grease the primnary shaft bearing via the nipple (**1**) using a grease gun. Use an EP wheel bearing grease. Press in grease until it is forced out of the bearing. If the old grease indicates water contamination the bearing must be inspected and replaced if damaged.

⚠ **WARNING!** Removal of the drive requires special knowledge and tools. A falling drive can cause serious personalinjury. Please contact your nearest authorized Volvo Penta dealer for assistance.

⚠ **IMPORTANT!** Failure to lubricate the gimbal bearing and universal joints each year will result in damage to the pivot housing and drive unit.



Lubrication. U-joint

Remove the drive from mounting fork. The U-joint is lubricated by the two lubricating nipples (**A**). Press in grease until it is forced out of the bearing. Use an EP wheel bearing grease.

NOTE! The splined joint on the shaft (**B**) must be greased using molybdenum grease. Lubricate the two O rings (**C**) with a little engine oil.

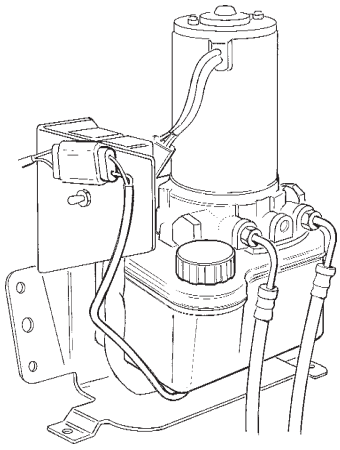
⚠ **WARNING!** Removal of the drive requires special knowledge and tools. A falling drive can cause serious personal injury. Please contact your nearest authorized Volvo Penta dealer for assistance.

Bellows. Replacement

Check the condition of the universal joint and exhaust pipe bellows **every year.** If there are cracks or any other defects, they should be replaced. They should be replaced every second year.

⚠ **WARNING!** Never work on the bellows or hydraulic components of the drive unless you have first locked the drive in the folded up position, in such a way that it can not possibly fall down. A drive which falls down can cause severe personal injury.

Bellows replacement means that the drive has to be removed from the drive shaft bearing housing. Drive shaft removal requires knowledge and special tools. Contact your Volvo Penta workshop for assistance.

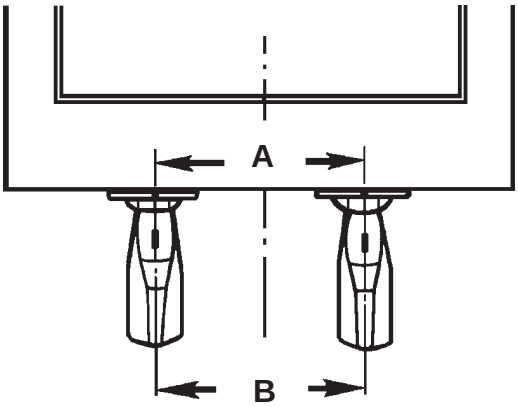


Power Trim pump.Oil level DP-S drives

At the beginning of each boating season, check the oil level in the reservoir as follows:

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

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



Twin installations, DP-S drive

Duo Prop drive units have counter-rotating propellers. There is no need to alter the direction of rotation of the drive units in twin installation.

In Duo Prop drive unit twin installation the drive unit must be adjusted so operation is free from cavitation. To adjust, measure the distance (**A**) between the center line of the two transom shields. Adjust tie bar so the distance (**B**) between the center of the cavitation plate is equal to distance (**A**).

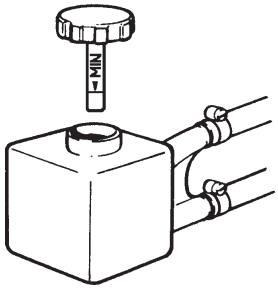
Engine alignment

Engine alignment requires special tools and that the drive unit be removed. This should be done when the drive unit is removed for lubrication during off-season storage preparations. Because of the special tools required, engine alignment must be performed by a Volvo Penta dealer.

⚠ **IMPORTANT** Failure to check engine alignment could result in premature failure of engine coupler, universal joints, and gimbal bearing.

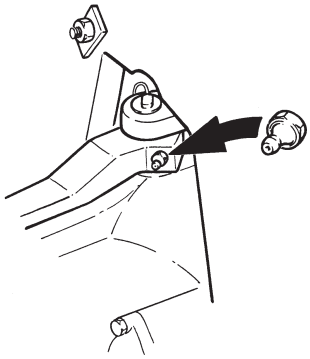
Steering

The DP drive is equipped with power-assisted mechanical steering. The DPX drive is equipped with the Xact™ fully hydraulic power steering system.



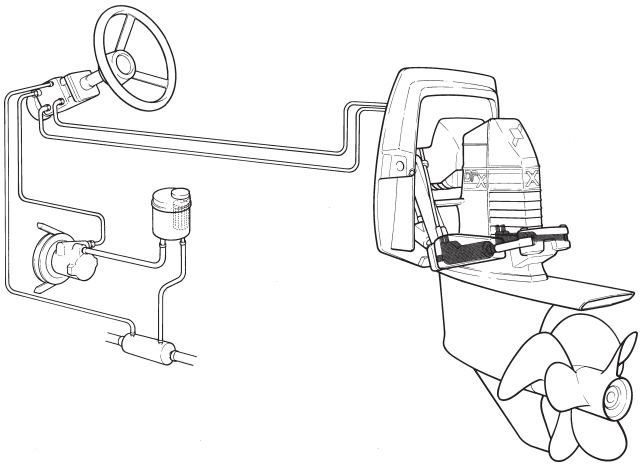
DP power steering pump. Oil level

Turn the filler cap counterclockwise and remove. Check the oil level is between the MAX and MIN markings on the dipstick. For oil grade, see Technical data



DP steering shaft bearing. Lubrication

Lubricate steering shaft bearing with a grease gun. Use water resistant grease. Press in grease until it is forced out of the bearing.



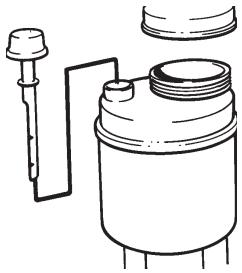
Xact™ Power steering, DPX

IMPORTANT!

To ensure safe and reliable steering follow these instructions:

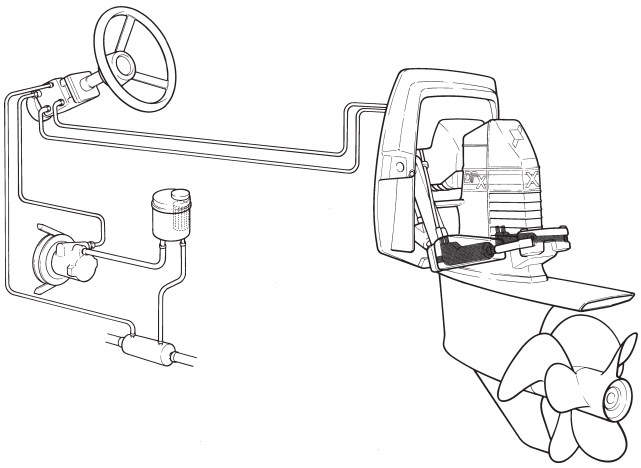
Check steering system oil level every two weeks to detect changes. The oil level should not normally change, oil consumption is negligible over a year. If the oil level drops there is probably a leak. This leak must immediately be localized and remedied. Please contact your nearest authorized Volvo Penta workshop for repairs. The steering system is filled with automatic transmission fluid (ATF), the fluid should not normally require changing. As long as the oil is red and contains no visible contaminants you do not need to change the oil. If the color of the oil changes to black or contains visible contaminants you must change the oil. The oil should also be changed if the steering system has been opened for servicing.

⚠ **WARNING!** Always use the recommended grade of ATF from a recognized manufacturer. Never fill the steering system with an unknown grade of fluid. **The wrong type of oil can negatively affect steering, and at worst steering can be lost altogether.** The wrong oil can also damage steering system components.



DPX Hydraulic pump Oil level

Check with the engine(s) idling. The level should be between MAX and MIN markings on the dipstick. NOTE! The level is slightly higher with the engine stopped. Fill with ATF. For ATF grade, see Technical data.

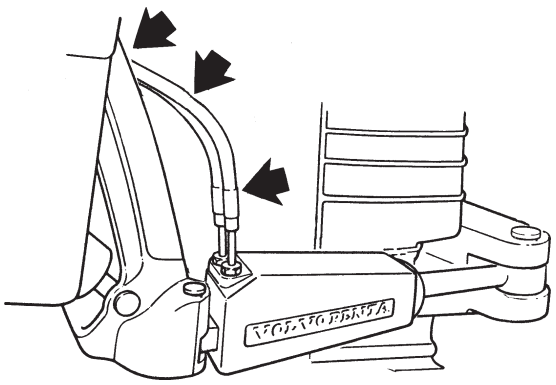


DPX Hydraulic circuits Venting

If the steering system hydraulic circuit has been removed or dismantled, the system must be vented. Venting is easier if you have an assistant.

⚠ **WARNING!** Be extremely careful that hands, clothes, hair, necklaces and tools do not come into contact with engine drive belts or pulleys.

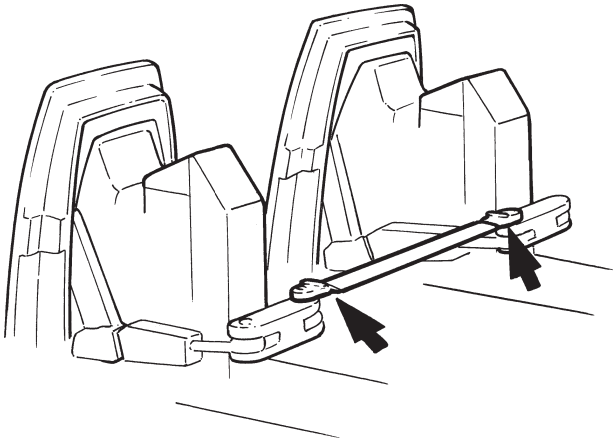
Fill the system. Start the engine(s). The steering system engine circuit is automatically vented when the engines have been running for 2–3 minutes. Other parts of the system are vented as follows: Turn the wheel 2–3 times port and starboard to full lock. Check the oil level as the wheel is being turned and top up as necessary. The oil level can drop rapidly when the wheel is turned. Be ready to top up the oil immediately so that no air is sucked into the system. Check the oil level one last time with the dipstick and top up as necessary. Check that there are no leaks before running, particularly if the system has been dismantled. Also check that all connections have been tightened properly.



DPX Hydraulic hoses. Checking

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

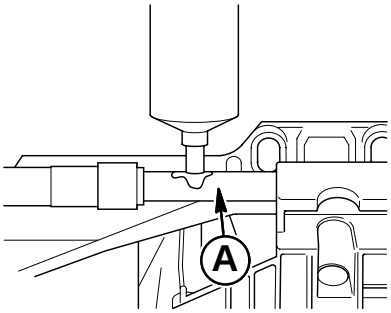
⚠ **WARNING!** A leaking hydraulic hose can negatively affect steering, and at worst steering can be lost altogether. Cleanliness is extremely important, no dirt must get into the hydraulic system. Before removing, clean and check carefully how hoses are routed and connected. **Faulty routing or dirt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



DPX Parallel strut. Checking

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

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



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.

Some twin engine boats may have both engine power steering systems coupled together with a priority valve. This allows the use of either engine to provide power assist steering.

Steering bearing lubrication

Lubricate the steering ram (**A**) with a grease gun. Use water resistant grease.

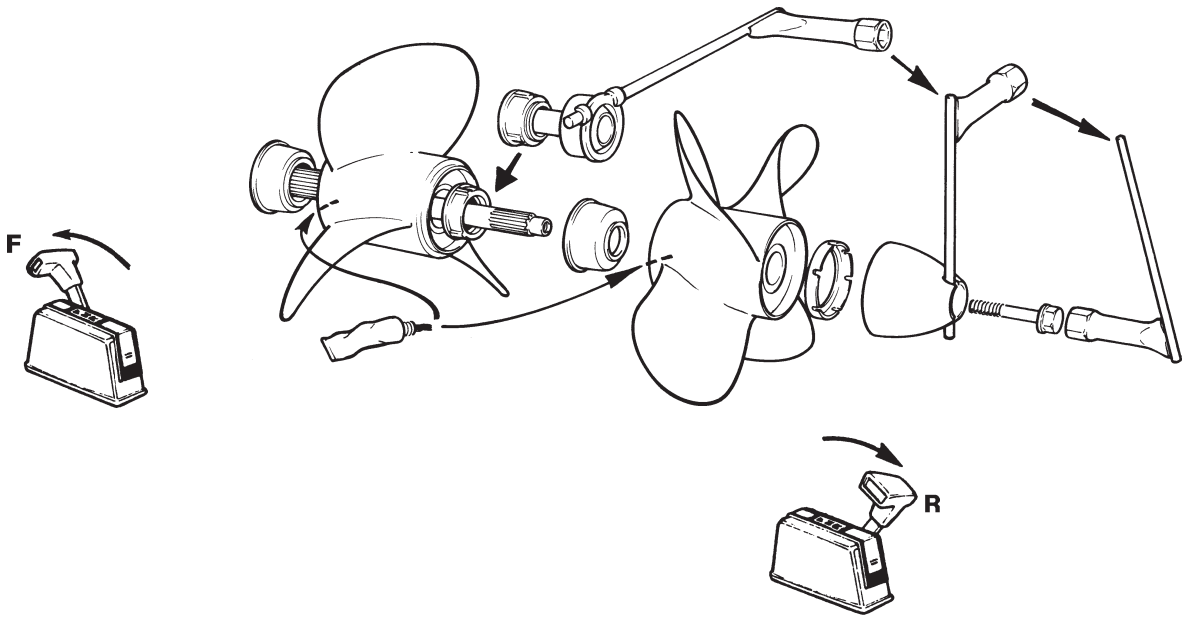
Propellers

For best performance and fuel economy the engine speed should be within the wide open throttle (WOT) range: See chapter "***Operation***". If the engine speed at wide open throttle (WOT) falls outside the WOT range then the propeller should be changed.

⚠ **WARNING!** immobilize the engine before starting work. Remove the ignition key and turn off the power supply with the main switch.

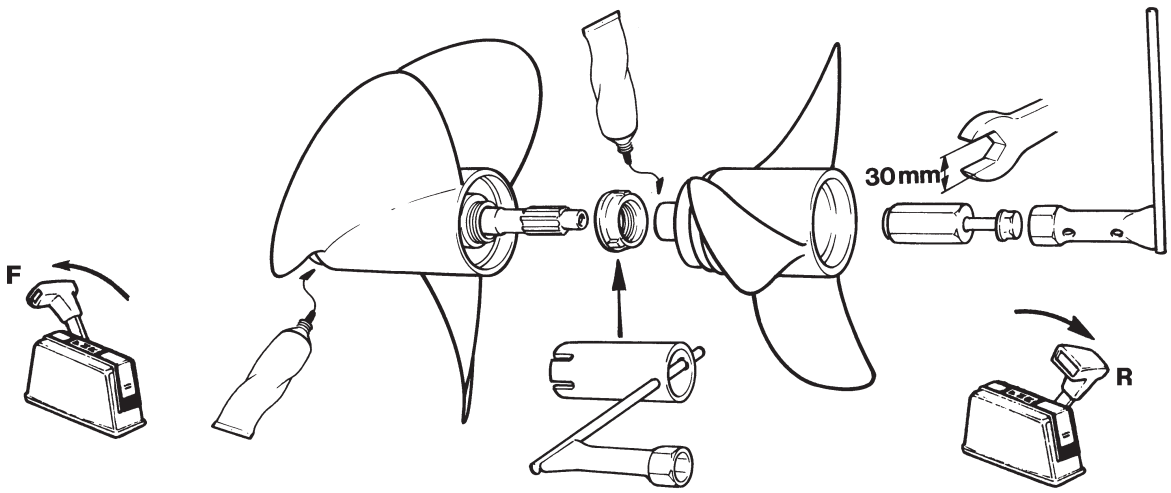
The line cutter (DP) has very sharp edges and must be handled with care.

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



Propeller installation. DP

1. Control lever in "Ahead" position.
2. Use the tool supplied when removing and installing propellers.
3. Lubricate both propeller hubs. Use Volvo Penta grease 828250-1.
4. Slide on the line cutter and the front propeller.
5. Screw on nut and tighten with tool. Tightening torque 50–75 Nm (5–7.7 kpm).
6. Control lever in "Astern" position.
7. Install rear propeller line cutter. Push on the rear propeller and the plastic washer and spacer ring if it was previously installed.
8. Screw on the propeller nut cone and tighten hard. Install the center screw and washer and tighten hard.



Propeller installation. DPX

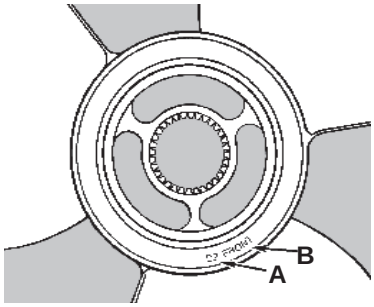
1. Control lever in “Ahead” position.
2. Use the tool supplied when removing and installing propellers.
3. Lubricate both propeller hubs. Use Volvo Penta grease 828250-1.
4. Push the front propeller onto the shaft. Screw on large locknut and tighten with tool. Tightening torque 50–70 Nm (5–7 kpm).
5. Control lever in “Astern” position.
6. Push rear propeller onto the shaft and tighten with nut. Use a 30 mm socket and tighten to 25–35 Nm (2.5–3.5 kpm)
7. Screw in the lock screw and tighten to 70–80 Nm (7–8 kpm).

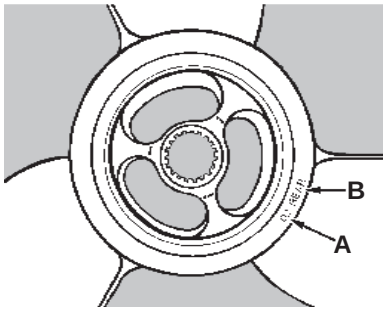
Propeller selection, DP-S drive

Propellers for the DP-S drive are classified together and are marked with a type designation (size code for size and pitch). **D0-D7** for aluminum propellers and **F4-F9** for stainless propellers.

⚠ **IMPORTANT!** The propellers on a DP-S drive must have the same designation, i.e. the same diameter and pitch. The part numbers differ, however, since one propeller is for left-hand rotation and the other one is for right-hand rotation. In twin installations, both drives must have propellers with the same type designation.

⚠ **IMPORTANT!** D-series aluminium propeller sets used on Duo Prop applications, are not recommended for use on boat and engine combinations that are capable of speeds in excess of 35 knots. E-series stainless steel propeller sets should be used in these applications.





Propeller identification, DP-S drive

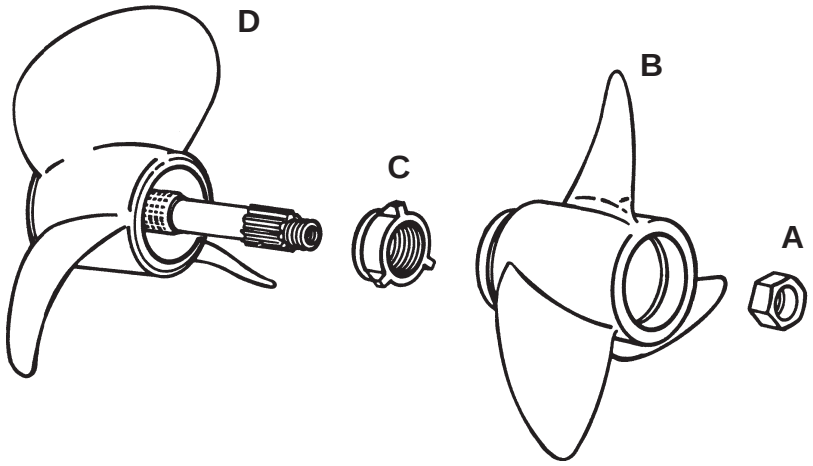
The type designation (**A**) and the FRONT and REAR identification (**B**) are stamped on the end of the propeller hubs. When replacement of the propeller is required, either a forward or rear propeller can be purchased to maintain the matched set. Always order replacement propellers by the part number.

Propeller care

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 local Volvo Penta dealer. Always carry a spare propeller and replace the damaged propeller as soon as possible.

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

Propeller replacement, DP-S drive



Removal

⚠ **WARNING!** Ignition switch must be OFF.

- Place remote control in the FORWARD position to lock propeller shafts.
- Remove rear propeller nut (**A**).
- Remove the rear propeller (**B**).
- Place remote control in the REVERSE position to lock propeller shafts.
- Remove the front propeller nut (**C**).
- Remove front propeller (**D**).
- Wipe propeller shafts clean. Inspect for monofilament line; remove if present.

Installation

- Coat the full length of both propeller shafts with Volvo Penta propeller shaft grease.
- Place remote control in the FORWARD position to lock propeller shafts.
- Install front propeller (**D**).
- Install front propeller nut (**C**) and tighten to 60 Nm.
- Place remote control in the REVERSE position to lock propeller shafts.
- Install rear propeller (**B**).
- Install the rear propeller nut (**A**) and tighten to 70 Nm.

NOTE! Failure to install propellers as shown could result in the loss of the rear propeller and damage to the drive unit when boat is operated.

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.

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

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

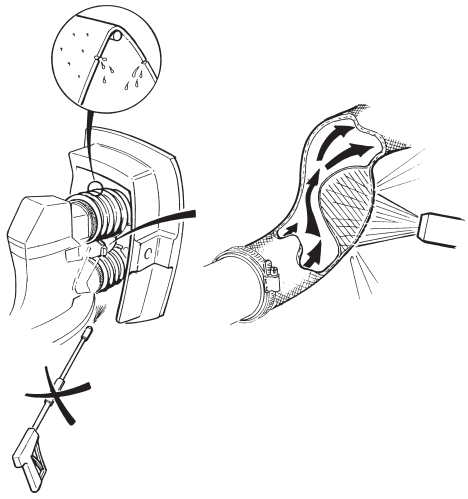
Inhibiting

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

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

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

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



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

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

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

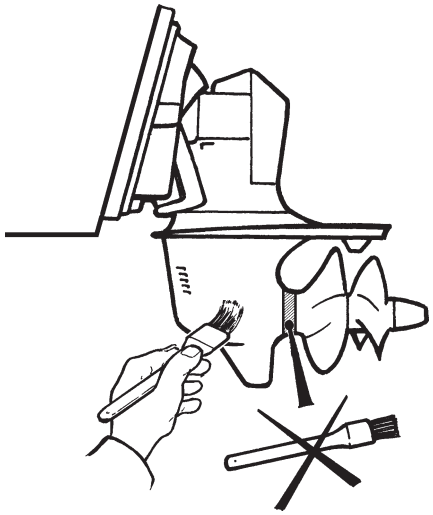
- Drain any water and contaminants from the fuel tank. Fill the tank completely with fuel to avoid condensation.
- Clean the outside of the engine. Do not use a high pressure spray to clean the engine. Touch up any damaged areas of paintwork with Volvo Penta original paint.
- Check all control cables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

Bringing out of storage

- Check oil level in the engine and drive/reverse gear. Top up if necessary. If there is inhibiting oil in the system drain and fill with new oil, change oil filter. For correct oil grade: See the chapter “Technical Data”.
- Drain the antifreeze from the seawater system.
- Install the impeller in the seawater pump (replace if the old one looks worn).
- Close/tighten drain cocks/plugs.
- Check the tension and condition of the drive belts.
- Check the condition of rubber hoses and tighten hose clamps.
- Check engine coolant level and antifreeze protection. Top up if necessary.
- Connect the fully charged batteries.
- Paint the drive and hull: See next page.
- Check the sacrificial anode on the drive. If there is less than 2/3 of the anode left it must be replaced. Clean with emery cloth just before the boat is launched.

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

- Install propellers.
- Launch the boat. Check for leaks.
- Vent and lubricate the propeller shaft seal (reverse gear).
- Start the engine. Check that there are no fuel, engine coolant or exhaust gas leaks and that all control functions are operating.



Painting the drive and underwater hull

Drive

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

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

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

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

Underwater hull

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

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

⚠ **IMPORTANT!** Leave an area of 10 mm around the transom shield 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.

Fault-tracing

Problem	Probable 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

List of probable causes

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

Technical Data

General

Engine designation	**AD31L/P KAD32P TAMD31L/M/P TMD31L**	**AD41P TAMD41H/M/P TMD41L**	**KAD43P KAMD43P TAMD42A/WJ***
Idling speed, rpm	675–725	625–725	625–675
Cylinder displacement, dm^3	2.39	3.59	3.59
Injection order	1-3-4-2	1-5-3-6-2-4	1-5-3-6-2-4
Rotational direction, viewed from in front	Clockwise	Clockwise	Clockwise
Maximum forward inclination	4°	4	4°
Maximum rake while running	15°	15°	15°
Maximum list while running	20°	20°	20°
Valve clearance. Intake/exhaust, cold engine, mm.	0.40	0.40	0.40
Oil capacity, excluding oil filter	8.5 litres	10.5 litres	10.5 litres
Oil capacity incl. oil filter	9.0 litres	11.0 litres	11.0 litres
At 15° rear rake, excluding oil filter	9.0 litres	11.0 litres	11.0 litres
At 15° rear rake, including oil filter	9.5 litres	11.5 litres	11.5 litres
Oil grade	VDS or CD	VDS or CD	VDS or CD
Viscosity	SAE 15W/40	SAE 15W/40	SAE 15W/40
Oil pressure, engine hot			
Idling, kg/cm^2	1.5	1.5	1.5
Wide open throttle (WOT), kg/cm^2	4.2–5.0	4.2–5.0	4.2–5.0

Kompressor

Oil capacity, dm^3	0.1 (KAD32)		0.1
Oil grade	VP part number 1141641-9		

Cooling system

Thermostats open/completely open	81°C/94°C	81°C/94°C	81°C/94°C
Freshwater system capacity, dm^3	13 litres	19 litres	20 litres

Electrical system **

System voltage	12 V/24 V	12 V/24 V	12 V/24 V
Starter motor battery, capacity	140 Ah	140 Ah	140 Ah
Battery electrolytic specific gravity:			
Charge at g/cm^3	1.230	1.230	1.230
Fully charged g/cm^3	1.275–1.285	1.275–1.285	1.275–1.285
Alternating current (AC) generator (GEN) max. output	14 V/60 A 24 V/50 A	14 V/60 A 24 V/50 A	14 V/60 A 24 V/50 A
Starter motor output at 12 V/24 V	3.0 kW/4.0 kW	3.0 kW/4.0 kW	3.0 kW/4.0 kW

Fuel specification

Fuel must meet national and international standards at least. For example:

EN 590 (with national environmental and cold standards)

ASTM D 975 No 1-D and 2-D

JIS KK 2204

Sulfur content: According to statutory requirements.

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

DP Drive

Oil grade	API GL5
Viscosity	SAE 75W/90 (100% synthetic) P/N 1141634-4 (1L)
Oil capacity	2.7 litres
Difference between MIN and MAX markings	0.15 litres
Tightening torque:	
Steering cap bolts, kpm (Nm)	3.5 (35)

DPX drive

Oil grade	API GL5
Viscosity	SAE 75W/90 (100% synthetic) P/N 1141634-4 (1L)
Oil capacity.	2.0 litres
Difference between MIN and MAX markings	0.15 litres

DP-S drive

Designation	**DP-S**
Oil grade/viscosity	SAE 75W/90 (100% synthetic) P/N 1141634-4 (1L)
Oil capacity	2.4 liters
Ratio	1.95:1

Power Trim hydraulic system

Oil grade	ATF (Dexron II)
Oil capacity	1.6 liters (DP, DPX 1.0 liters)

Power Steering

Oil grade	ATF (Dexron II)

Reverse gear HS45A

Oil grade	ATF (Dexron II)
Angle (output shaft)	8°
Oil capacity (without oil cooler).	2.0 litres

Reverse gear HS63A

Oil grade	ATF (Dexron II)
Angle (output shaft)	8°
Oil capacity (without oil cooler).	3.0 litres

Reverse gear HS63V

Oil grade	ATF (Dexron II)
Angle (output shaft)	12°
Oil capacity (without oil cooler).	4.0 litres

Hydraulic steering (Volvo Penta)

Oil grade	Volvo Penta P/N 1141640-1, Shell Aero 4, Texaco HO15 Esso Univis N15, Chevron Aviation Fluid A, Mobil Aero HFA

Hydraulic steering (DPX)

Oil grade	ATF, type G

** TAMD 42A/WJ: For technical information for water jet units refer to the manufacturer's manual.*

*** 24 V system only available on certain engine variants*

Notes

VOLVO
PENTA

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7740088-5 English 03-1999