

# **INSTRUCTION BOOK**

**AD31, TMD31, TAMD31  
D41, AD41, TMD41, TAMD41  
TAMD42/WJ, KAD42, KAMD42**



# Owner's Manual

## Marine engines

TMD31L    TAMD31L/M/P • AD31L/P • D41L  
TMD41L • TAMD41H/M/P • AD41L/P  
KAMD42L/P • KAD42L/P  
TAMD 42A/WJ

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### 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.

# Safety precautions

## Introduction

This Owner's Manual contains the information you will need to operate the engine correctly. Check that you have the correct Owner's Manual for your engine.

**Read the manual carefully before operating or servicing the engine.** Incorrect operation or servicing of the engine could result in personal injury or material damage as well as damaging the engine itself. **If you do not understand or are uncertain on any operation in this manual, contact your dealer who can explain or demonstrate the procedure for you.**

## Important

You will find the following special warning symbols in this manual and on the engine:



**WARNING!** Possible danger of personal injury, damage to property or mechanical malfunction if the instructions are not followed.



**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.



Read instructions in the Owner's Manual.

Below is a summary of the risks you should be aware of and safety precautions you should always observe when operating or servicing the engine.



Check that the warning or information labels on the engine are always clearly visible. Replace labels which have been damaged or painted over.



Always turn the engine off before starting service procedures. Avoid burns. Take precautions to avoid hot surfaces and liquids in supply lines and hoses when the engine has been turned off immediately prior to starting work on it and it is still hot.

Reinstall all protective parts removed during service operations before starting work on the engine. Make a point of familiarizing yourself with other risk factors, such as rotating parts and hot surfaces (exhaust manifold, Turbo unit, charge pipe, starter heater etc.).

Approaching an engine which is operating is a safety risk. Loose clothing or long hair can fasten in rotating parts and cause serious personal injury.

If the service operation requires that the engine is operating let your Penta authorized dealer carry out the work. If working in proximity of an engine which is operating, careless movements or a dropped tool can result in personal injury.



Immobilize the engine by turning off the power supply to the engine at the main switch (breakers) so it is impossible to start, and lock the switch (breakers) in the OFF position before starting work. Set up a warning notice at the engine control point or helm.



Engines with Turbo compressors: Never start the engine without installing the air cleaner (ACL). The rotating compressor parts in the Turbo can cause serious personal injury. Foreign objects entering the intake ducts can also cause mechanical damage.



Engines with intake air pre-heating: Never use starting spray in the intake. Use of such products could result in an explosion in the air intake pipe due to the hot-spot pre-heater. Danger of personal injury.



Do not open the filler cap for the engine coolant (freshwater cooled engines) when the engine is hot. Steam or hot engine coolant can be ejected and any pressure in the system will be lost. Open the filler cap slowly and release coolant system pressure (freshwater cooled engines), if the filler cap or drain cock must be opened, or if a plug or engine coolant line must be removed on a hot engine. Steam or hot coolant can be ejected.

















Stop the engine and close the bottom valve before carrying out operations on the cooling system.



Only start the engine in a well-ventilated area. If operating the engine in a closed area ensure that there is exhaust ventilation leading out of the work area to remove exhaust gases and crankcase ventilation emissions.



Anti-corrosion agents are hazardous to health. Read the instructions on the product packaging!

-  Anti-freeze agents are hazardous to health. Read the instructions on the product packaging!
-  Certain engine conservation oils are inflammable. Some of them are also dangerous if breathed in. Ensure good ventilation in the work place. Use a protective mask when spraying.
-  Hot oil can cause burns. Avoid getting hot oil on the skin. Ensure that the lubrication system is not under pressure before carrying out any work. Never start or operate the engine with the oil filler cap removed, otherwise oil could be ejected.
-  Never allow an open flame or electric sparks near the battery area. Never smoke in proximity to the batteries. The batteries give off hydrogen gas during charging which when mixed with air can form an explosive gas. This gas is easily ignited and highly volatile. Incorrect connection of the battery can cause sparks sufficient to cause an explosion with resulting damage. Do not shift the connections when attempting to start the engine (spark risk) and do not lean over any of the batteries. Refer to instructions in the Instruction Book.
-  Always ensure that the Plus (positive) and Minus (negative) battery leads are correctly installed on the corresponding terminal posts on the battery. Incorrect installation can result in serious damage to the electrical equipment. Refer to the wiring diagrams.
-  Always use protective goggles when charging and handling the batteries. The battery electrolyte contains extremely corrosive sulphuric acid. If this should come in contact with the skin, immediately wash with soap and plenty of water. If battery acid comes in contact with the eyes, immediately flush with water and obtain medical assistance.
-  Turn the engine off and turn off the power at the main switches (breakers) before carrying out work on the electrical system.
-  Clutch adjustments, where a clutch is fitted, must be carried out with the engine turned off.
-  Use the lifting eyes fitted on the engine/reverse gear when lifting the drive unit. Always check that the lifting equipment used is in good condition and has the load capacity to lift the engine (engine weight including
- reverse gear and any extra equipment installed).
- To ensure safe lifting and avoid damage to components installed on the top of the engine use an adjustable lifting beam. All chains and cables must run parallel to each other and as perpendicular as possible to the upper side of the engine.
- If extra equipment is installed on the engine which alters its center of gravity a special lifting device is required to obtain the correct balance for safe handling.
- Never carry out work on an engine suspended on a hoist.
-  The components in the electrical system, the ignition system (gasoline/petrol engines) and in the fuel system on Volvo Penta products are designed and manufactured to minimize risks of fire and explosion.
- Using parts that are not Original Volvo Penta parts which do not correspond to the demands above, can result in fire or explosion on board. Any type of damage which is the result of using replacement parts that are not original Volvo Penta replacement parts for the product in question will not be covered under any warranty or guarantee provided by AB Volvo Penta.
-  Fuel filter replacement should be carried out on a cold engine in order to avoid the risk of fire caused by fuel spillage on the exhaust manifold. Always cover the generator (alternator), if it is located under the fuel filter. The generator (alternator) can be damaged by spilled fuel.
-  Always use protective gloves when detecting leaks. Liquids ejected under pressure can penetrate the body tissues and cause serious injury. Danger of blood poisoning.
-  Always use fuels recommended by Volvo Penta. Refer to the Instruction Book. Use of fuels that are of a lower quality can damage the engine. On a diesel engine poor quality fuel can cause the actuating rod to hang and the engine to overrev with resulting risk of damage to the engine and personal injury. Poor fuel quality can also lead to higher maintenance costs.
-  Observe the following when cleaning with high-pressure water jets. Never point the water jet at seals, rubber hoses or electrical components. Never use high pressure jets when washing the engine.

# General Information

## Welcome aboard

Thank you for choosing a Volvo Penta marine engine. Volvo Penta have been building marine engines since 1907. Quality, operating reliability and innovation have made Volvo Penta a world leader in the marine engine industry.

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

We would like to wish you many pleasant voyages.

## AB VOLVO PENTA

### Technical Information

## Your new boat

Every new boat has its own special characteristics. Even experienced boat owners are advised to note carefully how the boat behaves at different speeds, weather conditions and loads. If your boat and engine combination permit highspeed use, we strongly recommend that a safety breaker is fitted, regardless of the type of boat. If your boat is not fitted with a safety breaker contact your Volvo Penta dealer who can assist you in selecting one.

## Running-in

A new marine engine requires a running-in period of 20 operating hours. Run the engine at varying engine speeds, but not over a maximum of 3/4 throttle opening for the first two hours. For the next 8 hours run the engine in the same way, but with max. 2 minute periods at wide open throttle (WOT). During the final 10 hours increase wide open throttle periods to 5-10 minutes at a time. Reduce the throttle opening to idle periodically to allow the engine temperature to drop. During the running-in period never run the engine for long periods at a constant engine speed. It is normal for the engine to use more engine oil during the running-in period. Make a point of checking the engine oil level more frequently during the running-in period than during normal operation. Carry out the First Service Inspection after the initial 20-hour running-in period.

## Fuel and lubricants

Only use lubricants and fuels recommended under "Technical Information". Use of other classifications can cause malfunctions and reduced service life.

## Spare parts



**WARNING!** The components in the electrical system and in the fuel system on Volvo Penta products are designed and manufactured to minimize the risk of fire and explosion.

Using parts that are not Original Volvo Penta parts and which do not correspond to the demands above, can result in fire or explosion on board. Any type of damage which is the result of using replacement parts that are not original Volvo Penta replacement parts for the product in question will not be covered under any warranty or guarantee provided by AB Volvo Penta.

## Maintenance Manual

This Instruction Book contains a short maintenance guide/instructions in the form of a maintenance plan with text and illustrations.

If you prefer to carry out some maintenance and service yourself there is the more comprehensive "Do-it-yourself" manual available. The book describes the engine systems, for example the coolant system and shows how to carry out work that does not demand special knowledge. References to tools, lubricants and other service products which may be required have been included.

"Do-it-yourself" is available from your VOLVO PENTA dealer. The publication reference numbers are in the engine manual bag.

## Safety

Everyone wants and expects to have a problem-free and pleasant time when they take their boat out. To help you do this we have provided a check-list below which can of course be added to according to personal experience. A major area is naturally the engine, its equipment and that the boat in general is properly maintained.

### Planning your trip

- Get out up-to-date charts for the route planned
- Calculate distance and fuel consumption
- Note down if there are fuel points on your planned course
- Tell friends or relatives about your trip plans

### Boat equipment

- Rescue and emergency items such as life-vests and signal rockets. Does everyone know where they are?
- Spare parts on board, for example: Kit with impeller etc.
- Proper tools for the equipment
- Fire extinguisher (checked and charged)

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## Our joint responsibility

Volvo Penta continually commits a considerable part of its development resources towards minimizing the environmental impact of its products. Examples of areas where we are always looking for improvements are; exhaust emissions, sound levels and fuel consumption.

Regardless of whether your Volvo Penta engine is installed in a boat used for pleasure or in commercial operation, incorrect operation or improper maintenance of the engine will result in disturbance or damage to the environment.

In this instruction book there are a number of service procedures, which, if not followed will lead to a deterioration of engine characteristics with regard to how it effects the environment, its service life and cost of operation. Always follow the recommended service intervals and make a habit of checking that the engine is operating normally every time you use it. One example is excessively smoky exhaust. Contact an authorized Volvo Penta workshop if you cannot correct the fault yourself.

Bear in mind that most of the chemicals used around boats are harmful to the environment if used incorrectly. Volvo Penta recommends the use of biodegradable degreasing agents for all cleaning. Always dispose of engine and transmission oil waste, old paint, degreasing agents and cleaning residue etc. at proper disposal areas so they do not harm the environment.

Adapt speed and distance during your boat trips so that swell and noise generated by the boat do not disturb or harm wildlife, moored boats, landing stages etc. Wherever you land or cruise, please show consideration and always leave the areas you visit as you would like to find them yourself.

## Warranty

A Service and Warranty book with conditions for Volvo Penta's International Limited Warranty is supplied with every engine. Contact your nearest Volvo Penta dealer or importer for your copy if you have not received one.

Some markets can have other warranty conditions depending on national legislation and regulations. These conditions are provided by the Volvo Penta importer or distributor for the market in question. If you wish to have a copy of the conditions please contact your local Volvo Penta representative.

## Warranty Registration Card

The Warranty Card must always be completed and returned to the dealer. Make sure that this has been done since warranty obligations may not be honored if the delivery date cannot be confirmed.

## Maintenance and care

— PDC (pre-delivery commissioning) undertaking, for marine engines: PDC enables us to ensure that Volvo Penta products operate correctly after installation in a boat, and further that the end-user gets acquainted with the product, its functions and care (for checklist see your Warranty and Service book). Delivery undertaking "PDC" is carried out at the time of the delivery of the boat to the end-user. The cost of this work is covered by the Volvo Penta International Limited Warranty.

— First Service inspection, for marine engines: A first Service Inspection must be carried out after operating the engine for 20-50 hours or within 180 days from the delivery date, or the end of the first season, whichever occurs first. Labor and material costs in connection with the First Service Inspection are **not** covered by the Volvo Penta International Limited Warranty (for checklist see your Warranty and Service book).

Regular maintenance should be carried out after the First Service Inspection in accordance with the maintenance plan in this book. Any work carried out in addition to maintenance services should be documented (refer to the Warranty and Service book).

It is an absolute condition for the Volvo Penta International Limited Warranty to apply that the PDC Delivery undertaking and First Service Inspection have been carried out by an authorized Volvo Penta Service workshop.

## Volvo Penta Service

Volvo Penta has a comprehensive dealer network that offers both service and spare parts for Volvo Penta engines. Volvo Penta dealers are carefully selected and then trained in order to provide customers with professional assistance on engine service and repairs. These dealers have the special tools required to carry out the work and the test equipment that ensures a high service standard. They are required to keep a stock of Volvo Penta Original Spare Parts and accessories that cover most requirements. When ordering service or spare parts always quote the complete engine and/or drive/reverse gear model designation and serial number. These are stated on the engine product plate and on a label on the engine valve cover.



## Certificated engines

### Important information for engines certificated for Lake Constance and Switzerland

All Volvo Penta engines and products are developed to minimize environmental impact.

National and regional legislation is not identical in all the markets where Volvo Penta sells its products. Occasionally legislation requires that we build special engine variants, or that an engine must be approved in advance, that is, certificated by the local authorities.

An engine with certification means that we, as the manufacturer, guarantee that all engines manufactured are of the same type as the certificated and approved example. Certification is not only a requirement covering engines from the factory, but also that engines in use must meet the environmental demands set for that engine. In order for Volvo Penta as the manufacturer to take responsibility for engines in use, certain requirements pertaining to service and spare parts must be met. We do not wish to discourage owners from carrying out service work themselves, rather the opposite since an owner can quickly notice if an engine is not operating normally. However, a number of service operations demand access to special expertise, workshop manuals, special tools and other equipment designed for the engines. These service operations may only be carried out by an authorized Volvo Penta Service workshop. Always contact your Volvo Penta dealer if you are not sure about anything concerning your engine's function or maintenance.

As an owner or operator of a certificated Volvo Penta engine it is important that you are aware of the following:

- The Service Intervals and maintenance operations recommended by Volvo Penta must be followed.
- Only Volvo Penta Original Spare parts intended for the certificated engine may be used.
- Service work on the ignition system, ignition settings and fuel injection system (gasoline/petrol) or injection pumps, pump settings and injectors (diesel) must always be carried out by an authorized Volvo Penta workshop.
- The engine may not be altered or modified in any way, with the exception of accessories and service kits developed by Volvo Penta for that engine.
- No modifications to the exhaust pipes and air supply ducts for the engine room (ventilation ducts) may be undertaken as this may effect exhaust emissions.
- Any seals on the engine may not be broken other than by authorized persons.



**IMPORTANT!** Use only Volvo Penta original spare parts. **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 through the use of replacement parts other than original Volvo Penta replacement parts for the product in question.

## Identifying Numbers

Immediately after you have taken delivery of your boat, make a note of the serial number and model designation of the engine and drive as well as the shield or reverse gear. Include the serial number and model designation of the boat and any extra equipment. This information is necessary when you contact your Volvo Penta or boat sales representative for service and spare parts. Take a copy of the information and keep it in a safe place so it is available should the boat be stolen.

Engine type. no. ....  
Serial no. ....

Drive type no. ....  
Serial no. drive .....  
Serial no. shield .....

Reverse gear type .....  
Serial no. ....

Propeller designation .....

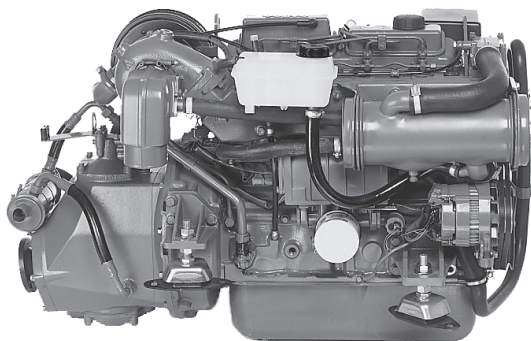
Boat type .....  
Serial no. ....  
Ignition switch no. ....

**NOTE!** Never leave key code numbers on board your boat!

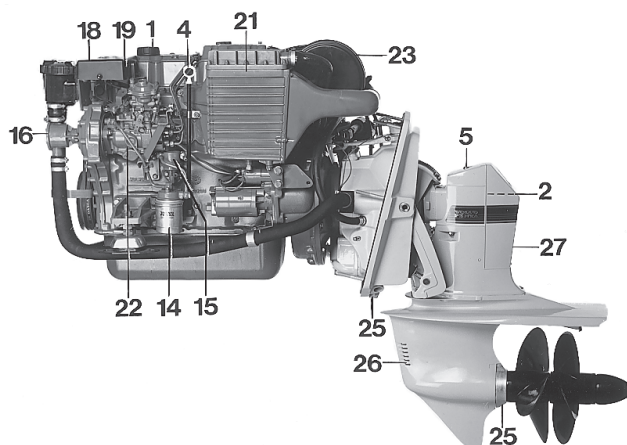
Other equipment .....  
.....  
.....  
.....  
.....  
.....  
.....



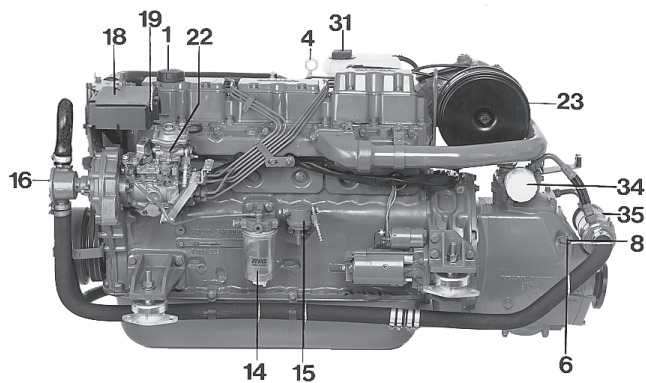
# Engine parts



TMD 31D/HS1A

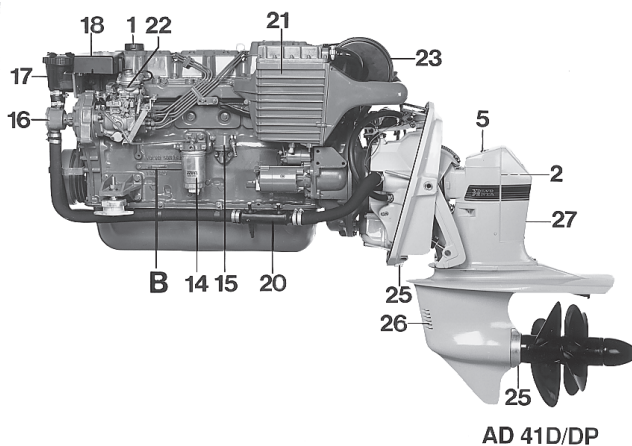


AD 31D/DP

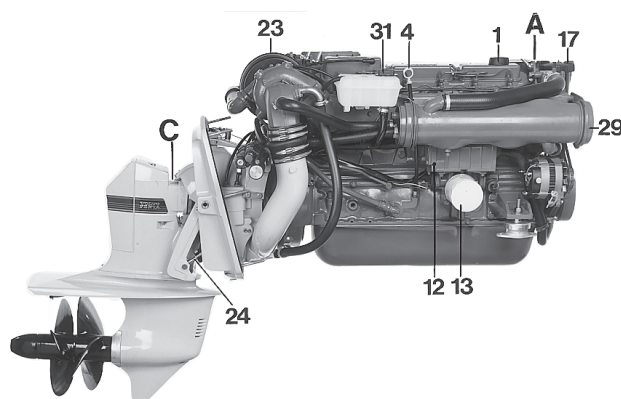


TMD 41D/HS1A

- 1 Oil filler, engine
- 2 Oil filler, drive
- 3 Oil filler, reverse gear
- 4 Dipstick, engine
- 5 Dipstick, drive
- 6 Dipstick, reverse gear
- 7 Oil drain connection, engine
- 8 Oil drain connection, reverse gear
- 9 Oil drain, drive
- 10 Turbo
- 11 Water cooled exhaust elbow
- 12 Oil cooler, engine
- 13 Oil filter engine
- 14 Fuel filter
- 15 Fuel pump
- 16 Seawater pump
- 17 Seawater filter
- 18 Electrical terminal box
- 19 Main fuse, reset
- 20 Oil cooler, Power Steering
- 21 Aftercooler
- 22 Injection pump
- 23 Air filter
- 24 Trim cylinders
- 25 Corrosion protection
- 26 Cooling water inlet
- 27 Cover over gear mechanism
- 28 Compressor
- 29 Heat exchanger
- 30 Thermostat housing
- 31 Cooling water filler
- 32 Steering cylinders
- 33 Drain, Oil cooler/block, KAD42
- 34 Oil filter, reverse gear
- 35 Oil cooler, reverse gear



AD 41D/DP



AD 41D/DP

- 1 Oil filler, engine
- 2 Oil filler, drive
- 3 Oil filler, reverse gear
- 4 Dipstick, engine
- 5 Dipstick, drive
- 6 Dipstick, reverse gear
- 7 Oil drain connection, engine
- 8 Oil drain connection, reverse gear
- 9 Oil drain, drive
- 10 Turbo
- 11 Water cooled exhaust elbow
- 12 Oil cooler, engine
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- 31 Cooling water filler
- 32 Steering cylinders
- 33 Drain, Oil cooler/block,KAD42
- 34 Oil filter, reverse gear
- 35 Oil cooler, reverse gear

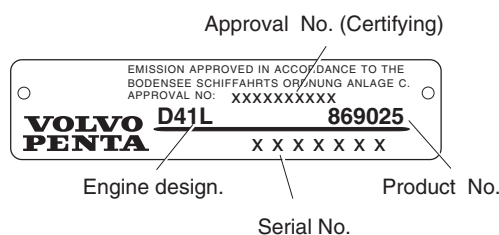
## Type designations (example)

### Engine

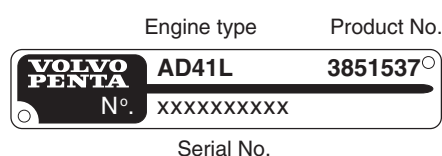
#### A



#### B

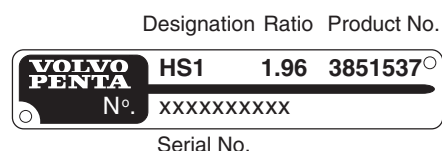


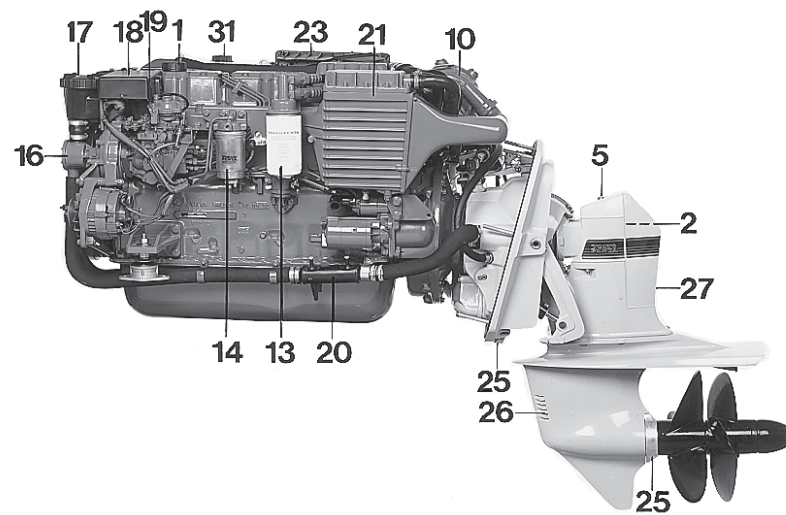
#### B



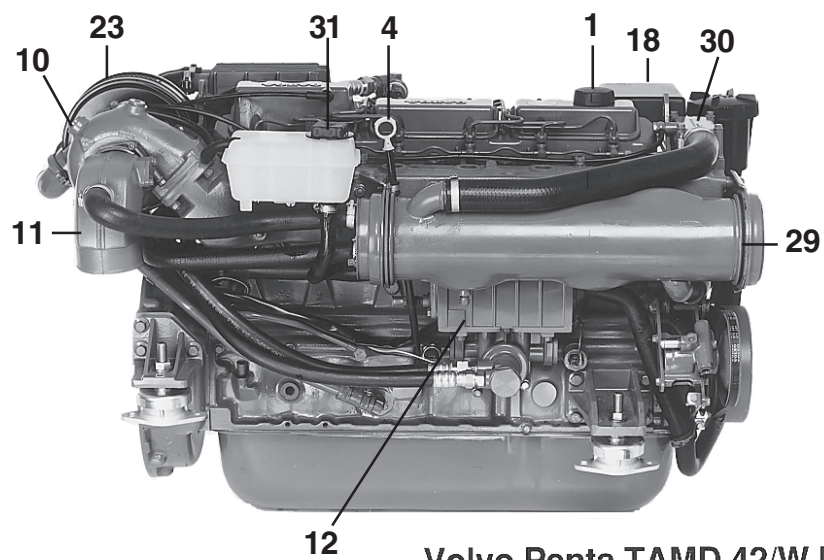
### Drive/Reverse gear

#### C

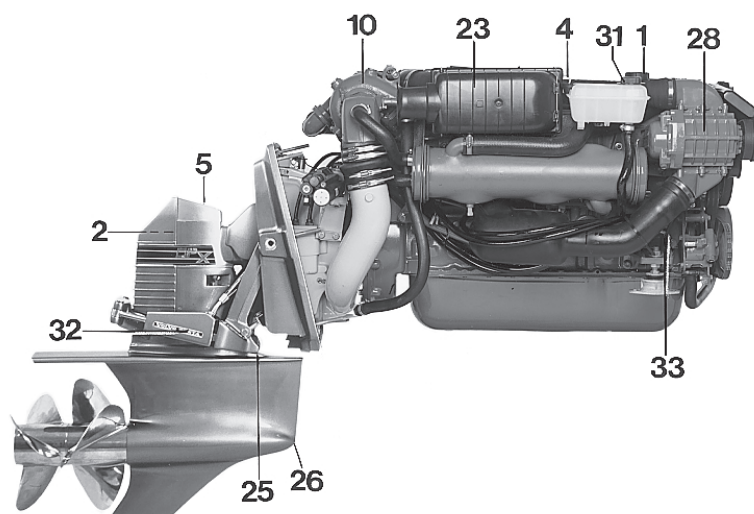




**KAD 42B/DP**



**Volvo Penta TAMD 42/WJ**

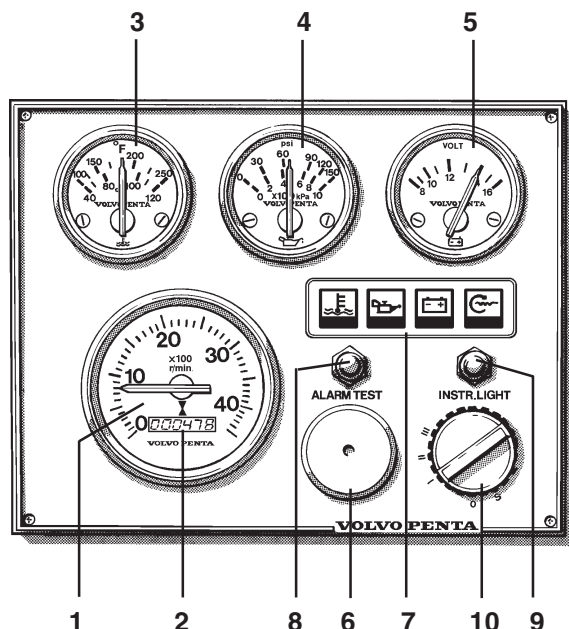


**KAD 42B/DPX**

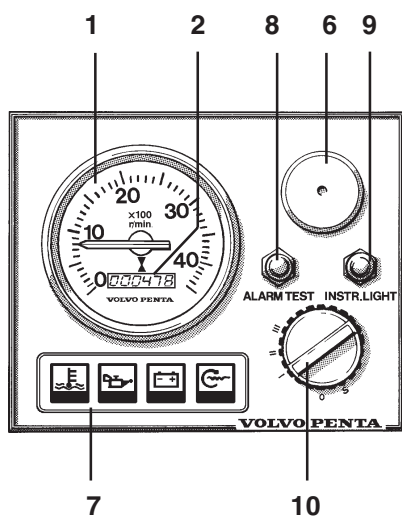
# Instruments

There are two types of instrument panel: the main panel and the secondary helm panel. The alarm panel and the main switch can in some cases be installed separately.

## Main panel



## Panel for auxiliary controls



### 1. Rev counter

This shows the engine speed in revs per minute x 100.

#### Speed

It is important that the engine reaches a maximum speed of 3900, or as near this speed as possible, with a normal load. A recommended maximum cruising speed is around 200 r/min below the maximum speed achieved.

Note! Growth on the hull reduces the speed.

### 2. Operating hours

Shows the number of operating hours in hours and tenths of an hour.

### 3. Temperature gauge

During normal use, the temperature gauge should display 75–90°C (165–195°F). The alarm will sound if the cooling water temperature is too high.



**If the alarm comes on, reduce the speed to idling in neutral. Check the reason for the alarm, if necessary stop the engine and repair the fault.**

### 4. Oil pressure gauge

The oil pressure gauge should normally show 300–500 kPa (45–75 psi) when the engine is running. It is normal for the gauge to show a lower reading at lower speeds. An acoustic alarm will sound if the oil pressure is too low.



**If the alarm comes on, stop the engine immediately and determine the cause.**

### 5. Voltmeter

The voltmeter shows the system voltage. When the engine is running, this is ca 14 V in a 12 V system and ca 28 V in a 24 V system. The voltages are 12 and 24 V respectively when the engine is switched off.

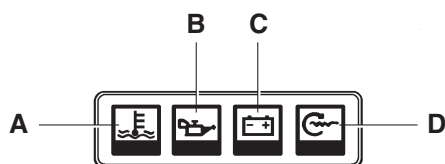
### 6. Alarm

Sounds if the engine oil pressure is too low, if the coolant temperature is too high or if the generator is not charging.

### 7. Warning display

The panel has four windows which light up red to indicate the reason for the alarm, the acoustic alarm signal also sounds:





- A. High cooling water temperature
- B. Low oil pressure
- C. No charge
- D. Pre-heating (extra equipment)

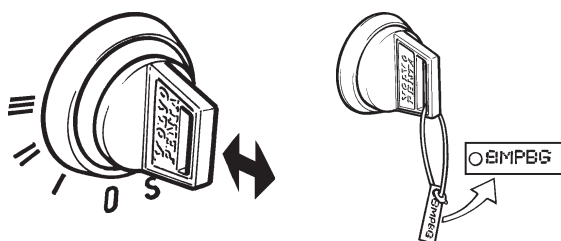
## 8. Pushbutton circuit breaker

For testing alarm functions and for acknowledging an alarm.

- **No alarm:** Alarm test, all warning lights come on with a steady light and the siren sounds.
- **On alarm:** Acknowledges alarm, the siren stops but the warning lights flash until the fault has been repaired. If a new alarm is triggered the siren sound and the next warning light starts flashing.

## 9. Pushbutton circuit breaker

For turning the instrument lights on and off.



## 10. Key switch

**S** = Stop position for stopping the engine.

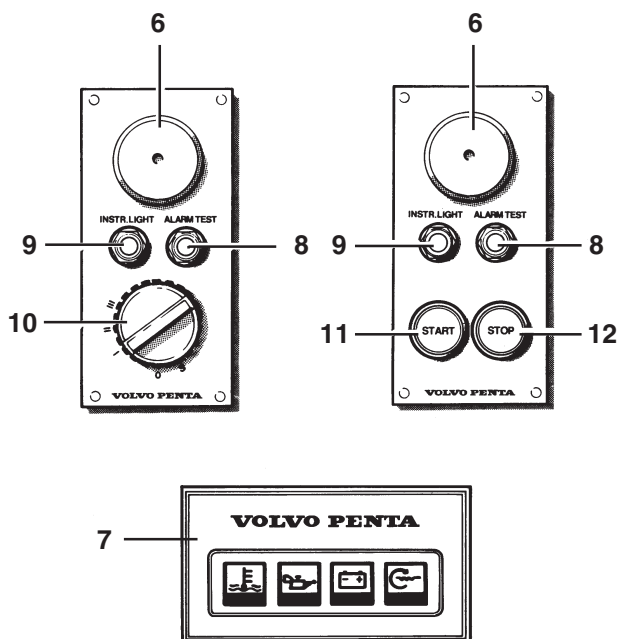
**0** = Everything connected across the key is switched off. The key can be withdrawn from the lock.

**1** = Drive position. The warning display is lit up during the start procedure and the alarm can be tested using "alarm test".

**2** = Glow plug. Used only on engines equipped with preheating.

**3** = Start position. Release the key as soon as the engine starts.

The ignition switch key has a tag attached with the key code on it. When ordering an extra key this code must be included. Do not keep the code tag on the boat to avoid unauthorized persons obtaining the code.



## Instrument kits

Instruments are also available in kits. Three smaller panels for starting and stopping the engine and disconnecting the alarm functions are available. The functions are similar to the main panel. For the operating panel on the auxiliary or secondary controls the following applies:

The key switch in the main panel must be in position 1 (operating position) in order to start the engine from the auxiliary controls.

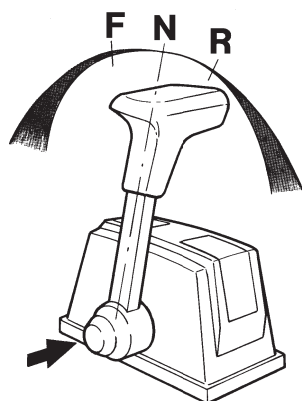
Engines with pre-heating: The glow plugs can only be activated via the ignition switch in the main panel.

**11.** Starter button. Release the button as soon as the engine starts.

**12.** Stop engine button

# Control units

## Single lever control

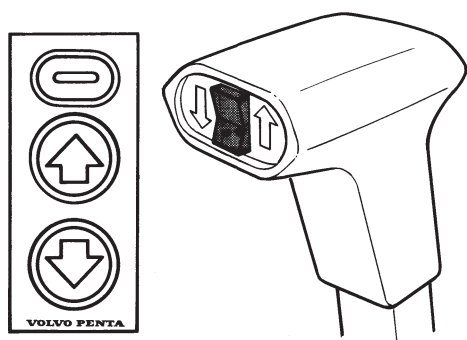


**Release.** Lever in neutral **N**. Press the button in the centre of the lever hub. Push the lever forward slightly. Release the button. Only the speed will be affected now. When the lever is returned to the neutral position, it comes out of neutral automatically and the speed, forward and reverse can be regulated.

**F = Forward.** Simultaneous control of speed and movement.

**R = Reverse.** Simultaneous control of speed and movement.

## Power Trim controls



**Trimming and tilting** the drive is done either from the separate control panel or using trim buttons on the control, if the control is suitably equipped.

The drive's trim position is shown on the separate instrument which is available in two configurations - digital and analog.

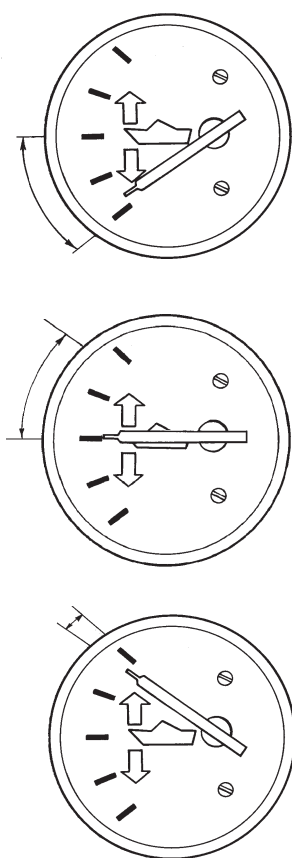
The control panel has three buttons. The bottom one lowers the bow, the middle one raises the bow and the other, red, button in combination with the middle button trims the drive in the Beach range (not DPX).

The control button on the control lever raises and lowers the bow by pressing its upper or lower segment. The separate switch on the instrument panel must be pressed to put the drive into Beach range (not DPX).



# Trim instruments

## Analog trim instrument, DP



The instrument is provided with a 5-line instrument face. The range from the lowermost to the 4th mark is the trim range, and is used during running, from start to planing speed.

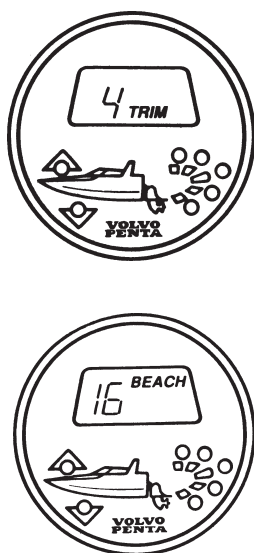
The red range to just below the the last line is the beach range. The beach range is used where shallow waters are suspected and when running in shallow waters at reduced speed, when launching or winching from/to a trailer ramp and when the boat is beached.

The area just before the last line is the lift range. This range is used when you need a maximum tilt. The Power Trim system is provided with an automatic switch which breaks the current at the end position. The stop is reset automatically when the drive is lowered.



**WARNING !** The engine must never be run while the drive is in the lift range.

## Digital trim instrument, DP



Shows the current figure within the measurement angle. This figure corresponds to the drive's angle in relation to a vertical line (boat laying still). The Power Trim instrument is provided with a built-in checking program, which starts every time the instrumentation is engaged – every time the key switch is turned on. When the checking program is running, all the LCD segments light up and "A BEACH" is indicated. After that the instrument returns to the mode indicating the actual trim angle of the drive.

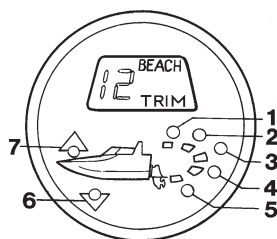
**TRIM** = Max trim through 5. Drive position at all speeds.

**BEACH** = Used when tying up in shallow water or where there is doubt about the depth. The speed must always be slow. Range 6 through 40

**LIFT** = Flashing red warning light (digital instruments). Drive fully tilted.



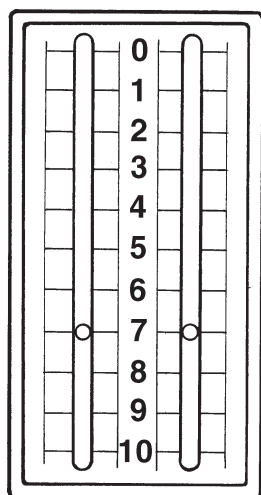
**WARNING !** The engine must never be run while the drive is in the lift range.



### LEDs (digital trim instruments)

- 1 Flashes red in tilt range above 40. Otherwise off.
- 2 Continuous red light: Range 6 through 40. Otherwise switched off.
- 3 Continuous green light: Range 2 through 5. Otherwise switched off.
- 4 Continuous green light in the range 0 through 2. Otherwise switched off.
- 5 Continuous green light in trimmed position through 0. Otherwise switched off.
- 6 Continuous yellow light in max. trimmed position through 0. Flashes when drive moves and the bow is lowered. Otherwise switched off.
- 7 Continuous yellow light: Range 2 through 5. Flashes when the drive moves and the bow is raised.

### Trim indicator, DPX



The trim indicator, which is mechanically controlled, displays the drive position in the trim range as a digit from 0 to 7. Check during the first test drive which trim position provides the best comfort and then use this number as a starting position in the future.

When the drive is in the Beach range, 7-10, the speed must be lower than planing speed. The engine must be stopped when fully tilted.

The trim indicator displays the position in the trim range and the beginning of the Beach range only. In the case of a double installation, individual trimming of the drives is permitted in the trim range. Take note of the trim indicators.



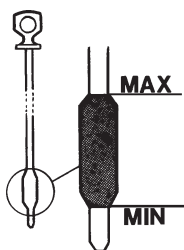
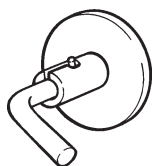
**WARNING !** If the drive needs to be tilted in the Beach range, both drives must be tilted at the same time (i.e. parallel) to prevent unnecessary stress on the tie rod between the drives.

When tilting in parallel, both drives must be trimmed to their forward positions first. Start lifting from this position.

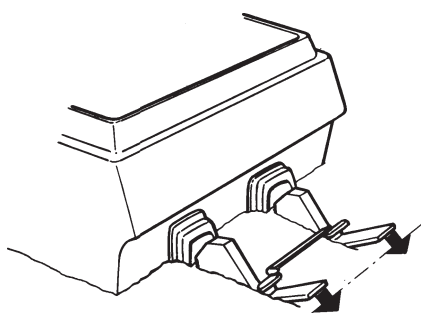
When lowering the drives, it is important for both to be lowered in parallel to avoid breaking the tie rod.

# Driving

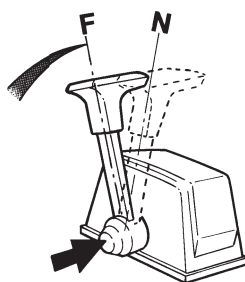
## Starting



- 1 Check the oil level in the engine.
- 2 Switch on the main switch.
- 3 Start the engine room fan. Let it run for a few minutes.



- 4 Lower the drive if it is tilted.  
DPX Double installation: Lower both drives at the same time.



- 5 Release the control lever. Idling position.
- 6 Start the engine. (See "Ignition switch".) Adjust the speed to idling.

If the engine is equipped with pre-heating, this must be engaged about 30 s before starting.



**WARNING!** Do not race the engine immediately after starting. This could damage the turbo compressor.

- 7 Read the instruments. If the readings are abnormal, stop the engine and determine the cause.
- 8 Check for obstructions in front of and behind the boat before selecting "Forward" or "Reverse".

The maximum cruising speed is maximum speed less ca 200 r/min. Good operating economy is achieved if full throttle is avoided.

We recommend that you decrease speed and raise the drive(s) to Beach range when operating in shallow water.

**DPX double installation:** The drives must be tilted simultaneously to avoid stress on the tie rod.

Check the instruments regularly while driving. Stop the engine to determine the cause if any reading is abnormal.

## Power Trim

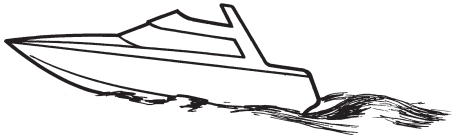
The DP and DPX drives have a hydraulic trim system (Power Trim) which makes it possible to adjust the boat's trim for maximum comfort and fuel economy in different operating conditions.

Every boat has its own unique characteristics that are also affected by external factors. When you have got to know your boat thoroughly you can experiment with the best trim angles for different speed, load and sea conditions. 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. **NOTE!** For information about the Power Trim controls and instruments. See chapters **Control units** and **Tim instruments**

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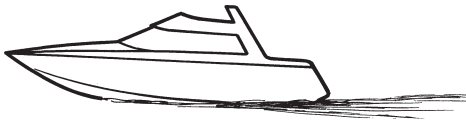
## With the drive in the "Trim range"

**⚠ WARNING!** The drive should not be trimmed violently when running at high speed. If the bow is lowered at high speed the boat's ability to hold a course may become unstable. To a great extent this is dependant on the shape of the hull and will vary from boat to boat. However, even if safety is not compromised the result may be an unpleasant experience for driver and passengers, who may lose confidence in the boat's handling.



### 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 running position which feels comfortable and the boat feels stable and smooth.

### For maximum fuel economy

Run boat at a constant throttle opening. Trim the drive out/in a little. 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.



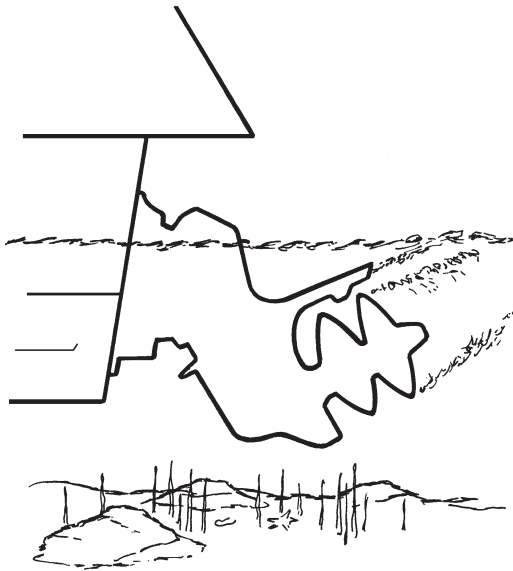
### In choppy seas or running against a heavy sea

Trim drive so the bows drop. This will provide more comfortable running.

**⚠ WARNING!** High speed running in a heavy sea is dangerous. High speed running in a heavy sea requires the driver's maximum attention and a boat of the right size and design for this type of running.

### Side winds

If the boat has a dual installation the drives can be trimmed at different trim angles. This compensates for side winds or uneven transverse load distribution (athwartships), which makes the boat list during running.

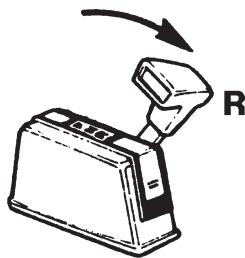


## With the drive in the "Beach range", running in shallow water

If you do not know how much water is under the keel, slow down and trim the drive to the "Beach range".

**⚠ IMPORTANT!** Maneuvering characteristics change with the drive in the "Beach range": Always lower your speed before trimming the drive in the "Beach range". Max. permitted engine speed (rpm) when running in the "Beach range" is 1000 rpm.

**⚠ IMPORTANT!** DPX: There is no automatic stop between the "Beach" and "Lift" ranges. Check the trim indicator carefully to see if the "Lift" range has been reached. The engine must not be run with the drive in the "Lift" range.



## Maneuvering astern (reverse)

Maneuvering astern should be carried out with the drive in the "Trim" or "Beach" position. Always let engine speed drop to idling speed before shifting to reverse. Be careful not to go aground or hit anything when maneuvering astern. The hydraulic system can only free the drive when travelling forward, there is no protection in case of a collision when maneuvering astern.

**⚠ WARNING!** Never shift to reverse when the boat is planing. There is a danger that water will get into the engine causing serious damage.



## Running aground, kick-up function

The DP/DPX drive has a built-in Kick-up function which releases the drive if it grounds or strikes an obstruction 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).

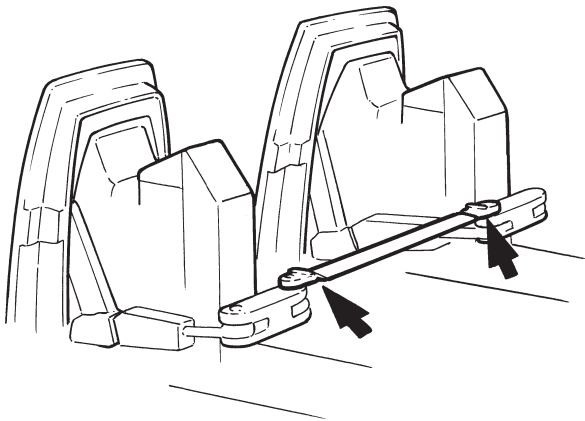
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After running aground check for damage to the drive or propeller and for vibrations from the drive. If this is the case then the boat (if possible) should be run to harbor at reduced speed and taken out of the water.

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 a 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 chapter on ***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 dealer for assistance.

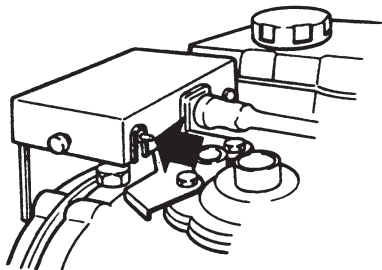
#### With the drive in the "Lift range"

**⚠ IMPORTANT!** The engine must never be run in the "Lift" range.

See also chapter: **Stopping the engine**, "Using a boat trailer".

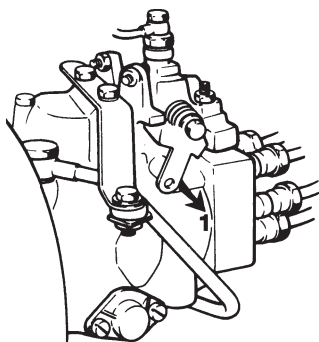


## General information, engine



### Automatic fuse

An automatic fuse may have tripped if the engine cannot be started or if the instruments display 0 readings. If this is the case, reset the fuse using the button. Always investigate the cause of overloading.



### Emergency stop

A diesel engine is not dependent on a power supply for its operation. Should a serious electrical fault occur, the engine can continue to run but the normal stop function of the ignition switch is inoperative. Emergency stopping of the engine can always be done by pulling the injection pump lever (1) backwards.

### KAD42, KAMD42

The engine is equipped with a mechanical compressor which provides powerful acceleration up to the planing position. The compressor is engaged and disengaged electronically depending on the speed. Engagement is at approx. 1700 rpm depending on the setting and disengagement takes place at approx. 2500 rpm.

The compressor also has a “kickdown” function which engages the compressor at speeds from idling to 3100 rpm.

When operating in the vicinity of the compressor's engagement/disengagement speeds, the compressor can be engaged/disengaged for brief periods. If this is done, adapt the speed so that the compressor is either constantly engaged or disengaged. The engine sound changes when the compressor is engaged. This is quite normal.

### Sailing boats

During sailing the propeller may cause the propeller shaft to rotate when the engine is stopped. This rotation may be harmful to the reverse gear since its oil pump is stationary when the engine is stopped. **When the engine is stopped, the propeller shaft can be allowed to rotate for max 24 hours.** However, it is beneficial where possible to run the engine every 8 hours to lubricate and cool the reverse gear. If the above cannot be accomplished, a shaft brake must be fitted.

### After use

- 9 After use and when the boat is tied up, it is important for the engine to run at idling for at least 1 minute to avoid subsequent boiling of the coolant.
- 10 Trim the drive to the maximum trimmed position to protect the trim cylinders' untreated surfaces from fouling. The exception to this is when there is a risk that the drive could run aground. The drive then must be raised instead to the maximum position. Do not forget to lower the drive before starting.

**DPX double installation:** Both drives must be tilted at the same time and lowered at the same time before starting.

Stop the engine using the ignition switch.



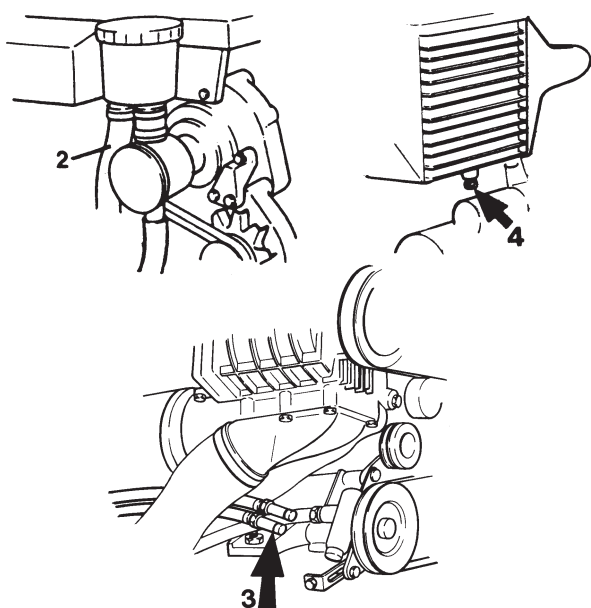
**WARNING! Never** switch off at the main switch before stopping the engine. This could damage the alternator.

- 11 Switch off the main switch.
- 12 Before you leave the boat check for leaks around the engine and that everything else in the engine compartment appears normal.

## Cold weather precautions

15 In cold weather when there is a risk of freezing, it is important that the freshwater system's coolant has sufficient frost protection. The seawater system must be drained.

Watch out for leakage into the boat. Drain as follows:



Disconnect the hose (2) from the seawater filter and bend it down so that the water runs out. Reconnect the hose. Drain the oil cooler and the aftercooler (4), and undo the cover on the seawater pump and allow the water to drain out. Drain the oil cooler on the KAD42 via the hose (3) marked blue.

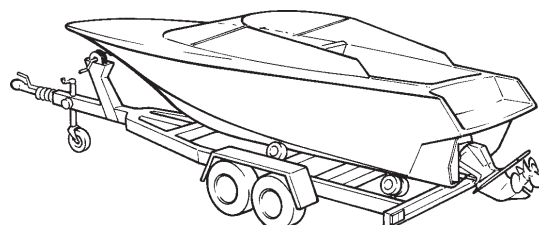
Reverse gear HS1A: Close the bottom cock and undo the hose on the oil cooler port side.



**WARNING!** Do not forget to close the cocks. Never leave the boat with open cocks or hoses that are not connected. There is a risk that the boat could sink.

## Idling the engine

If the engine is to remain unused for a long period of time, the engine should be run warm, at least once a month.



## Using a boat trailer

Raise the drive to the maximum before loading on the trailer. Also refer to pages 13-14 Trim instrument, Power Trim. Before the boat is transported on a trailer, the drive must always be secured in the raised position so that it cannot possibly drop down. Boats which are to be stored on land between periods of operation have an impaired galvanic protection due to oxide formation on the zinc anodes. Hence, before launching, the protective anodes on the drive and shield should be cleaned with emery cloth to remove any oxide.

**Note!** A steel brush or other steel tools may not be used for cleaning as this will cause deterioration of the galvanic protection.



**WARNING!** To avoid injury, always make sure that the engine is switched off before starting work on it. There are many moving parts - pulleys, drive belts etc.

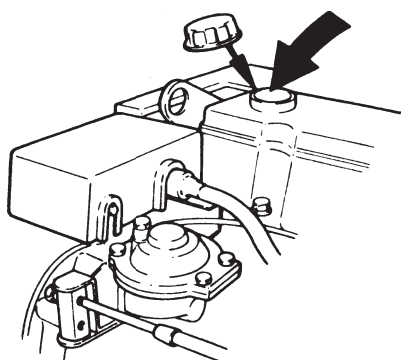
# Regular maintenance

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## Daily inspection before starting

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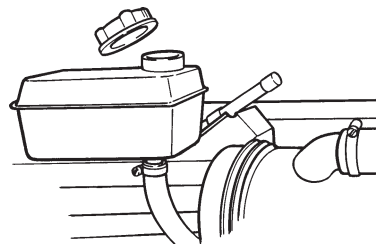
### Checking the engine oil level



When checking the level refer to "Technical data" for the correct type of oil.

**CAUTION!** Fill to no higher than the "Max" mark. Never allow the level to fall below the "Min" mark.

### Checking the coolant level



**WARNING !** Observe extreme caution when checking the coolant level if the engine is hot or running - the system is pressurized.

Turn the cap on the expansion tank to the first stop to relieve the pressure. The level should be between the maximum and minimum marks when the engine is hot. It is normal for the level to be lower when the engine is cold. Fill as required when the engine is running.



**WARNING !** Beware of moving pulleys and drive belts.

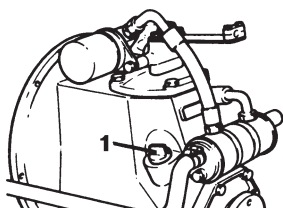
Use Volvo Penta type 90 coolant or a 50/50 mixture of antifreeze and water.

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## Check every 14 days

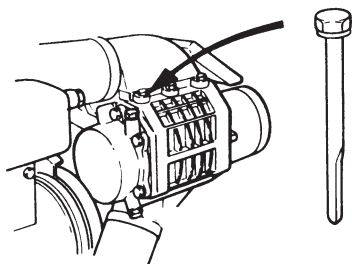
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### Checking the oil in the reverse gear



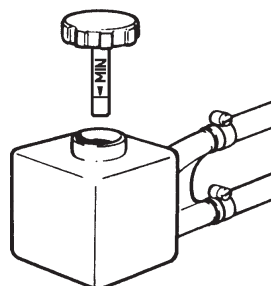
Check with the engine stopped. The dipstick (1) should not be screwed in during measurement. Top up with oil as required in accordance with "Technical Data".

## Checking the oil level in the compressor KAD42



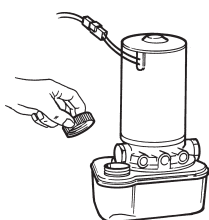
Check with the engine stopped. The dipstick (1) must not be screwed in during measurement. The oil should be changed every 200 hours. For oil type, see "Technical Data".

## Checking the oil level in the servo steering (DP)



Turn the filler cap anti-clockwise and remove it. Check that the oil level is between MAX and MIN on the dipstick. For oil grade, refer to "Technical Data".

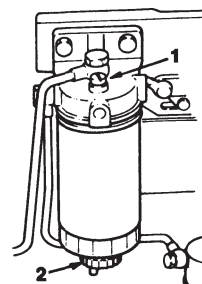
## Checking the oil level in the trim pump



Check that the oil level is between MAX and MIN in the container with the drive trimmed. For oil grade, refer to "Technical Data".

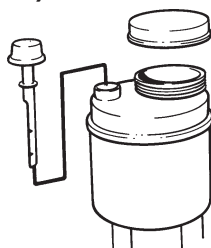
Never mix engine and ATF oil.

## Drain water from the fuel filter



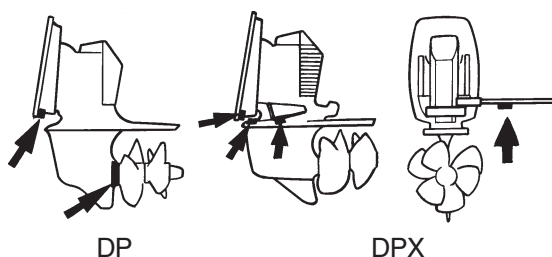
Open the vent screw (1) 3 turns, then the drain screw (2) and let any water run out. Vent the fuel system.

## Checking the oil level in the hydraulic pump (DPX)



Check with the engine(s) running at idling speed. The level should be between Max and Min markings on the dipstick. Note! The level is somewhat higher with the engine stopped. Top up with ATF oil. For grade, refer to "Technical Data".

## Check the corrosion protection

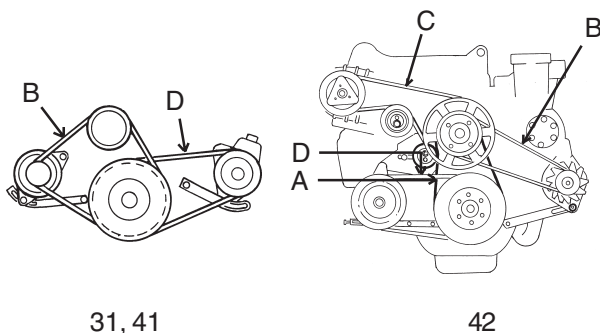


Replace the sacrificial anodes when they are halfway corroded. Remove the oxide layer from the corrosion protectors with an emery cloth. Never use a steel brush or other steel tools.

During replacement - **scrape the contact surface clean.**

For detailed corrosion information, see page 30

## Checking belt tension

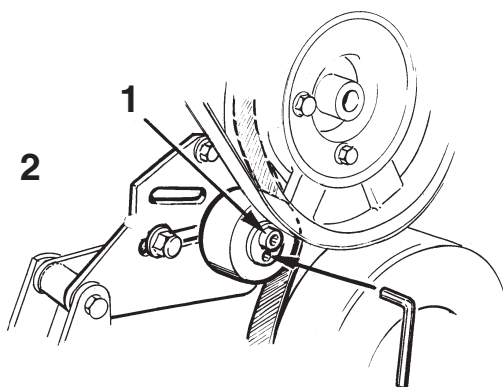


If belts are too highly tensioned it can damage the bearings in the water pump and alternator. If belts are undertightened they can slip. Worn belts should be replaced. Adjust belt tension immediately after the engine has been run and while the belt is warm and flexible. After a few hours' running the belt tension should be checked and re-adjusted as necessary. Check tension by depressing the belts using normal thumb pressure at the checkpoints (A, B, C etc.) shown for each belt.



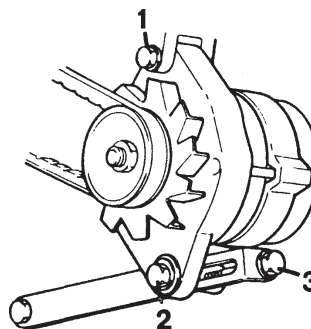
**IMPORTANT!** KAMD 42/KAD 42; to avoid uneven loading the belts are tensioned in the order shown below.

## Circulation pump belt (42)



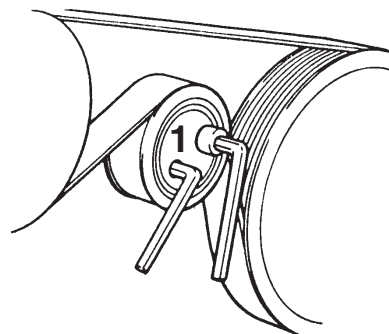
Loosen screws (1) and (2) so that the belt slackens. Place an Allen key in the hole and turn the belt tensioner until correct tension is set. Tighten screw (1) and then (2). At the correct tension it should be possible to depress the belt approx. 5 mm at (A).

## Generator (alternator) belt



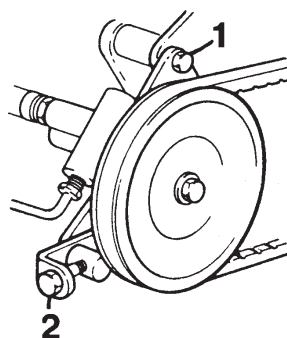
Loosen the generator mounting screws (1) and (2). Tighten the belt with the adjuster screw (3) so that the belt can be depressed approx. 10 mm between the pulleys at (B). Tighten the screws (1) and (2).

## Compressor belt (42)



Remove the cover. Loosen the screw (1) so that the belt slackens. Insert an Allen key in the hole and turn the belt tensioner until the belt is sufficiently tensioned. It should be possible to depress the belt 5 mm at (C).

## Servo-pump belt



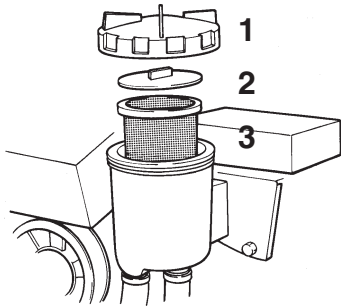
Loosen the mounting screw (1). Tension the belt with the adjuster screw (2) so that the belt can be depressed approx. 10 mm between the pulleys at (D). Tighten the screw (1).

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## Check every 50 hours

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### Check the sea water filter

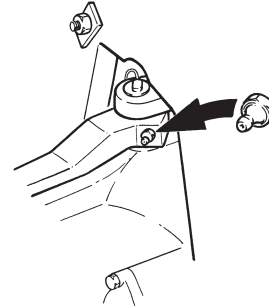


Loosen the cover (1) and remove the sealing plate (2), then lift out the insert (3). Shake out the insert and flush it clean. Note! Check and clean more often when the boat is operated in waters containing considerable amounts of sediment, contaminants or barnacles. Risk of clogging and overheating.



**WARNING!** Avoid water penetration.

### Lubrication of steering shaft bearing



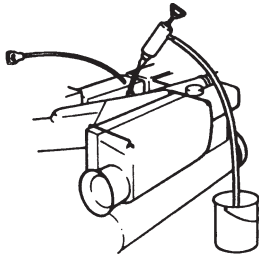
Lubricate the steering-shaft bearing with a grease gun. Use water-resistant grease. Press grease in until it emerges by the bearing.

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## Check every 100 hours or at least once every season

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### Changing engine oil

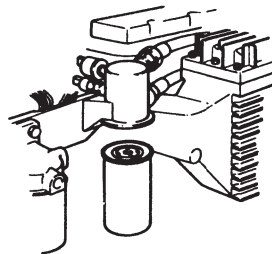


Run engine until warm. Stop the engine and suck up the oil through the tube for the dipstick. Change the oil filter and top up with oil to the right level. Oil type - see "Technical Data".

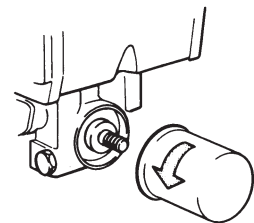


**WARNING!** Hot oil can cause burns.

### Changing the oil filter



KAD 42



31, 42

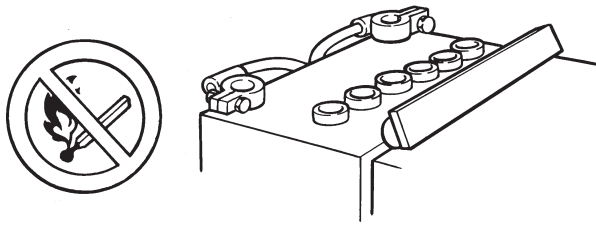
The oil filter is replaced for the first time after 20 hours and then every 100 hours.

Coat the rubber gasket on the new filter lightly with oil. Screw the filter onto the contact surface and then another half turn, no more. Check for leakage.

**NOTE!** The oil filter contains oil, dispose of it in a way that will not harm the environment.



## Battery electrolyte level



The level should be 5-10 mm above the cell plates in the battery. Top up with distilled water when necessary.

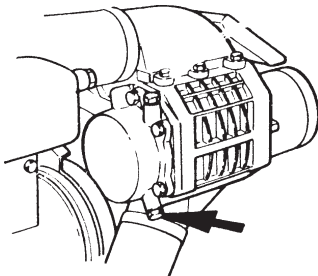
**NOTE!** Certain maintenance-free batteries have special instructions that must be followed.



**WARNING!** Risk of explosion. No naked flames or sparks! Electrolyte can cause personal injury. If it gets into the eyes, rinse with plenty of water. Obtain medical assistance immediately!

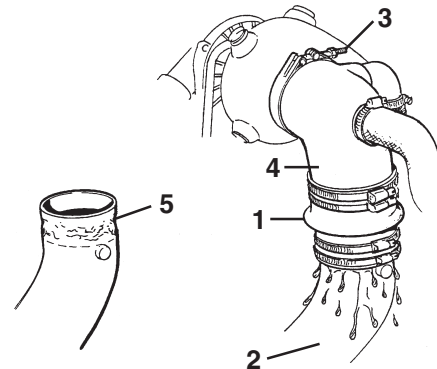
## Check every 200 hours or at least once every season

### Oil change in compressor



Run the engine until warm. Stop the engine and remove the oil dipstick. Remove the plug and let the oil run out. Refit the plug and fill up with oil. Concerning quality and capacity see Technical Data.

### Exhaust pipe, Inspection



The exhaust pipe in outboard drive installations must be checked annually for corrosion damage between the hose (1) and the pipe (2).

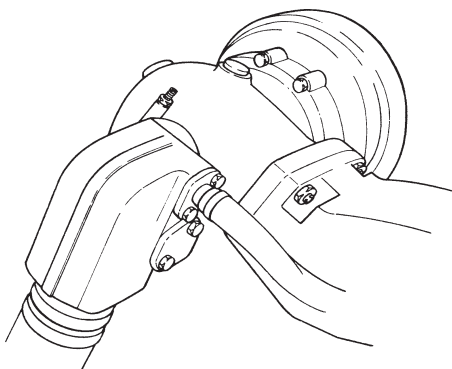


**WARNING!** Risk of water entry. Check the exhaust pipe with the boat hauled up on land.

If there is considerable corrosion damage, the pipe must be repaired or replaced by a new one.

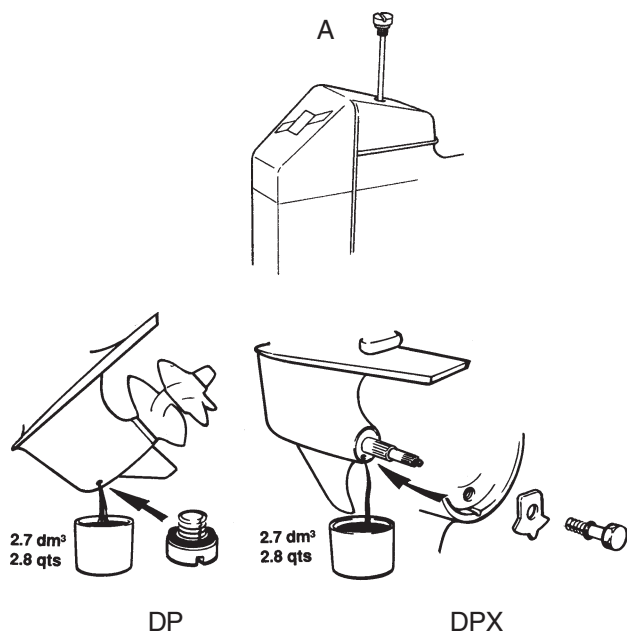
To check: Undo clamp (3) and the two lower clamps which hold hose (1). Lift up the elbow (4) to undo the hose from the pipe. Check the mating surface (5). If there is considerable corrosion damage, the pipe must be repaired or replaced by a new one.

### Turbocharger

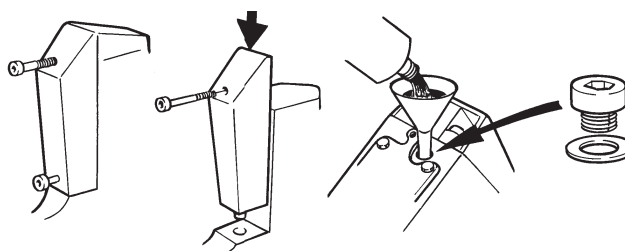


Check the airtube and connections for leakage. Check the airtube when the engine is running. Whistling or hissing sounds are signs of leakage. Leakage can also be detected by brushing soapwater on suspected spots on the pressure side between the turbocharger and the engine. Tighten hoseclamps or replace the airtube if necessary. If there are problems with the turbocharger contact an authorized Volvo Penta dealer.

## Changing the oil in the drive



Take out the dipstick (A). The DP-drive should then be trimmed upwards to the maximum. The DPX drive should be trimmed (forwards) to the maximum. Remove the plug from the gear housing and let the oil run out. If the oil is discolored, contact your VP service workshop. Refit the plug with its O-ring. A damaged O-ring should always be replaced. Consider the environment and dispose of the old oil at an environment protection or service station.

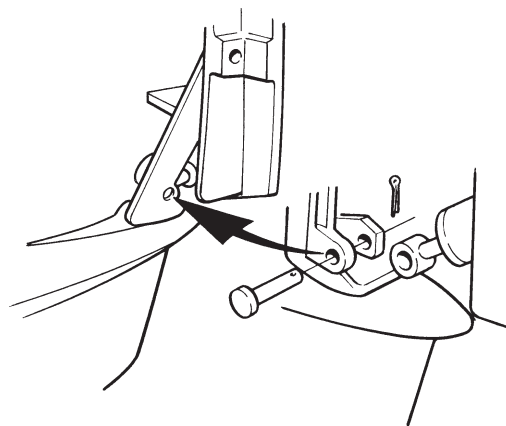


Take off the cover and remove the oil filler plug together with its O-ring. Top up with fresh oil. For grade and quantity, refer to "Technical Data". Lower the drive.

Check the oil level after a while with the dipstick. The dipstick must not be screwed in when checking the level. If the level is too high, oil must be drained off. If too low, oil must be topped up through the hole for the dipstick.

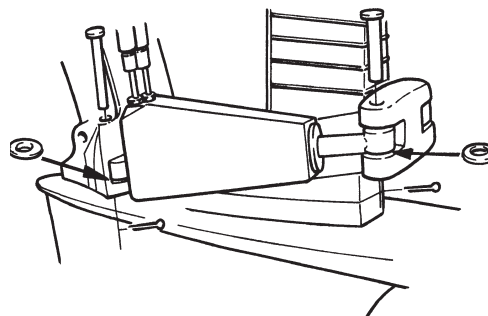
Check the tightening of the dipstick and bottom plug. Refit the cover.

## Bellows. Replacement

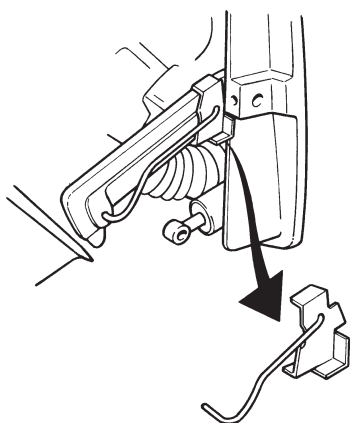


Check the condition on the universal joint and the exhaust bellows every year. If there are cracks or other defects they must be replaced. Otherwise replace every other year. The drive may need to be removed from the support fork to replace the bellows. Removal of the drive requires special knowledge 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.

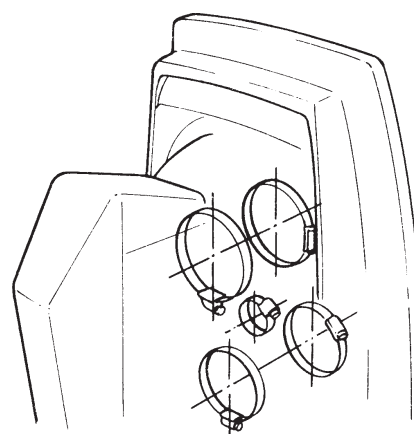


**DPX:** Also remove steering cylinders by removing pins. Tie up the steering cylinder so that they do not hang in the way.

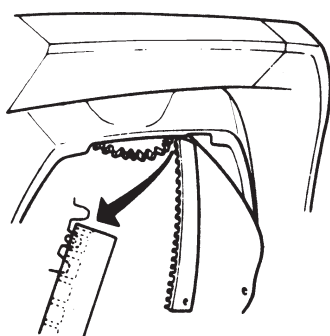


Tool 885143-8, when properly installed, prevents the drive falling. Install the tool as follows: Trim the drive down to 0. Remove cotter pins and knock out trim cylinder bolts. The drive can now be lifted by hand to its raised position. Hold the drive steady in this position and install the tool on the starboard side as illustrated. Carefully check the bellows for damage. The exhaust bellows can be replaced without removing the drive.

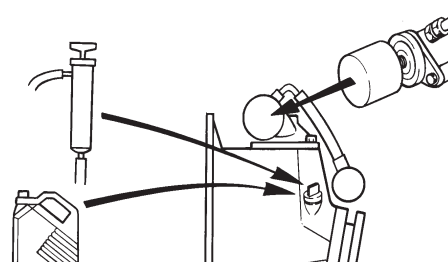
**⚠ WARNING!** Do not overload the tool by standing on the raised drive.



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



**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.

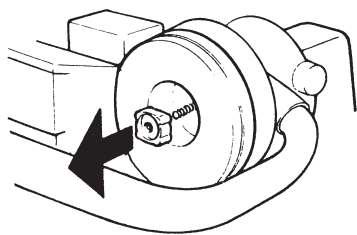


## Changing oil in the reverse gear

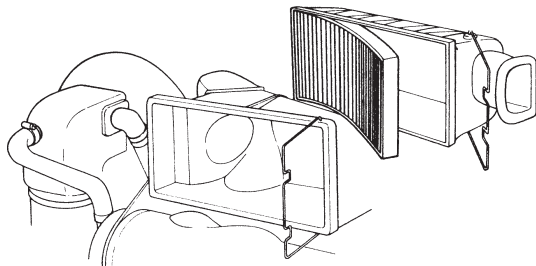
Use the oil bilge pump and suck up the oil through the hole for the dipstick. Replace the oil filter. The reverse gear should be filled up to the upper mark on the dipstick. Then start the engine and run it at least 1500 rpm to fill the reverse gear oil cooler with oil. Stop the engine and check the oil level. Then top up again as necessary. Oil grade, refer to "Technical Data".

**Note!** Dispose of the discarded oil and oil filter so as not to cause damage to the environment.

## Changing the air cleaner (ACL)



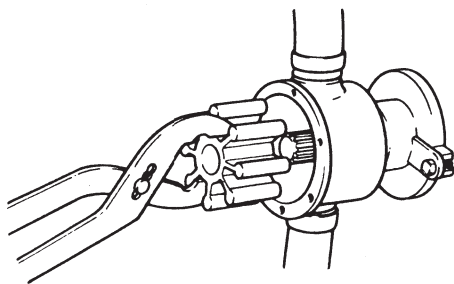
31,41



42

The engine must not be running - risk of personal injury! Be careful so that dirt does not get into the cover.

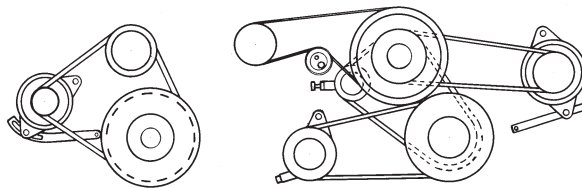
## Checking and replacing the pump impeller



**WARNING! Avoid water penetration.**

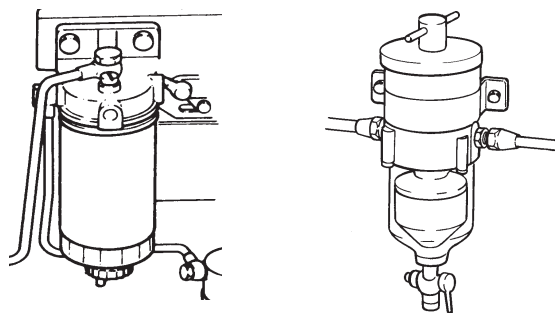
Remove the cover on the seawater pump. Inspect the pump impeller. A defective impeller should be replaced. If the shaft can be rotated, the driver must be replaced. The most common cause of damage to the impeller is shortage of seawater, so check the seawater inlet and filter.

## Checking the belts



Replace the belts when worn or cracked. Check belt tension after a few hour's running. Refer to "Check every 14 days"

## Replacing the fuel filter



Unscrew the old filter. Take care with fuel spillage. **NOTE!** The old filter contains fuel. For environmental and fire protection reasons, it should be disposed of in a suitable way.

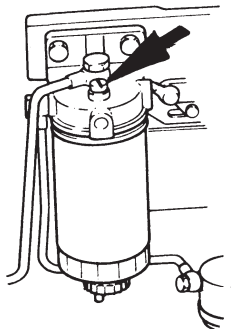
Check that the mating surface on the engine is clean. Lightly lubricate the rubber gasket on the new filter with diesel oil. Tighten by hand until contact and then a further half turn. Vent the system and check for leaks. If an extra fuel filter is fitted, the filter cartridge is replaced and the water drained off. Water can damage the injection pump and injectors.

## Venting the fuel system

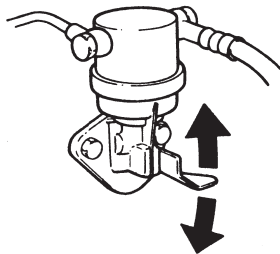
Venting must be carried out in the following cases before the engine can be started:

- ☐ When a filter is replaced
- ☐ When the engine runs out of fuel
- ☐ When the injection pump has been removed
- ☐ When the fuel system is repaired
- ☐ Leakages or if the fuel lines are opened
- ☐ If the engine has not been run for a long time

**Vent** system as follows:

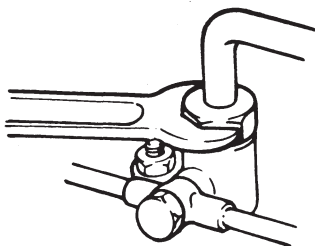


Open 4 turns. Avoid spilling fuel. Pump manually.



Close when there are no more air bubbles visible in the fuel. If the pump effect is poor rotate the engine a little.

If the engine does not start, continue bleeding. Pump manually for approx. ½ minute for automatic bleeding of the injection pump.



Undo all pressure pipe nuts. Set the speed control to full speed. Run using the starter motor until fuel appears. Avoid spillage. Tighten the nuts.

## Other checks

Some checks and tasks require special knowledge and we therefore recommend that you use an authorised workshop. The following checks fall into this category:

- ☐ Checking the Turbo compressor (200 hours)
- ☐ Adjusting the valves (200 hours)
- ☐ Checking the starter motor and alternator (200 hours)
- ☐ Checking the injectors (600 hours)
- ☐ Checking the electrical system (200 hours)

**The cooling system** operates normally when the gauge shows 75–90°C (165-195°F). Overheating can be caused by the following:

- ☐ Blocked seawater inlet, seawater filter or oil cooler.
- ☐ Defective pump impeller and/or carrier in seawater pump.
- ☐ Air in freshwater system.
- ☐ Coolant level low.
- ☐ Slipping or broken drive belt for circulation pump.
- ☐ Faulty thermostat, temperature gauge or instruments.

**Avoid water penetration** when working on the cooling system.



**WARNING! If the boat must be left with parts of the cooling system removed, make sure that water cannot leak into the boat in an uncontrolled manner causing it to sink.**

**Never top up** the cooling system with water alone since the coolant properties with respect to boiling point, corrosion protection and frost protection may be reduced.

Drain and flush the cooling systems once a year.

If the boat is used in water with a high salt content or in abnormally contaminated water, it is important for the seawater system to be flushed more often with freshwater. This avoids the accumulation of deposits and salt crystals.

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## Electrolytic corrosion

Your boat and its engine/transmission package are equipped with sacrificial zinc anodes (replace with magnesium anodes in freshwater lakes) in order to protect the drive and propellers against galvanic corrosion. This protection can malfunction if so-called leakage currents from the electrical system occur. This can happen if faulty equipment is used or the connection of electrical equipment to the negative pole is incorrect (grounding, protector ground). The following should always be observed:

The main switch for the engine should be connected to the positive (+) pole of the battery. The main switch should disconnect all circuits. Electrical cables should be routed and clamped so that they are not exposed to dampness or the risk of exposure to any bilge water in the keelson.

If several batteries are used, there should be separate switches for extra equipment. There should also be a main switch between the positive (+) pole of the extra battery and the fuse panel for the boat's electrical equipment. The main switch for the extra battery should disconnect all circuits connected to it and should be switched off when there is no longer a need for electricity. The main switch for the engine should be disconnected as soon as the engine is stopped.

The engine or drive must not be electrically connected with other equipment such as trim tabs, ladders, etc. The engine and drive must not be used as ground for radio or navigation equipment or for other electrical equipment where separate ground cables are used. All such separate ground connections should be gathered to a common ground point separated from the engine/drive.

If shore power is connected, no protector ground must be connected to the engine or to any other ground point in the boat.

The transformer for shore power should have the protector ground on the input side (120/220 V) and the negative connection on the output side (12/24 V) without any connection to each other.



**WARNING!** Electrolytic corrosion resulting from leakage currents may cause severe and expensive damage to the boat's equipment in a short space of time. Work on the boat's low-tension circuit must only be carried out by trained electricians or by people who have expertise in the subject. Installation or work on the shore power equipment must only be carried out by electricians qualified to work on high-voltage installations.

## Galvanic corrosion

Your drive has been protected from galvanic corrosion in various ways. Apart from sacrificial anodes, there are grounding loops that provide a link between the various separate parts of the drive. Check annually that loops are intact and ensure good contact. A broken connection can result in considerable corrosion of an individual component despite functioning protection for the rest of the drive.

Volvo Penta drives are equipped as standard with sacrificial anodes intended for salt water. These are furthermore dimensioned for the propellers with which the drive is equipped as standard. For DP drive the following must be borne in mind regarding freshwater operation and propeller replacement.

Boats that are operated primarily in fresh water should have these anodes replaced by a magnesium ring, VP Part No. 876138-9. DP drives fitted with stainless steel propellers should be provided with two zinc plates on the shield. These are fitted with 2 bolts Part No. 963701-8 and 2 spacer sleeves 854486-8.

Anti-fouling bottom paints or incorrectly undertaken painting can increase galvanic corrosion. Also refer to page 33 regarding bottom painting.



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## Maintenance instructions for DP drive installations in commercial use

The more detailed instructions given in the instruction book must be followed in addition to these brief instructions. This applies to items of equipment as well as when running-in the engine.

Note that the service intervals for installations in commercial operation differ from the intervals given in the instruction book.

The checks which should be carried out by technicians at an authorized workshop are written in italics.

### Daily

Visual inspection of the drive and propellers. Damaged propellers must be replaced.

### Monthly

Check the corrosion protection on the drive and cover. Replace when half the anode has been corroded. Check the universal-joint and exhaust bellows. Replace as required.

Replace the corrosion protection.

Check painted surfaces for corrosion damage and/or places where mechanical action has removed the paint.

### Annually

Clean and touch up paint.

*Replace the universal-joint and exhaust bellows.*

Replace the exhaust bellows between the engine's exhaust bend and the cover's exhaust pipe.

### After the first 2-5 hours

Run in the drive with a light load. The oil in the drive **must be changed after 2-5 hours**. Check that the drive is properly drained.

### Every 125 hours

Change the lubricating oil. See the recommendations in Technical Data.

Lubricate the guide bushings in the cover.

Check the oil level in the servopump (on the engine).

Check the oil level in the trim pump.

Check the tightening torque at the following points:

*1 The joint between the lower gear housing and the intermediate housing.*

*2 The joint between the upper gear housing and the intermediate housing.*

*3 The joint between the steering arm and the steering spindle.*

Tighten the hose clamps.

Check the universal-joint bellows for any water leakage.

### Every 500 hours

*Check the bushings in the drive mounting.*

*Check the guide bushings and seal in the cover.*

*Check for play in the holes for the drive mounting journals in the drive.*

Lubricate the guide bearing in the guide fork.

Check the control cable, coupling bushings and controls.<sup>2</sup>

Check the grounding.

Check the servo cylinder and hoses for any oil leakage.

*Check for wear/play in the control cable.*

*Check the propeller shaft for straightness.*

*Check the gear mechanism for wear and serviceability.*

Check the "non-return valve" in the exhaust.

*Check that there is no abnormal play in the steering.*

### Every 1000 hours

*Change the drive for a replacement drive or recondition drive.*

Replace control cables and control bushings.

Check the exhaust pipe for corrosion damage.

Check the bellows between the exhaust pipe on the engine and the exhaust pipe on the inside of the cover.

Check the cooling water hoses and connections on the inside of the cover.

Check the hydraulic hoses for leakage and wear on the outside of the cover.

Additional action may be necessary if the type of operation differs significantly from Volvo Penta's application classes or if gear-changing is more frequent (more than 20 changes per hour on average).

### Restrictions

This maintenance instruction applies to:

Engine AD41 "Medium Duty" (165 hp / 3800 rpm).

Engine AD41 "Light Duty" (200 hp / 3800 rpm).

Maximum drive extension for commercial operation = 1".

If the water is severely polluted, particular attention must be given to corrosion damage.

Long period of operation in neutral should be avoided. The gear for forward propulsion must be engaged for a continuous period of at least 5 minutes for every hour of use.

# Laying-up

## Laying-up

If the boat is unlikely to be used for more than 90 days, or if there is a risk of frost, it must be put into storage.

### Long-term laying-up during the winter.

Let an authorized workshop test the engine and equipment before the boat is taken out of the water.

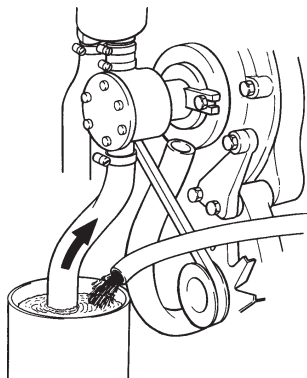
Do the following while the boat is in the water:

- ☐ Drain the engine oil once the engine is at normal operating temperature.
- ☐ Change the oil filter.
- ☐ Fill with engine oil to the correct level. See Technical Data.

Do the following with the boat laid up:

- ☐ Change the fuel filter.
- ☐ Bleed the fuel system.
- ☐ Change the air filter.

## Seawater system

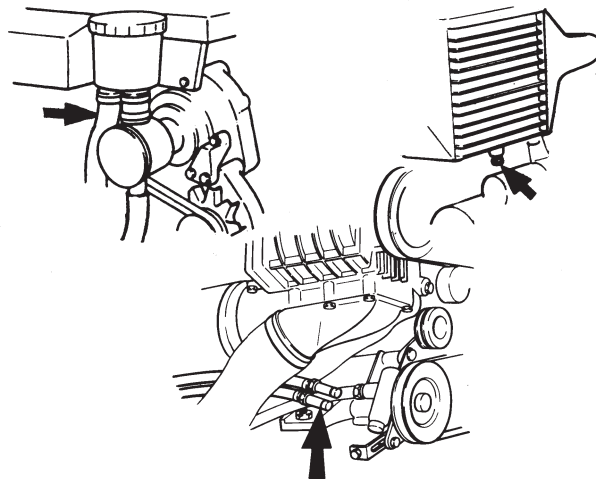


Flush the seawater system by placing one end of a suction hose from the pump into a bucket of fresh water. Arrange so that it can be refilled, then start the engine and let it idle for a while. It is very important to flush out any deposits and to avoid any salt crystals being formed. **CAUTION!** Do not allow the pump to run dry. To avoid corrosion damage in the cooling water channels, these must be filled with a mixture of 50/50 fresh water and anti-corrosion glycol, or a mixture of fresh water and emulsifying oil. The latter mixture does **not provide any frost protection** and must therefore be drained directly.

The procedure is as follows for both mixtures:

Place the end of the suction hose in a bucket containing the mixture. Provide a collection vessel to return mixture to the bucket. Make sure nothing is splashed. Run the engine for a few minutes.

**CAUTION! Do not let the pump run dry.** The anti-freeze mixture need not be drained until shortly before setting the boat back in the water. The seawater system is drained at the drainage points shown;



in the case of the KAD/KAMD 42 also through the hose marked in blue.

**NOTE! Do not run the remaining mixture out into the sea!**

Disassemble the pump impeller for winter storage in a cool place.

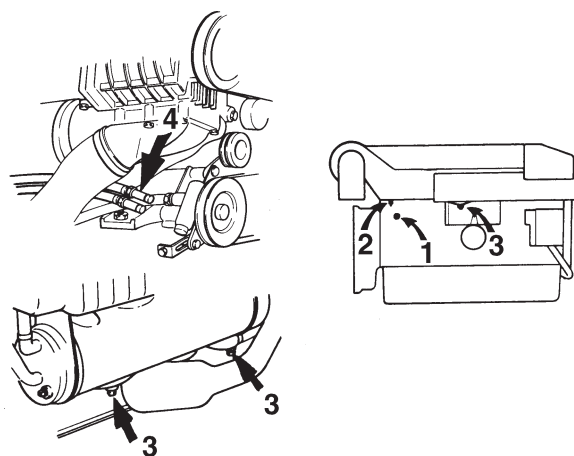
## Freshwater system

Inhibiting can be done in two ways:

Option 1. Check the freezing point if the system is filled with an antifreeze mixture.

Option 2. If the system is filled with a corrosion-protection mixture, it must be replaced once every season.

**CAUTION! The latter mixture (option 2) does not provide frost protection.**



Drain points: exhaust manifold (2), heat exchanger (3) and engine block (1) (KAD42: through the hose not marked blue (4)). The system can be left empty during the winter but do not forget to refill it before putting the boat back into the water.

## Other tasks

**Change the oil** in the drive or the reverse gear.

**Remove the propellers** for winter storage and lubricate the propeller shafts with rust protection oil.

**Provide corrosion protection** for control components and cables and the components of the electrical system.

**The finish** on the engine and drive must be checked. Touch up the paint where necessary to prevent corrosion damage.

**The battery** can be kept on board only if it is fully charged.

**Fill the fuel tanks** to avoid condensation. Check that you are allowed to store the boat with its tanks full.

**The vacuum valve**, if fitted, shall be dismantled for cleaning.

## Bringing out of storage and launching

**Check the oil levels** in the engine and drive. If special inhibiting oil is used, replace with oil according to the Technical Data. **Check the coolant level** and the frost protection. Use Volvo Penta coolant type 90.

**Check the tightness of the hose clamps** at the same time as the condition of the bellows is checked.



**WARNING!** Never work on the drive hose clamps, bellows or hydraulics without securing the drive so that it cannot fall down. Special tool (885143-8) is used to lock the drive in the tilted position. A falling drive can cause severe injury.

The joint bellows and hose camps should be replaced every other year.

**Check the tightness of the steering helmet screws (DP)** which link the steering helmet to the drive. See Technical Data.

## Painting the drive and the bottom of the hull

Check the paint on the outboard drive. Touch up damaged areas using Volvo Penta original paint. Then paint the drive with a teflon-based agent for aluminum drives. We recommend Volvo Penta anti-fouling agent. These teflon-based agents are specially designed for the drive and are as kind as possible to the environment.



**IMPORANT!** Never paint the drive's zinc anodes or treat them with teflon.

Paint the hull of the boat with a suitable bottom paint or a pure teflon agent. All anti-fouling paints are toxic and are more or less harmful to the environment. Avoid using such agents. Most countries have legislation which regulates the use of anti-fouling bottom paint. Always comply with such legislation. If it is necessary to use anti-fouling paint, use a pure copper-based paint which contains copper thiocyanate. The paint must not contain copper oxide.

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

Find out about the legislation which applies for the area where the boat is going to be used. Do not paint closer than 10 mm (.4") to the shield/drive.

**Check that the batteries** are fully charged.

**Bleed the fuel system.**

**A propeller shaft seal (inboard)** made of rubber shall be vented after launching by pressing together the opening and pushing it down until water appears. Force about 1 cm<sup>3</sup> of water-resistant grease into the seal.

**Replace the propeller shaft seal every 5 years.**

**Fit the propellers.** See page 34 for an illustrated description.

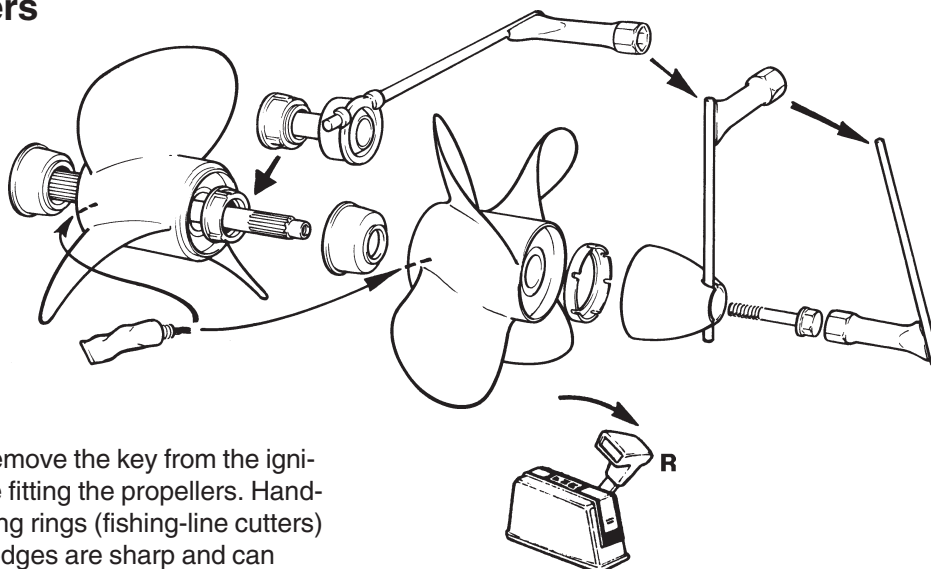
**Launch the boat.** Check the functions and for leaks.

## Fitting propellers

### DP



**WARNING!** Remove the key from the ignition lock before fitting the propellers. Handle the anti-fouling rings (fishing-line cutters) with care, the edges are sharp and can cause injury.



Set the controls to "Forward".

Use the tools supplied to dismantle and install the propellers.

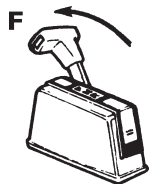
Lubricate both propeller hubs. Use Volvo Penta grease 828250-1. Slide on the anti-fouling ring (fishing-line cutter) and the front propeller. Screw on the nut and tighten with the tool. Tightening torque 50-75 Nm (5-7.7 kpm).

Set controls to "Reverse".

Fit the rear propeller anti-fouling ring. Slide on the rear propeller and then the plastic washer and spacer ring, if this was previously fitted.

Screw on the propeller cone and tighten it hard. Fit the centre screw and washer and tighten them hard.

### DPX



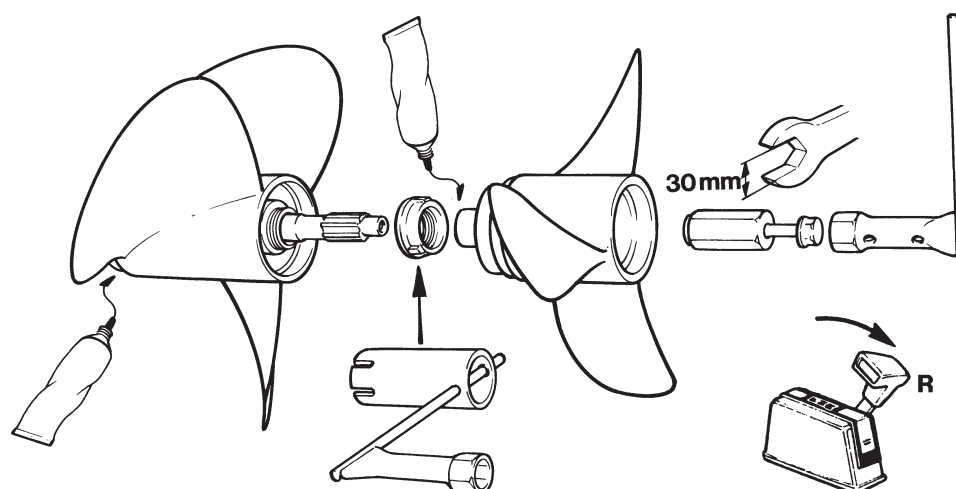
**WARNING!** Remove the key from the ignition lock before fitting the propellers.

Set the controls to "Forward".

Use the tools supplied to dismantle and fit the propellers.

Lubricate both propeller hubs. Use Volvo Penta grease 828250-1.

Slide on the front propeller. Screw on the large lock and tighten with the tool. Tightening torque 50-70 Nm (5-7 kpm).



Set controls to "Reverse".

Slide the rear propeller onto the shaft and tighten with the nut. Use a 30 mm socket and tighten to 25-35 Nm (2.5-3.5 kpm).

Screw in the lock screw and tighten to 70-80 Nm (7-8 kpm).

## Troubleshooting chart, engine

Does not start	Stops	Does not reach full speed	Runs unevenly, vibrates	Abnormal hot	Cause
●					Check the battery, electric cables, main switch, automatic fuse
●	●	●			Check the amount of fuel, fuel cock, fuel filter
●	●	●	●		Water, air or contamination in fuel / fuel filter
		●	●		Defective injectors
		●			Boat abnormally loaded, fouling on the hull of the boat.
		●	●		Blocked air filter, faulty turbo compressor, damage to propeller.
				●	Blocked coolant intake, blocked water filter, incorrect freshwater level, defective pump impeller or thermostat, air in cooling system.

# Technical Data

## General

Engine designation .....	AD31L/P TMD31L TAMD31L/M/P	D41L AD41L/P TMD41L TAMD41H/M/P	KAD42L/P KAMD42L/P TAMD42A/WJ*
Idling speed, RPM .....	675-725	625-725	625-675
Swept volume, dm <sup>3</sup> .....	2.39	3.59	3.59
cu.inch .....	145	216	219
Injection sequence .....	1-3-4-2	1-5-3-6-2-4	1-5-3-6-2-4
Rotational direction, seen from front .....	Clockwise	Clockwise	Clockwise
Max. forward tilt .....	4°	4°	4°
Max. backward tilt when running .....	15°	15°	15°
Max. side tilt when running .....	20°	20°	20°
Valve clearance, intake/exhaust, cold engine, mm ....	0.40	0.40	0.40
inch ...	.0157	.0157	.0157
Engine, oil capacity, dm <sup>3</sup> , excl. oil filter .....	8.5	10.5	10.5
quarts (US) .....	8.0	9.9	9.9
Engine, oil capacity, dm <sup>3</sup> , incl. oil filter. ....	9.0	11.0	11.0
quarts (US) .....	8.5	10.4	10.4
At 15° backward tilt, dm <sup>3</sup> , excl oil filter .....	9.0	11.0	11.0
quarts (US) .....	8.5	10.4	10.4
At 15° backward tilt, incl. oil filter .....	9.5	11.5	11.5
quarts (US) .....	8.9	10.8	10.8
Oil type .....	VDS or CD	VDS or CD	VDS or CD
Viscosity .....	SAE 15W/40	SAE 15W/40	SAE 15W/40
Oil pressure, hot engine .....			
Idling, kp/cm <sup>2</sup> .....	1.5	1.5	1.5
psi .....	21.3	21.3	21.3
WOT, kp/cm <sup>2</sup> .....	4.2–5.0	4.2–5.0	4.2–5.0
psi .....	59–71	59–71	59–71

## Fuel specifications

The fuel must be approved according to national and international standards for commercial fuels, for example:

- EN 590 (With environmental and sub-zero temperature specifications according to national requirements)
- ASTM D 975 No. 1-D and 2-D
- JIS KK 2204

**Sulfur content:** According to current legislation in the respective country.

## Compressor\*\*

Oil capacity, dm <sup>3</sup> .....	0.1
pints (US) .....	.047
Oil type (Volvo Penta P/N) .....	1141592-4

## Power Trim \*\*

Oil capacity, dm <sup>3</sup> .....	1.0	1.0	1.0
quarts (US) .....	.94	.94	.94
Oil type, viscosity .....	See engine	See engine	See engine
Oil type, DPX .....			ATF, type G

\* TAMD 42A/WJ: For technical data on the water jet unit, refer to manufacturer's manual.



Engine designation .....	AD31L/P TMD31L TAMD31L/M/P	D41L AD41L/P TMD41L TAMD41H/M/P	KAD42L/P KAMD42L/P TAMD42A/WJ*
<b>Hydraulic steering, DPX</b>			
Oil type .....			ATF, type G
<b>Power Steering **</b>			
Oil type, viscosity .....	See engine	See engine	See engine
<b>Hydraulic steering, Volvo Penta **</b>			
Oil type .....	Volvo Penta P/N 1140595-8 , Shell Aero 4, Texaco HO15 Esso Univis N15, Chevron Aviation Fluid A, Mobil Aero HFA		
<b>Engine coolant system</b>			
Thermostats open/fully open .....	81°C/94°C 177°F/201°F	81°C/94°C 177°F/201°F	81°C/94°C 177°F/201°F
Freshwater system capacity, dm³ .....	13	19	20
quarts (US) .....	12.3	17.9	18.9
<b>Electrical system*</b>			
System voltage, volt .....	12 or 24	12 or 24	12 or 24
Starter motor battery, capacity Ah .....	140	140	140
Battery electrolyte spec. gravity:			
Charge at g/cm³ .....	1.230	1.230	1.230
Fully charged at g/cm³ .....	1.275–1.285	1.275–1.285	1.275–1.285
AC generator, output max.	14V 60A 24V 50A	14V 60A 24V 50A	14V 60A 24V 50A
Starter motor, output kW, 12V .....	3.0	3.0	3.0
24V*** .....	4.0	4.0	4.0
<b>Drive, DP</b>			
Oil capacity, dm³. ....	2.7	2.7	2.7
quarts (US) .....	2.5	2.5	2.5
Oil type, viscosity .....	Volvo Penta, P/N 1141572-6 (APIGL5SAE75W/90 Synthetic)		
Difference between Max and Min oil levels, dm³ .....	0.15	0.15	0.15
pints (US) .....	.070	.070	.070
<b>Drive, DPX</b>			
Oil capacity, dm³ .....			2.0
quarts (US) .....			1.9
Oil type, viscosity .....	Volvo Penta, P/N 1141572-6 (APIGL5SAE75W/90 Synthetic)		
Difference between Max and Min oil levels, dm³ .....			0.15
pints (US) .....			.070
<b>Reverse gear, HS1A</b>			
Oil capacity, dm³ .....	3.3	3.3	3.3
quarts (US) .....	3.1	3.1	3.1
Oil type, viscosity .....	See engine	See engine	See engine
<b>Tightening torques</b>			
Steering cover screw DP, kpm (Nm) .....	3.5 (35)	3.5 (35)	3.5 (35)

\* TAMD42A/WJ: For technical data on the water jet unit, refer to manufacturer's manual.

\*\* Not TAMD42A/WJ

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

## Notes

[illegible]

