

# **OPERATOR'S MANUAL**

**MD, TMD, TAMD, AQAD31A  
TMD, TAMD, AQD, AQAD41A**

**VOLVO  
PENTA**

# IMPORTANT INFORMATION

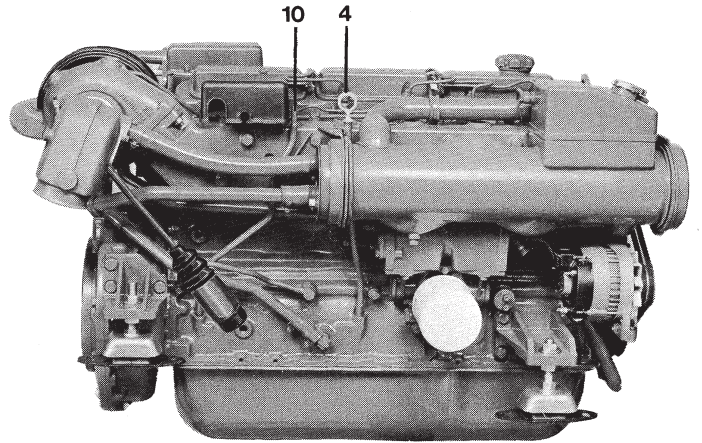
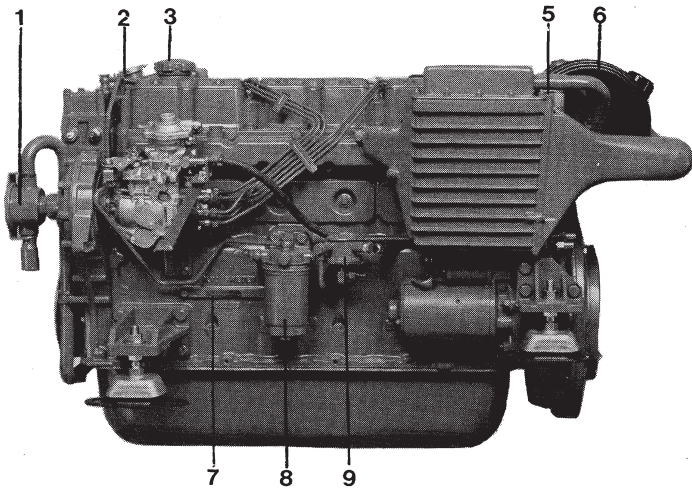
Stop the engine before opening the hatch to the engine compartment. An engine which is running has rotating and moving parts which are dangerous to touch.

Bear in mind the risk of a fire. All engine fuel is inflammable. Alcohol, methanol or ethanol is sometimes added to fuel, especially to unleaded petrol. These additives shorten the life of rubber and plastic components in the fuel system. Inspect regularly.

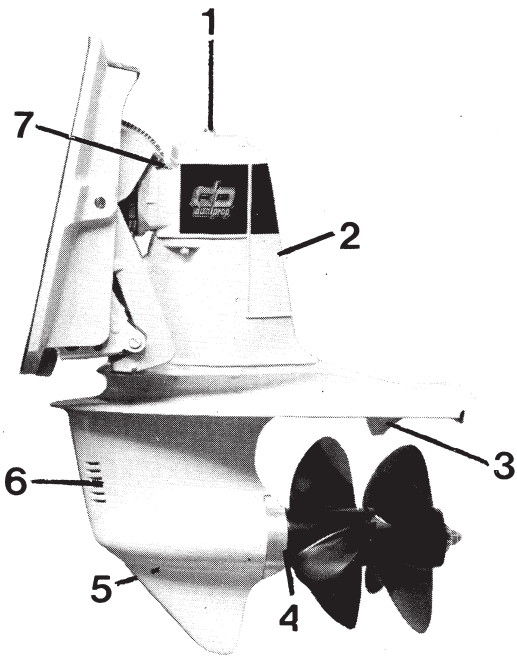
The cooling system is filled with liquid and it should be drained when there is risk of frost. The fresh water part of the system can

be filled with an anti-freeze mixture or drained. Note that in certain cases a suction action may occur when the sea-water system is being drained. Close all drainage points when the boat is not under constant supervision. Incorrectly performed drainage may cause the boat to become filled with water and sink. When working on the drive in the upper position, lock the drive in position with the special tool available or in some other secure way so that there is no possibility of the drive falling down.

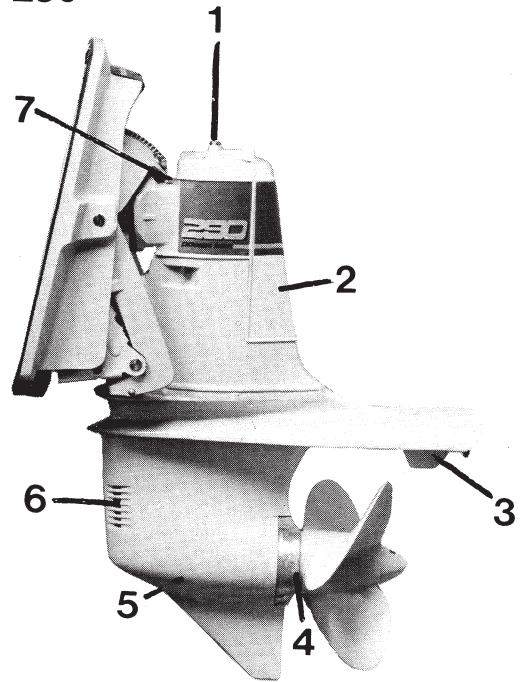
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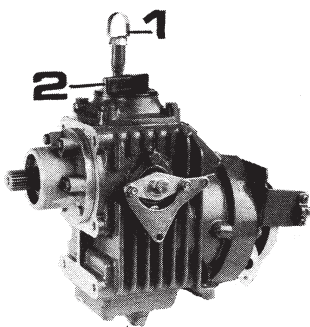
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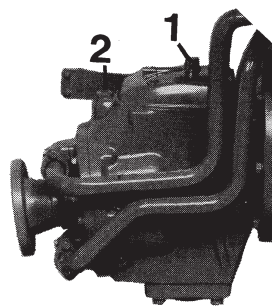
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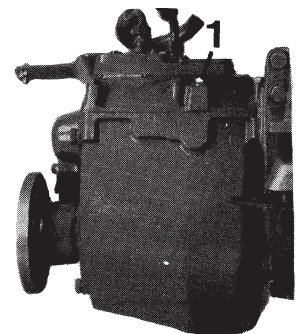
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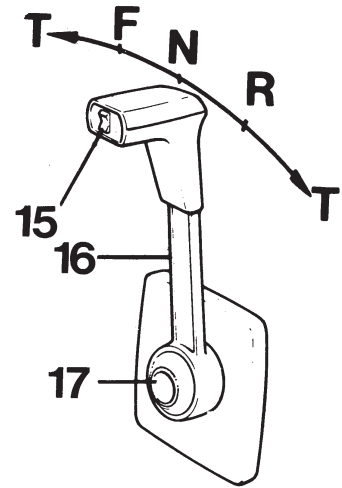
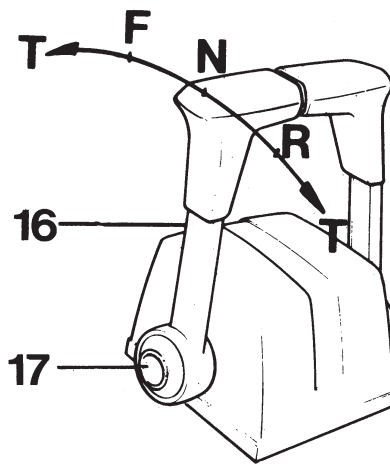
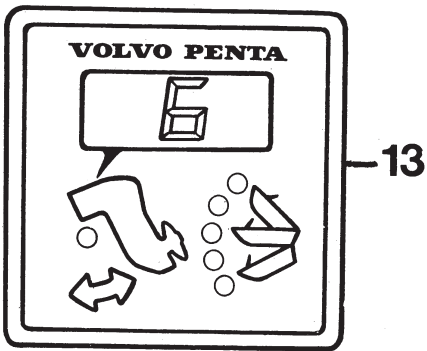
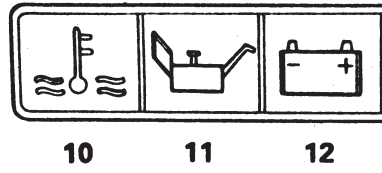
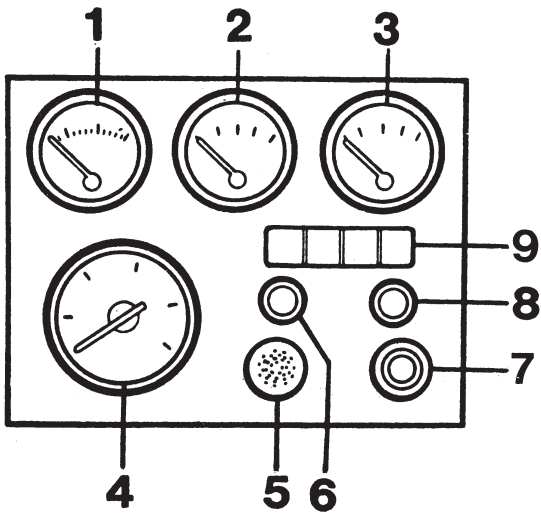


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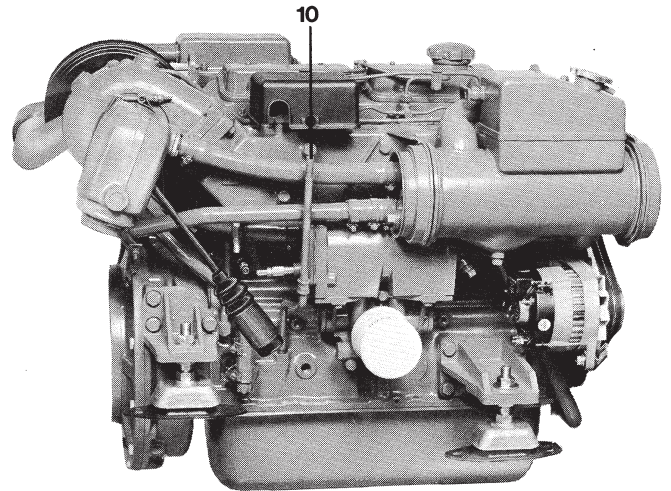
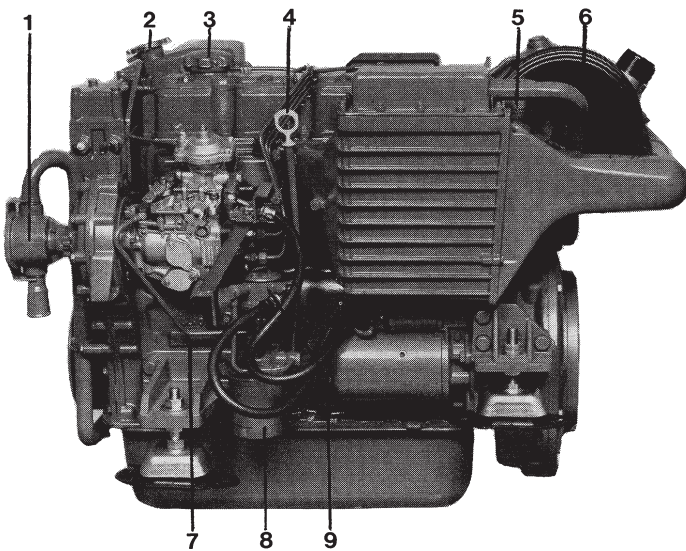


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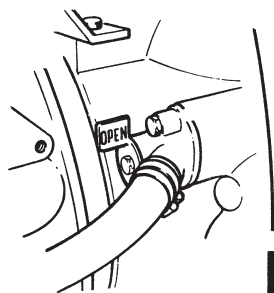
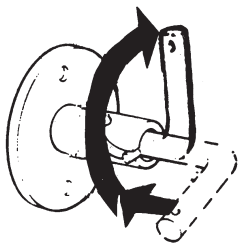




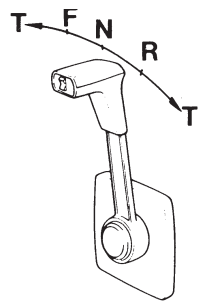
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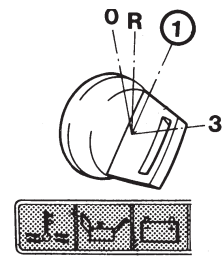




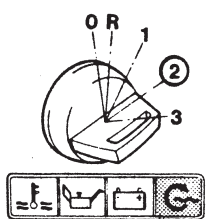
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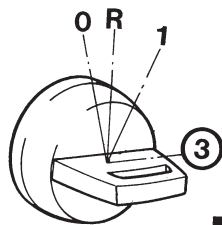
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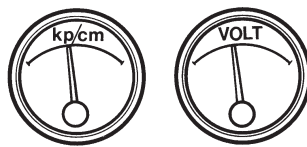
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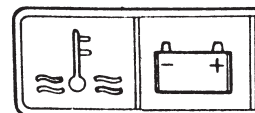
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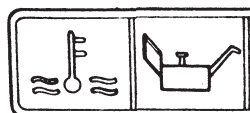
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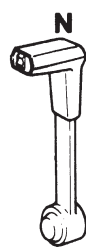
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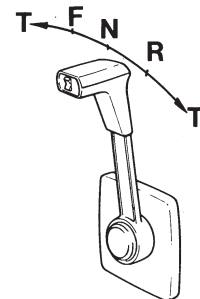
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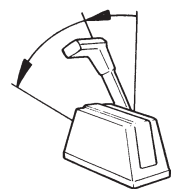
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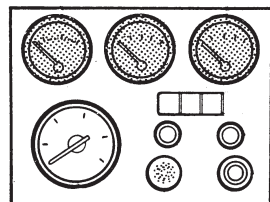
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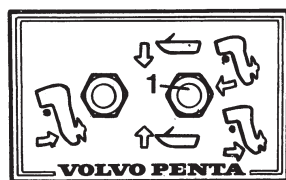
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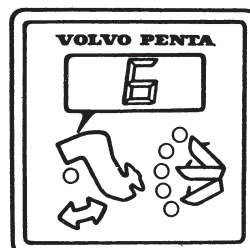
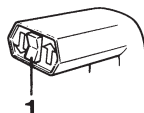
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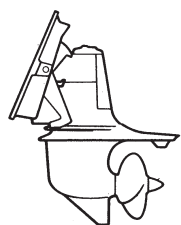
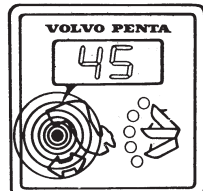
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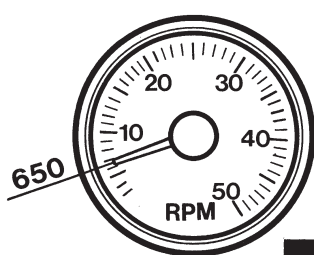
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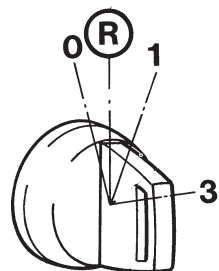
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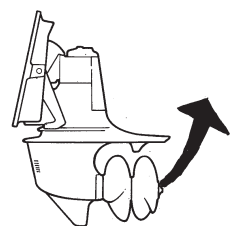
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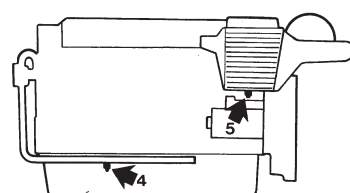
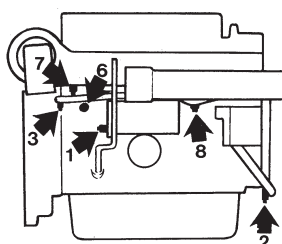
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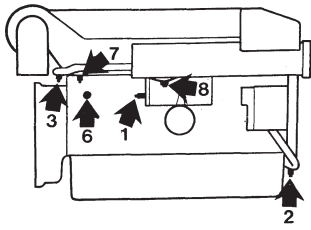
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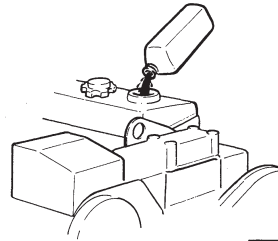
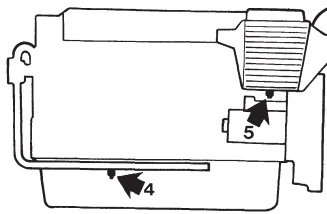
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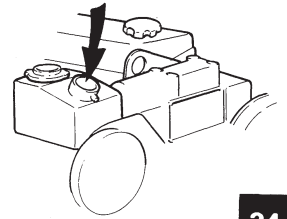
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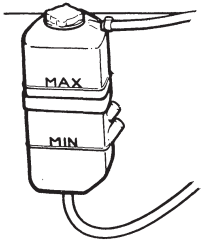
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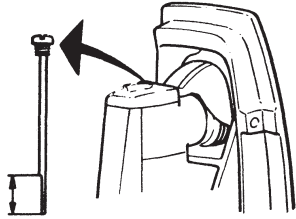
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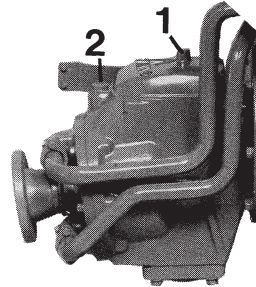
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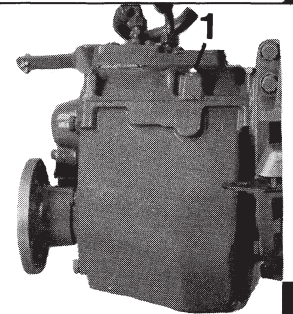
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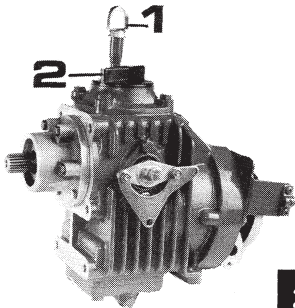
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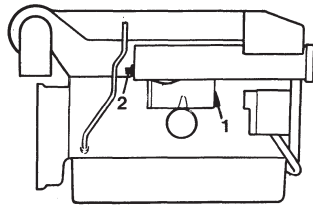
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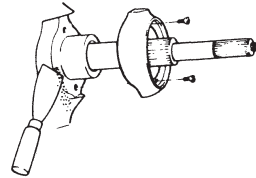
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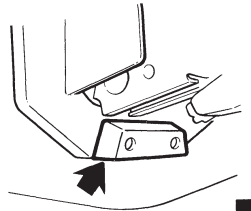
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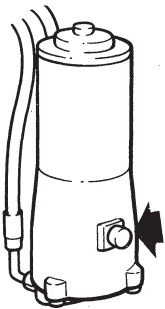
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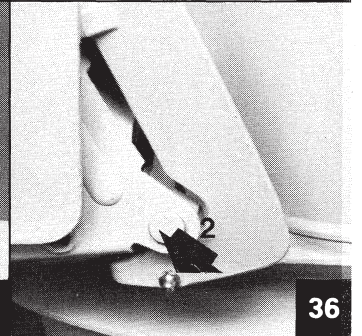
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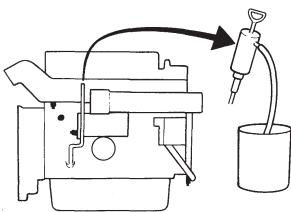
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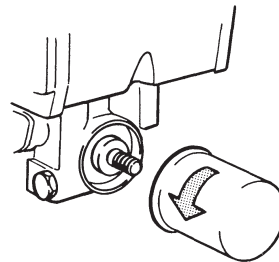
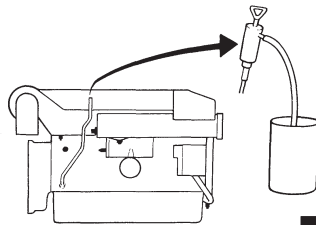
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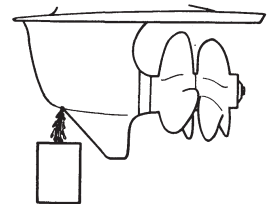
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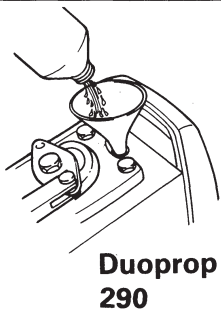
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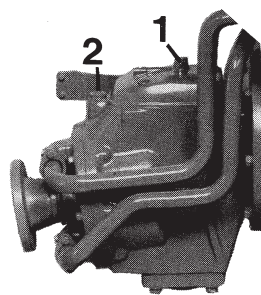


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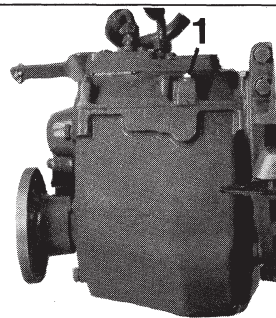


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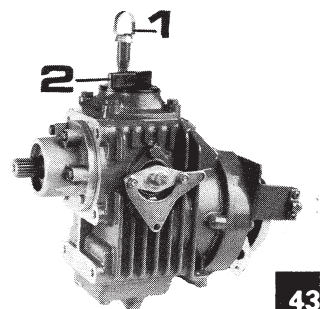
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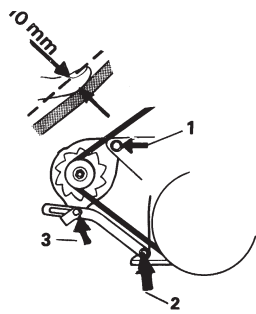
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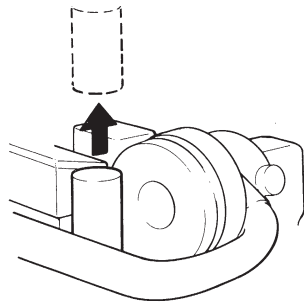
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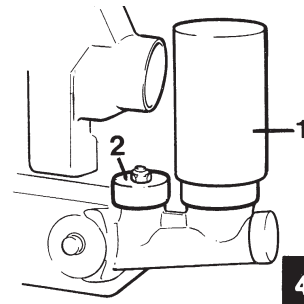
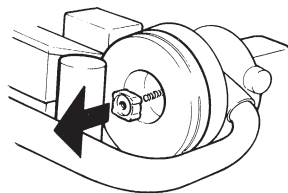
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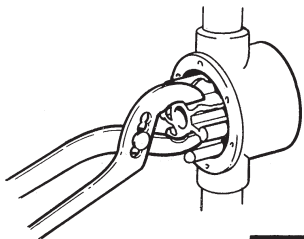
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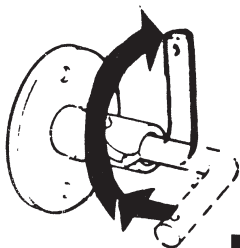
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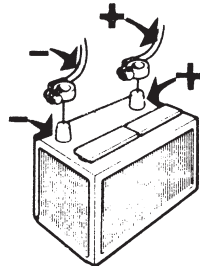
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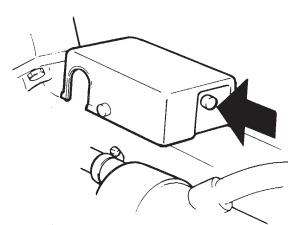
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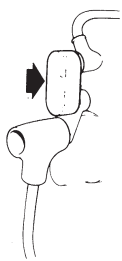
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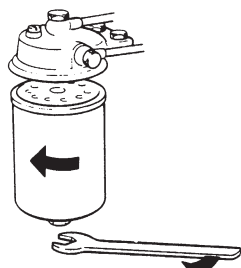
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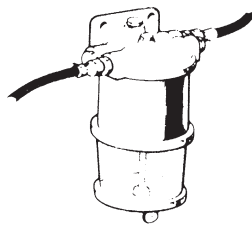
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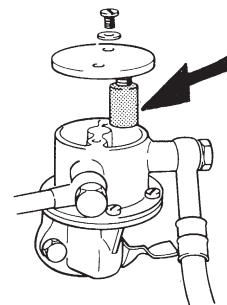
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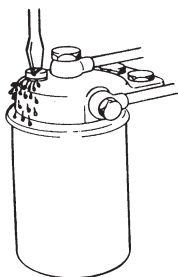
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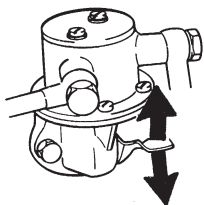
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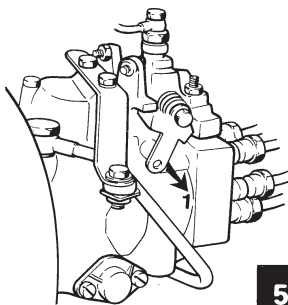
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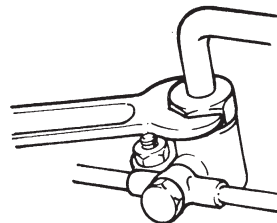
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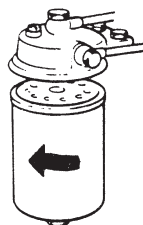
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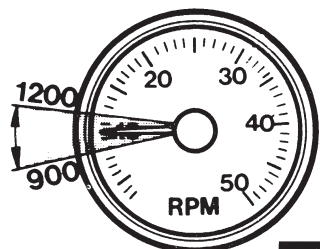
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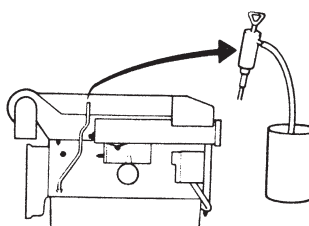
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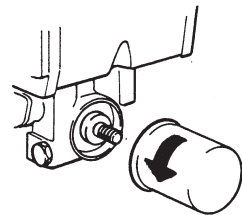
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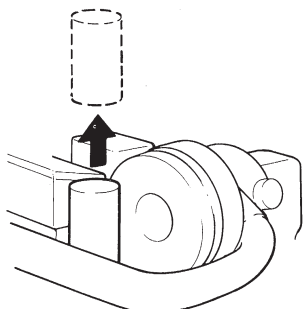
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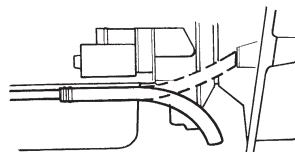
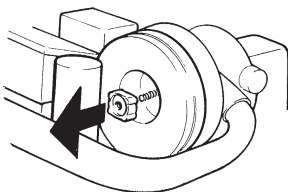
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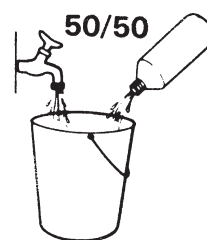
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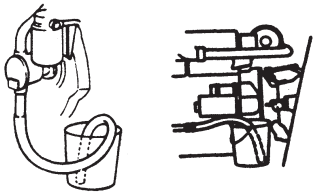
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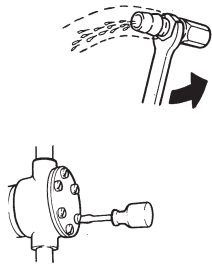
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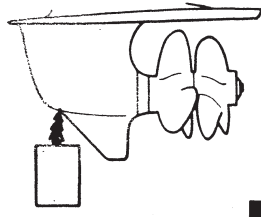
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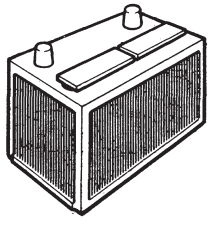
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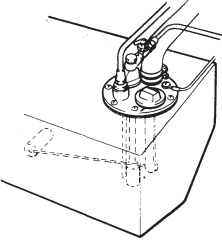
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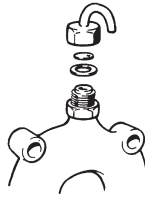
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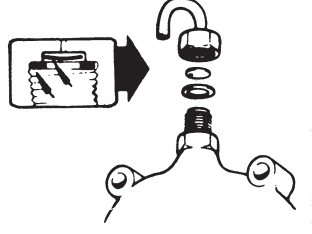
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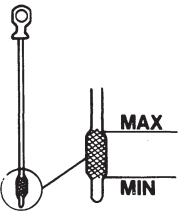
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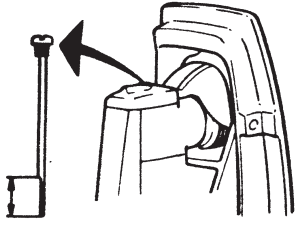
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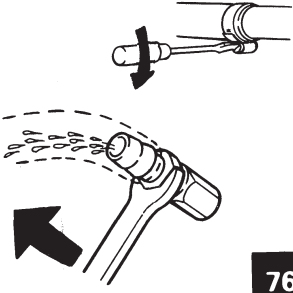
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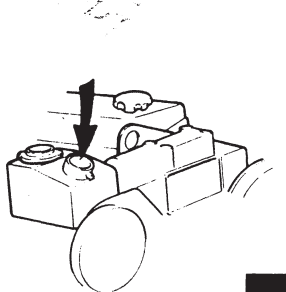
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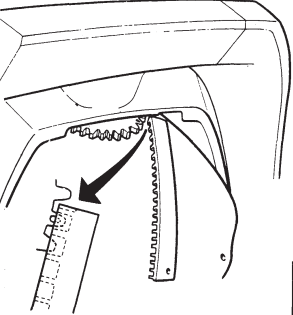
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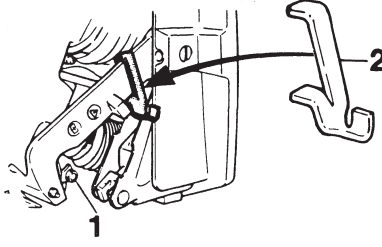
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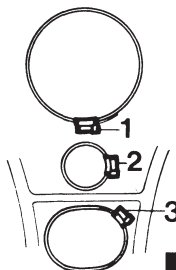
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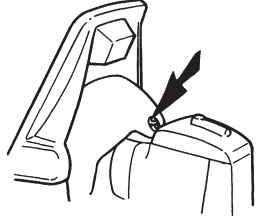
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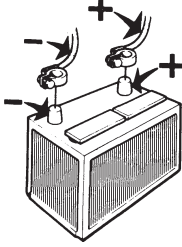
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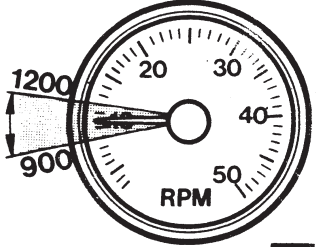
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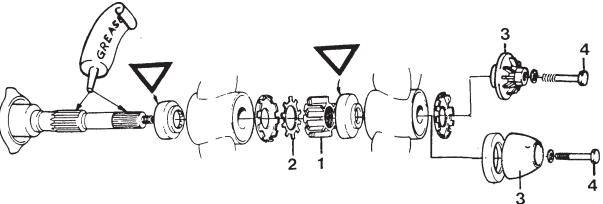
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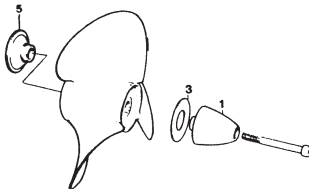
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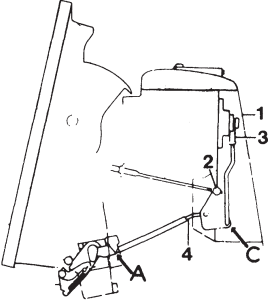
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## Instrument and controls

1. Temperature gauge for cooling water (fresh water). Normal cooling water temperature 75–90°C (167–194°F)
2. Oil pressure gauge
3. Voltmeter
4. Rev counter – scale 0–5000 r/m
5. Alarm “Low oil pressure” or “Temperature too high”
6. Alarm check
7. Ignition switch
8. Switch for instrument lighting
9. Alarm panel
10. Warning lamp, high temperature
11. Warning lamp, low oil pressure
12. Warning lamp, no charging
13. Instrument for trim angle
14. Operating switch for outdrive “UP”, “DOWN”.
15. Operating switch for Power Trim
16. Control lever
17. Disengaging device. Push in the button when the control lever is in neutral and move the lever forwards slightly. Release the button. The lever now operates the throttle only. Pull back the lever when you wish to use it for operating the speed and for manoeuvring.

N = Neutral

F = Control lever in position for running “Forward”

R = Control lever in position for reversing”

T = Engine speed

## Engine component guide

1. Sea water pump
2. Fresh water filler
3. Engine oil filler
4. Oil dipstick
5. Flywheel housing ventilation filter
6. Air filter
7. Engine serial numer
8. Fuel filter
9. Feed pump
10. Pipe for oil bilge pump

## Drive 290, Drive DP

1. Oil dipstick
2. Shift mechanism cover
3. Trim tab
4. Zinc-ring
5. Oil draining
6. Cooling water intake
7. Serial number

## Reverse gear, MS2

1. Oil dipstick
2. Oil filling

## Reverse gear, MS4A

1. Oil dipstick
2. Oil filling

## Reverse gear, PRM

1. Oil dipstick, oil filling

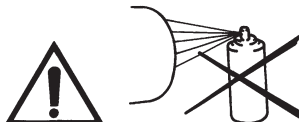
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### Important Information

Figures before text refer to illustrations on pull-out pages of cover.

**Varning! Använd aldrig startspray.  
Explosionsrisk!  
Warning! Never use start gas.  
Danger of explosion!  
Achtung! Niemals Startspray benutzen.  
Explosionsgefahr!**



**Avertissement! N'utilisez jamais en aerosol  
de demarrage. Risque d'explosion!  
Atención! No usar spray de arranque.  
Hay peligro de explosión!  
Attenzione! Non usare alcuno spray di  
avviamento. Pericolo di esplosione!**

859318

## INTRODUCTION

This instruction book provides helpful information for running and maintaining your Volvo Penta products.

The contents herein apply to particular engine specifications. Each engine is supplied from Volvo Penta in accordance with the published specifications. Examine your engine and other components to be able to find them in this book. Read this book carefully before placing the engine in operation. Do not wait until a problem occurs.

## WARRANTY

A service and warranty book which states the Volvo Penta International Limited Warranty (all markets except USA) should have been provided by the selling dealer. If you have not received this publication contact the nearest Volvo Penta Importer for a copy.

Some markets provide special or limited warranties as a supplement or replacement for the Volvo Penta International limited warranty. Contact the local Volvo Penta Importer to obtain copies of such special warranties if applicable.

**For products operating in the USA special limited warranties and warranty documents apply.**

## WARRANTY REGISTRATION CARD – DELIVERY CARD

The Warranty Registration Card (US markets) Delivery Card (other markets) should be filled out and sent in by the selling dealer always. Ensure this has been done as refusal of warranty can occur if no proof of delivery date can be provided.

## VOLVO PENTA SERVICE

Volvo Penta has built up an extensive dealer network to support you with service and parts. These dealers have the necessary training, special tools, test equipment and stocks of parts to provide the quality service. When requesting service or parts always quote the complete product model and serial number from the product serial number plate.

## AB VOLVO PENTA Technical Publications Dept.

**NOTICE:** All information, illustration and specifications contained in this manual are based on the latest production information available at the time of publication. Volvo Penta reserves the right, without prior notice, to revise prices, materials, standard equipment, specifications, models and to discontinue models. Not all models, standard equipment and accessories are available in all countries.

Duoprop propellers are sold in matched sets. Place your color coded duoprop sticker here. This sticker will help when ordering replacement prop or a new prop set.

## SAFETY NOTICE

The following special warning notes will alert you to possible bodily injury dangers and to important information on safe operation of equipment. Observe them carefully. "Warning" follow notes alone do not eliminate the dangers that they signal. Personal close attention to detail plus common sense operation of equipment are major accident prevention measures.



**WARNING:** You are warned that personal injuries, damage to property or malfunction of the engine can result from your not following these instructions.

## GENERAL INFORMATION

**Important information concerning the function of your engine:**

### FUEL

Use diesel fuel oil of "Autodiesel" quality. Lower fuel quality can cause operational breakdowns.

### LUBRICATING OIL

Use only oil with quality CD (DS) according to the API-system. Volvo Penta oil for diesel engines fulfills these quality requirements and can be used to advantage. See "Technical data" for viscosity.

### RUNNING IN

A new engine must be run in with due care during the first 20 hours of operation. Therefore, avoid operating the engine under full load during this period. A higher oil consumption during this running in period is normal. Therefore, check the oil-level in the engine more frequently than normally during this period.

### REPLACEMENT PARTS

**Warning:** Electrical, ignition and fuel system components on Volvo Penta products are designed and manufactured to comply with US coast guard rules and regulations to minimize risks of fire or explosion.

Use of non approved replacement parts, which do not comply to these rules and regulations, could result in a fire or explosion hazard.

When servicing the electrical, ignition and fuel systems insure that parts are properly installed and tightened.

### WARRANTY INSPECTION

**(Not applicable for US market)**

Is carried out after between 20 and 50 hours' running or within 180 days after delivery by an authorized Volvo Penta dealer.

## OIL CHANGE

In conjunction with the guarantee warranty the engine oil and the oil filter should be changed. See also "Inspection and Service".

## FULL THROTTLE OPERATING RANGE

When fitting a propeller to a specific boat-engine combination it is sometimes hard to select the proper sized propeller for varying load and weather conditions. Therefore Volvo Penta offers a wide range of propeller sizes and types. In some boats there are advantages to selecting a propeller that limits engine rpm including lower fuel consumption, lower noise, lower vibration and better propeller efficiency.

### Full throttle operating range, pleasure duty, light duty

AQAD31A: 3700–3900 rpm  
MD31A: 3300–3500 rpm  
TMD31A: 3600–3900 rpm  
TAMD31A: 3700–3900 rpm  
AQD41A: 3700–3900 rpm  
AQAD41A: 3700–3900 rpm  
TMD41A: 3500–3900 rpm  
TAMD41A: 3600–3900 rpm

### Full throttle operating range, medium duty

AQAD31A: 3000–3250 rpm  
TAMD31A: 3000–3250 rpm  
AQAD41A: 3400–3600 rpm  
TAMD41A: 3000–3250 rpm

If the boat has been in the water for some time the boat speed and the maximum engine speed can drop as a result of marine growth on the boat hull and the outboard drive. Prevent growth by painting boat hull and outboard drive with "copper free" anti fouling paint.

## SAFETY EQUIPMENT

Irrespective of whether the boat is being used for long cruises or short day trips, it should be equipped with safety equipment as suggested below. This list can, of course, be supplemented further according to personal option. Inspect at regular intervals to ensure that there is safety equipment on board and that it is in working order.

**LIFE-JACKETS** for all on board, approved type.

**FIRE EXTINGUISHER**, approved type at least one and installed easy to get at.

**DISTRESS ROCKETS** and matches. Packed watertight.

**FIRST AID BOX**

**TOOLS** suitable for the equipment on board.

**ON BOARD KIT** containing, e.g. an impeller, spare engine parts, etc. (See your dealer for recommended on board kit for your engine).

**ANCHOR** with line.

**RADAR REFLECTOR**

**RADIO** for listening to, e.g. weather reports.

**COMPASS** which has been corrected for deviation.

**BOAT HOOK** and **PADDLE**.

**MOORING ROPES, BUMPERS.**

**FOG-HORN** and **WHISTLE.**

**SEA ANCHOR**

**FLASHLIGHT**

**EXTRA PROPELLER AND MOUNTING TOOLS.**

**NOTICE:** USCG regulations, state and federal laws specify equipment and safety requirements that must be complied with to operate boat safely and legally. Consult USCG, state and federal publications for details.

## PREPARATIONS BEFORE STARTING

Before starting engine make sure that:

There is no **FUEL LEAKAGE**

There is no **WATER LEAKAGE** from engine or hull

There is no **OIL LEAKAGE**


There is no **SMELL OF LP-GAS** in the deep cavities of the boat or elsewhere.

The **OIL LEVELS** are correct

**COOLING WATER LEVEL** in the expansion tank for the fresh water system is correct. If the expansion tank is empty, cooling system venting must be done after refilling. See instructions under Checks and Service.

The proper **NAUTICAL CHARTS** are on board for the planned voyage.

There is enough **FUEL** on board for the planned voyage.

 **WARNING:** Make sure when filling your fuel tank that there is no open flame on board, e.g. in the galley. Ventilate the boat and run the engine room fan (if fitted) for 4 minutes before starting the engine. Do not fill fuel tank with too much fuel.

If some people are on board for the first time, tell them how to manoeuvre the boat and where to find life-jackets and fire-extinguishers. Also tell them everything else you think necessary from the point of view of safety. Should something unexpected happen during the voyage, very often it is too late to tell those on board how the safety equipment works.

## RUNNING INSTRUCTIONS

### STARTING THE ENGINE

**1** Switch on the **main battery switch**. Start the **engine room blower** (if fitted) and allow it to run for at least four minutes before starting the engine.

**Lower the drive**, if it has been tilted. Make sure there is no obstacle near the propeller.


Open the seawater cock at the shield.

**2** When starting the engine, keep the control in idling/neutral. The engine is fitted with automatic cold starting.

**3** Turn the key to position "1". Temp-oil pressure-charging lamp on.

**4** (Not applicable to MD31 engines.) Turn the key to "2", and keep the pre-heater connected for approx. 30 seconds. Warm engines do not need pre-heating.

**5** "3" Starting position. Key to "1" after starting. Begin in position "0" when restarting.


 **TURBO WARNING:** Do not race the engine immediately after starting. Cold oil flows less rapidly and will **not** reach all necessary parts immediately.

**6** Check immediately after starting that the **oil pressure gauge** and the **voltmeter** show normal values and that the **alarm** is quiet. If abnormal values are shown and the alarm sounds, the engine must be stopped immediately and the cause investigated.

**7** Temp. and ammeter lamp on (no acoustic alarm) = charging fault.

**8** Temp. or oil lamp and acoustic alarm on = temp. too high or oil pressure too low. Find cause of fault.

**9** Run the engine warm, keeping the control in idling/neutral.

 **WARNING:** Do not shift into gear if engine speed is above 800 r.p.m.

## RUNNING INSTRUCTIONS

**10** The single control lever operates both the speed and the drive shaft. (Please see under 17 on page 1.)


F = Forwards  
R = Reverse  
N = Neutral  
T = Engine speed  
(Volvo Penta controls only)


**11** To obtain good operating economy the engine should not be run at maximum speed for long periods.


When under sail, the control lever should be in the neutral position if the propeller is a fixed propeller. If the propeller is a folding propeller, the control lever should be in the reverse position. Start the engine and run it for five minutes every ten hours when on long-distance cruises.

**12** Check that the engine temperature is normal when running (75–90°C) (167–194°F) and that the instruments for charging and oil pressure show normal values. If abnormal values are shown the engine must be stopped immediately and the cause investigated.

**13** The outdrive can be hydraulically trimmed (“in” or “out”) during boat operation according to the symbols shown on trim adjustment instrument panel. The bow of the boat is lowered when switch no. 1 (on control lever or on instrument panel) is held in the up position. The bow of the boat is raised when switch no. 1 is held down.


 **WARNING:** Do not operate both switch no. 1 on control and switch no. 1 on panel at same time as damage to electronics will occur.

 **WARNING:** Damage caused by shallow water operations (e.g. Physical damage to propeller, outdrive etc. is not covered by the Volvo Penta limited warranties.

 **WARNING:** When adjusting for maximum trim angle use extreme care.


**14** The outdrive is adjustable within specific trim limit angles to obtain the best running position. For the 290 drive the max. trim angle is number 12 and for the Duo-prop number 6 as shown on the trim indicator display panel.

**15** **Running in shallow waters.** If you are uncertain about the depth of the water, it is recommended that speed of the boat be reduced and the outdrive raised. To allow outdrive to pass the maximum trim angle switch no. 2 must be held in while at the same time switch no. 1 must be held in the down position. The drive unit can now be raised to a maximum tilt position of number 44 on trim indicator.

 **WARNING:** Engine must be turned off whenever the drive unit is tilted above number 45 on trim indicator. This area or tilt must only be used when moored in shallow water or transporting boat by trailer.

## **16** Manoeuvring astern

Running astern can be carried out with the drive raised to maximum position of 44.

 **WARNING:** Never shift into reverse when the boat is planing or at engine speeds above 800 r.p.m.

## SHUTDOWN PROCEDURE

**17** After stopping the boat, allow the engine to idle for a minute or so at idling speed with the control lever in the neutral position to avoid subsequent coolant boiling and engine thermal stresses. This is particularly important if the engine has been run at high speed.

**18** Stop the engine. Note, key must stay in stop position until engine off and then it can be moved to “0” or removal position – do not leave key in stop position as it will discharge battery.

**EMERGENCY STOP:** Turn the lever (1), point 57 downwards.

**19** If there is shallow water at the mooring place and if there is risk that the drive can strike the bottom, it should be fully tilted. Otherwise it is not necessary to tilt the drive.

**20** Switch off the main battery switch!

 **WARNING:** The main switch must never be switched off until the engine has stopped.

Close the cooling water cock at the shield during long intervals between use. Before leaving the boat, check that no leakages have occurred.

## IF RISK OF FROST (D31)

Check before leaving the boat that there is no water leakage. In cold weather, where there is a risk of freezing, the cooling water must be drained from the engine as follows:

**21** The engine’s **sea-water system** is drained through the cock on the oil cooler (1) and the cock in the pipe (2). AQ models also have cocks in the pipes (3) and (4). Drain the after-cooler through the cock (5).

For MS4A reverse gears, remove the plugs on the port side. For MS2 reverse gears, remove both coolant connections. There may be a siphoning effect in certain circumstances. If siphoning occurs, unfasten the suction pipe from the shield. You should also unfasten the cover on the sea-water pump. **NOTE:** Close the cocks, re-fasten the cover on the pump and re-fasten the suction pipe before leaving the boat.

If the **fresh-water system** is filled with coolant which does not contain anti-freeze, drain it through the cock on the engine block (6), the two cocks on the exhaust pipe (7) and the cock on the heat exchanger (8). You should also unfasten the cover on the thermostat housing so that the coolant runs out faster. If the system is filled with a mixture containing anti-freeze it does not need draining.



## IF RISK OF FROST (D41)

22

Before leaving the boat check that there is no water leakage. If there is a risk of freezing, drain the cooling water from the engine as follows:

The engine's **sea-water system** is drained through the cock on the oil cooler (1) and the cock in the pipe (2). AQ models also have cocks in the pipes (3) and (4). Drain the after-cooler through the cock (5).

For MS4A reverse gears, remove the plugs on the port side. There may be a siphoning effect in certain circumstances. If siphoning occurs, unfasten the suction pipe from the shield. You should also unfasten the cover on the sea-water pump. **NOTE:** Close the cocks, refasten the cover on the pump and refasten the suction pipe before leaving the boat.

If the **fresh-water system** is filled with coolant which does not contain anti-freeze, drain it through the cock on the engine block (6) and the two cocks on the exhaust pipe (7). For TAM31 models drain the engine through the cock on the heat exchanger (8). If the engine is fitted with an expansion chamber, unfasten the cover so that the coolant runs out faster. If the system is filled with a mixture containing anti-freeze it does not need draining.

### CHECK DAILY BEFORE STARTING

23

## OIL LEVEL IN ENGINE

Check the oil level daily before starting and make sure that the oil level is within the marked field on the dipstick. Fill with oil when necessary through the oil filler. **NOTE!** Do not exceed the maximum mark. See "Technical Data" for choice of oil.

## COOLANT

The coolant system is to be filled with a corrosion-protective anti-freeze mixture, 50 % anti-freeze and 50 % fresh water. Alternatively a mixture of fresh water with about 1 litre corrosion protective additive. (Volvo Penta accessory).

If there is a risk of freezing, an anti-freeze mixture must be filled or the system must be drained after each use. Regarding draining of fresh water and sea water system, see "Shutdown Procedure".

Fresh water system should be drained and flushed once per year. (See lay-up procedure).

24

## Level of Coolant in Thermostat Housing

Before starting the engine for the first time on any day, check that the thermostat housing is filled with coolant. If necessary, replenish to bring the level up to the hole in the filler pipe. Then start the engine, and replenish if necessary with the engine running.

25

## Level of Coolant in Expansion Chamber (MD31)

Before starting the engine for the first time on any day, check that the coolant level is between the MAX and MIN marks. If necessary, replenish with fresh water or anti-freeze corrosion protection mixture to bring the level up between the marks.



**WARNING:** Top up using only a 50/50 mix of water and anti-freeze.



**WARNING:** Closed fresh water system is under pressure. If pressure cap is removed when engine is at operating temperature, turn cap to first stop and allow pressure to escape before completely removing cap.

### CHECK EVERY 14 DAYS

## OIL LEVEL IN DRIVE

26

Check the oil level with the drive fully down. The oil level should be between the marks on the dipstick, which must **not** be screwed down when measuring the oil level. Make sure that water cannot enter the drive while carrying out the oil-level check. If necessary, top-up with oil through the hole for the dipstick. Concerning the type of oil same as engine. (DP in commercial duty, see "Technical Data").

**NOTE!** The O-ring which lies in the groove under the dipstick tightening screw must be in place.

## OIL LEVEL IN REVERSE GEAR MS4A

27

Check the oil level using the oil dipstick (1). The oil level should be between the marks on the dipstick. **NOTE!** The dipstick must **not** be screwed down when checking the oil level. Top-up if necessary through the oil filler hole (2). Use the same type of oil as already in the reverse gear. See "Technical Data".

## OIL LEVEL IN REVERSE GEAR PRM

28

Use the dipstick (1) to check the oil level. The level should be between the MAX and MIN marks on the dipstick. **NOTE:** Screw the dipstick in when checking the oil level. If necessary, replenish with the same brand of oil as that already in the reverse gear. Please see "Technical Data".

## OIL LEVEL IN REVERSE GEAR MS2B

29

The oil level is checked by using the dipstick (1). The level should be between the marks on the dipstick. If necessary the oil can be topped up through the oil filler (2) using the same quality oil as already in the reverse gear. See "Technical Data".

## ELECTROLYTE LEVEL IN BATTERY

The level should be 5–10 mm (3/16"–3/8") above the cell plates in the battery. If necessary, top-up with distilled water.



**WARNING:** Some maintenance free batteries have special inspection instructions which should be followed.

## BELT TENSION


The V-belt must be properly tensioned in order to get full alternator output and correct cooling water temperature. **WARNING:** Belts too tight will cause short belt life and may damage alternator and/or water pump bearings, belts too loose may jump off pulleys or slip, causing short belt life. The V-belts are properly tensioned when it is possible to depress them 10 mm (3/8") midway between the pulleys.

## CORROSION PROTECTION


- 30** Replace the zinc plug when it has been worn down by 50 %.
1. Zinc plug location.
  2. Zinc plug location (not MD31)

## CORROSION PROTECTION – OUTDRIVE/ SHIELD

- 31** Replace the zinc ring when it has been worn down by 50 %.

 **WARNING:** Make sure that the contact surface on the drive is clean before installing the new zinc ring.

- 32** Replace the zinc plate under the transom shield when it has been worn down by 50 %.

 **WARNING:** Make sure that the contact surface on the shield is clean before installing the new zinc plate.

Check zinc plugs as necessary but at least twice per season.

## OIL LEVEL IN THE HYDRAULIC PUMP (POWER TRIM)

- 33** Trim the drive inwards as far as possible. Remove the screw and check pump oil level. The oil level must be level with the screw hole. Top up if necessary. For choice of oil see "Technical Data". Take great care when checking the oil level that no foreign particles enter the system.

### SERVICE EVERY 50 HOURS OF OPERATION


## SEA-WATER FILTER AQAD31, 41 ONLY

**When there is risk of clogging the filter, check after 25 hours or as necessary.**

- 34** When checking and cleaning the waterfilter unscrew the cover (1) and remove the sealing-plate (2). Then lift out the insert (3). Shake the insert and rinse it. The insert can be refitted in one way only. Check that the seal on the insert is undamaged. Reinstall the sealing-plate and tighten the cover. Check for water leakage after the engine has been started.

 **WARNING!** Watch out for seawater entering the boat when working with the seawater filter.

## ON INBOARD APPLICATIONS

 **WARNING:** Volvo Penta recommends use of a properly installed sea strainer or raw filter to provide engine with an unrestricted flow of filtered cooling water. Regular inspection and cleaning of this strainer is required. Operation in areas where seaweed, sea grass, sand etc. or other foreign matter might block intake of filter require more frequent maintenance.

## LUBRICATING THE PRIMARY SHAFT AND STEERING SHAFT JOURNAL

- 35** Grease the fitting with a grease-gun until grease is forced out at the journals. Use water-resistant grease.
- 36** 1 – Upper fitting  
2 – Lower fitting

### SERVICE EVERY 100 HOURS OF OPERATION OR AT LEAST ONCE PER SEASON

## CHANGE OIL IN ENGINE

- 37** The oil is to be changed in new or reconditioned engines after the first 20 hours of operation and then after every 100 hours of operation.

Run the engine until it is hot. Suck up the oil through the tube for oil drain pump (1).

Fill up with oil to the correct level. See "Technical Data" for choice of oil.

### SERVICE EVERY 200 HOURS OF OPERATION OR AT LEAST ONCE PER SEASON

## OIL FILTER

- 38** The oil filter is to be changed the first time after 20 hours of operation and then after every 200 hours of operation. Screw off the old filter. If the oil filter is difficult to unscrew, there is a special tool which can be used. Alternatively a screwdriver can be driven through the outer section of the filter and then used as a lever. **CAUTION:** Be careful not to spill oil.

Coat the rubber seal of the new filter with oil. Check the contact surface on the engine and screw on the filter **by hand** until it touches the contact surface. Turn the filter a further **half turn, not more.**

**Note! Use only genuine Volvo Penta oil filters.**

Start the engine, run at idling and check immediately that the oil pressure-gauge shows normal values.

Check the oil-level and check also for leakage around the filter.

## OIL CHANGE IN DRIVE

### Draining

- 39** Remove the oil dipstick. Tilt the drive. Remove the plug under the propeller gear housing and let the oil run out. Refit the plug with its O-ring.

## Filling

40

Remove the outdrive cover and the oil filler plug. Fill up with oil. Concerning quality and capacity see "Technical Data". Refit the plug together with its O-ring. Lower the drive. Check the oil with the dipstick, which must **not** be screwed down when measuring the level. Fill up to the correct level through the dipstick hole. If the level is too high, the oil must be drained to the correct level. Re-insert the dipstick together with its O-ring.



**WARNING:** Check that the drain-plug is not leaking.

## OIL CHANGE IN REVERSE GEAR MS4A

41

Use the oil suction pump and suck up the oil through the hole for the oil dipstick (1).

The reverse gear should be filled to the upper mark on the dipstick, through the oil filler hole (2). Then start the engine and run it for a few minutes at idling speed in order to fill the reverse gear oil cooler with oil. Stop the engine and check the oil level. Top-up if necessary.

## OIL CHANGE IN REVERSE GEAR PRM

42

Use the oil suction pump and suck up the oil through the hole for the oil dipstick (1).

The reverse gear should be filled to the upper mark on the dipstick. Then start the engine and run it for a few minutes at idling speed in order to fill the reverse gear oil cooler with oil. Stop the engine and check the oil level. Top-up if necessary.

## OIL CHANGE IN REVERSE GEAR MS2B

43

The oil can be sucked up through the hole for the dipstick (1) by using an oil suction pump. When refilling the oil (2) the reverse gear should be filled up to the upper level marking on the dipstick. Start the engine and run it for a few minutes at idling, so that the reverse gear's oil cooler becomes filled with oil. Stop the engine and check the oil level. Top up, if necessary.

## CHECKING THE VALVE CLEARANCE

Checking and adjusting the valve clearance should be carried out by an authorized Volvo Penta Dealer. See "Valve Clearance Value" under "Technical Data".

## CHECKING AND REPLACEMENT OF V-BELTS

44

Check the belts thoroughly for wear and cracks. Any indication of such and the belts must be replaced. Loosen the alternator mounting bolts 1, 2 and 3 and slip off the belts. Clean the belt grooves on the pulleys before fitting the new belts. Tension the belts in such a way that they can be depressed 10 mm (3/8") between the pulleys. After a few hours of running recheck the belt tension and adjust if necessary. The most accurate belt tension can be objected if belt is adjusted while warm and flexible after engine has been run. Replace belts once per year using only genuine Volvo Penta belts.

## CHANGING THE AIRFILTER

45

The airfilter must be replaced **every 200 hours of operation or once each season**. Change the filter and reit in reversed order. Be careful so that no dirt enters the housing.



**WARNING:** Never remove air cleaner filter while engine is running. Personal injury or engine damage may result.

## CHANGING OF FILTER FOR CRANKCASE-VENTILATION

46

The airfilter for the crankcase-ventilation (1) must be changed every 200 hours of operation or once per season or when the vent-air, mixed with oil starts to flow out by the oil-valve (2).

## TURBOCHARGER,

### Check airtube and connections for leakage

Check the air-tube when the engine is running. Whistling or hissing sounds are signs of leakage. Leakage can also be detected by brushing soap-water on suspected spots on the pressure-side between the turbo-charger and the engine. Tighten hoseclamps or replace the air-tube if necessary. If there are problems with the turbo-charger contact an authorized Volvo Penta dealer.

## CHECKING THE COOLING SYSTEM



**WARNING:** Do not top up with water only. Water by itself reduces the rust protection and antifreeze qualities of the coolant and has a low boiling point. It can also cause damage to the engine if it should freeze. Drain and flush system once per year.

The cooling system functions normally when the needle of the temperature gauge is between 75–90°C (165–194°F). If the temperature is too high this can be caused by the following: blocked sea water intake, blocked seawater filter, defective pump impeller or carrier in the seawater pump, air in the freshwater system, coolant leakage, blocked oil cooler, too low coolant level, slipping or broken drive belt for the circulation pump, blocked heat exchanger, faulty thermostat or instrument and temperature sender. **WARNING: Watch out for water entry into boat** during all work with the cooling system.



**WARNING:** The cooling system must always be kept filled to correct level. If it is not kept filled, there can be high internal engine temperature resulting in damage.

## CHECKING AND REPLACING THE IMPELLER

47

The impeller can be damaged, mostly because of lack of water in the pump due to blocked intake or because of improper winter storage. To check remove the cover.



**WARNING: Watch out for water entry into boat.**


Inspect the impeller. If the impeller is damaged, it must be replaced. Pull out the impeller using a polygrip pliers. Do not damage the housing. The carrier is defective



if it is possible to turn the impeller and the shaft. A new carrier can be fitted after the pump has been removed.

## ELECTRICAL SYSTEM

### !CAUTIONS FOR ALTERNATOR

 The engine is equipped with an alternator. If the alternator and the regulator are to function without interference, it is important that the following instructions are observed:

48

1. **The main battery switch must not be switched off until the engine has stopped.**

Never disconnect battery cables or wiring in the charging system when the engine is running. Disconnecting any part of the charging circuit when engine is running will result in failure of the voltage regulator and serious damage to the alternator.

49

2. **Battery terminals polarity must never be mixed up, as improper will cause damage or equipment failure.** The battery terminals have a plus and a minus sign respectively. The cable from the minus terminal is connected to the engine block. The cable clamps must be well tightened and then greased.

3. **Do not switch the charging circuits while the engine is running.**

Install a Volvo Penta charging distributor (accessory) to the alternator when more than one battery is connected.

4. In the event the engine has to be started with the help of a spare battery, proceed as follows:

Let the ordinary battery remain connected. Connect the spare battery to the battery with plus to plus and minus to minus. When the engine has started, remove the spare battery but under no circumstances may the circuit to the ordinary battery to broken.

5. Do not use a rapid charger when the alternator is connected to the battery. Never use a rapid charger as a booster to provide starting voltage.
6. Disconnect both battery cables before doing any work on the alternator or electrical system.
7. Before carrying out any electrical welding on the engine or boat components, disconnect the charging regulator cables at the alternator and insulate the cable ends.
8. Check the belt tension and the cable connections regularly.

### Re-set button for circuit breaker (fuse)

50

The engine is equipped with an automatic circuit breaker which breaks the electrical system when overloaded. The automatic fuse has a re-set button (1). Always investigate the reason for the overload.

### Fuses in the electrical system (Power Trim)


51

The electrical system for Power Trim has a 55A fuse (one spare supplied with engine) at the starter motor, and a 5A fuse at the control.

## Checking of starter motor and alternator

Let an Volvo Penta dealer do all checking and repairs of the starter motor and the alternator. All inspection and testing should be carried out in connection with a general inspection of the engine.

## BATTERY

 **WARNING:** To prevent possible explosion, never expose battery to open flame or electrical spark. Do not smoke near battery. Batteries generate hydrogen gas which is flammable and explosive. Battery fluid contains sulfuric acid.

Do not allow battery fluid to contact eyes, skin or painted surface. If contact occurs, flush affected area immediately with water. Obtain medical attention if eyes are affected.

## Checking the state of charge

The battery will be maintained in top operating condition only by regular routine inspection and maintenance. When not in use, the battery will discharge slowly.

## ELECTROLYTE LEVEL

Electrolyte is checked every 14 days or 25 hours. The correct level is approximately 5 to 10 mm (3/16''-3/8'') above the battery plates. Add distilled water to bring to proper level, do not overfill. After adding water, battery should be charged for at least 30 minutes by running the engine at high idle. This will ensure proper mixing of distilled water and electrolyte.


## SPECIFIC GRAVITY

The electrical capacity of a battery is directly proportional to the specific gravity of the electrolyte and is checked with a hydrometer. A fully charged battery has a specific gravity reading of 1.260 plus .15 or minus .005 at 80°F. Additionally reading from cell to cell must not vary more than technical specification for battery. As specific gravity of electrolyte varies with temperature, the temperature at the time of testing must be known and the hydrometer reading corrected with the temperature correction chart included with a hydrometer. Specific gravity should be tested at least once per season. (See "Technical Data".)

## ROUTINE CLEANING

Batteries should be kept clean and dry. Battery connections must be clean and tight. A light film of grease applied to the battery connections will help to minimize corrosion.

## COLD WEATHER!

 **WARNING:** During cold weather, batteries must be charged immediately after adding distilled water. Water floating on top of battery cells will freeze, damaging the battery (see electrolyte level above). Battery capacity is considerably reduced at low temperatures. When stored outside in cold climate it will be necessary to provide a means of keeping batteries warm. If necessary remove batteries and store inside.



## FUEL SYSTEM



**WARNING:** Observe the greatest cleanliness when handling the fuel system. Try to avoid fuel spill. Dispose of spilled fuel properly. Observe all water pollution laws.

## CHANGING FUEL FILTER

52

The fuel filter should be changed at least **once each season**.

Unscrew the fuel filter. Try to avoid fuel spill. The fine filter and container are of throw-a-way type and therefore a new filter has to be installed.

Check that the contact surface in the cover is clean and that the filter-gasket is faultless. Screw on the new filter by hand until the gasket touches the cover. Then tighten a further half turn. Vent the fuel system, start the engine and check for leakage.

## EXTRA FUEL FILTER

53

If an extra fuel filter with water separator is fitted, check the transparent bowl to see if there is any water in the fuel. If necessary, drain the filter into a suitable container via the cock in the bottom of the bowl. **!CAUTION:** All water must be removed daily. Water in fuel system can damage fuel injection pump and/or injectors. Try to avoid fuel spill. Pump prime the filter and vent the system. The fuel filter element should be changed at least once each season.

## FUEL STRAINER

54

The fuel pump on the engine has a **built-in strainer**, which can be removed after removing the pump's cover. The strainer must be cleaned or replaced at least once per season. After replacement vent the fuel system. Refer to "Venting of Fuel System".



**WARNING:** Check immediately after starting that there is no fuel leakage.

## INJECTORS

All work on the engine fuel injectors must be carried out by an authorized dealer. Check the opening pressure, spray pattern and also check for leakage every 600 hours of operation.



**WARNING: Carbon monoxide is a poisonous colorless and odorless gas which is present in all exhaust gases. If you ever smell exhaust fumes inside the boat make sure all compartments are ventilated and have your engine inspected by your dealer immediately.**

## VENTING OF THE FUEL SYSTEM

To enable the engine to start, the fuel system must be vented after carrying out any of the following:

Change of fine filter

After cleaning or replacing the fuel pump strainer

If the fuel tank has been run empty

When installing the injection pump

If fuel system has been repaired

If leakage or if work has been carried out on fuel pipes

After long periods of no running

Venting is carried out as follows. For component location on engine see Engine Component Guide.

55

Open venting screw on the fuel filter about 4 turns. Watch out for fuel spill. Use rags around the vent opening.

Note: It is not necessary to remove screw totally as there is a built in venting channel in bleed screw.

56

Pump up the fuel by using the hand primer until fuel, free from air bubbles flows out. Close venting screw. **NOTE:** If the pump action is poor, turn the engine so that the cam driving the pump changes position.

57

If the fuel injection pump has been removed or when starting up a new engine for the first time the fuel injection pump must always be vented.

Use the hand primer and pump for about half a minute. During this procedure the injection pump is automatically vented.

58

Loosen the injector's delivery pipe nuts, and put the throttle control lever in the full speed position. Turn the engine using the starter motor until fuel flows out of the delivery pipes. Watch out for fuel spill. Use rags around the venting location. Tighten delivery pipe nuts and start the engine.

## SERVICE IN CONNECTION WITH LAYING-UP AND LAUNCHING THE BOAT

## INHIBITING

### IDLE ENGINE FOR BRIEF PERIODS WITH BOAT IN WATER

In order to prevent damage to the engine caused by corrosion, the engine should be run warm at least every 14 days as long as the boat is in the water. If the boat is not to be used over a month, long-term inhibiting should be carried out.

### INHIBITING WHEN LAYING UP FOR THE WINTER

An authorized dealer should test and inspect the engine and equipment before inhibiting the engine for a long period. It is advisable to test the compression to find out the condition of the engine. If anything is not in good condition let the shop repair it now.

## CARRIED OUT WITH THE BOAT IN WATER

59

Change the fuel filter. Pump fuel and vent the system. See "Venting the fuel system". Check the fuel hoses as well as the complete fuel system for leakages. If an extra fuel filter is fitted, this filter cartridge must also be changed.

60

Start the engine after venting and allow it to run at high idle until warm. Stop the engine.

61

Pump out all oil from the engine. (If reverse gear is fitted, the oil in this must also be changed.)

Use an oil suction pump or electric type pump designed for this job.

62

Change the filter. Fill up the engine (and reverse gear if fitted) to the correct level with Volvo Penta diesel engine oil, which also has corrosion protective properties. The engine is now ready to run on this oil next season. For long-time inhibiting, exceeding normal winter laying-up, preservative oil must be used. In this case the oil filter shall not be replaced until launching.


63

Change the air-filter and the crankcase ventilation filter.

#### Carried out with the boat on land

64

Loosen the hose on the seawater system suction line, between the transom shield and the cooling water tube. (If reverse gear is fitted loosen the hose between the seawater intake and the seawater pump). Connect a hose to the suction line on the engine and put the free end into a container with freshwater. Arrange for refilling of the container. Run the engine at fast idle for a few minutes.


 **WARNING:** The impeller must not be allowed to run dry. Drain the seawater system.

### FRESH-WATER SYSTEM

Inhibiting can be carried out according to 2 alternatives.

**Alt. I.** In case the fresh-water system is already filled with a mixture of ethylene glycol, which is also corrosion protective, the freezing point of the mixture should be checked.

**Alt. II.** If the system is filled with fresh water and a corrosion protective mixture, this must be changed once each season.

 **WARNING:** There is no protection against freezing and it is therefore recommended that the system be drained now and refilled when launching boat.


### SEAWATER SYSTEM

65

Mix a 50 % mixture of fresh water and corrosion-protective anti-freeze.

66

Put the end of the hose into the anti-freeze mixture. Arrange collection of the outgoing mixture. Start the engine and let run idle until the mixture is finished. Check that nothing behind the exhaust outlet, and the seawater system will be sprayed by anti-freeze.

 **WARNING:** The water pump must not be allowed to run dry.

67

There is no need to drain off this combined anti-corrosion and anti-freezing mixture. If inhibiting is done with emulsifying oils, there is no protection against freezing, and the seawater system must therefore be drained off. Check that the water runs out, since dirt can block the cocks. Then close all cocks. Remove the cover from the seawater pump. Remove the impeller and clean it and leave out during lay-up.

68

Drain and refill outdrive with approved oil. The outdrive is now ready to run on this oil next season.

Further inhibiting of the outdrive is not necessary. Remove the propeller (propellers) and coat the shaft with rust-proofing oil.

69

Clean the outside of engine, and outdrive or reverse gear. Touch-up any bare patches in the paintwork with Volvo Penta original paint. Spray the components of the electrical system, and all the control components with anti-moisture spray. All engine control linkages should be inspected for wear, properly adjusted and protected from corrosion.

70

A fully changed battery can remain onboard. But it is recommended that you store battery in a manner that protects it from freezing.

71

Drain off any water or sediment from fuel tanks. Top up all fuel tanks to prevent condensation during storage period.

72

If the engine has a vacuum valve it must be taken apart twice a season or whenever leaks occur.

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

Loosen the valve cover and remove the gasket and diaphragm and clean out any deposits. Deformed diaphragms must be replaced.

#### Installation should be done with the valve upside down

73

Place the diaphragm in the cover. Ensure that the entire diaphragm is placed in the right location. The diaphragm must not be trapped by the gasket. Insert the gasket and screw on the cover. **!CAUTION:** Tighten torque 2 Nm (1.47 ft.lbs). If the cover is tightened too hard the valve will stop working.

### MEASURES IN CONNECTION WITH LAUNCHING

74

If Volvo Penta oil has been used during lay up only the level needs to be checked.

If another type of inhibiting oil has been used, both the oil and the filter must be changed. See under "Service every 200 hours of operation".

75

Check the drive oil level. If it is too high, it must be lowered by draining. If it is too low, top-up through the hole for the oil dipstick. **NOTE!** The dipstick must **not** be screwed down when checking the oil level. Check also the oil level in the hydraulic pump (Power Trim).

76

Check the tightening of all hose-clamps. Check that all drain-cocks are closed and tight. Clean the engine and drive on the outside. Check the exhaust-hoses. Install the impeller.

77

Fill-up the freshwater system to the correct level. Fill-up through the filler-hole on top of the thermostat housing with a 50 % mixture of freshwater and rust-proofing ethylene glycol or additive.

78

If the drive has been dismantled and the rack-and-pinion that controls the drive's trimming angle have come out of alignment, the pinion should be turned until the marked tooth (notched) is visible. Mount the rack so that the first tooth gap engages with the marked tooth.

79

Check carefully bellows for damage and also check the tightening of all hose clamps. NOTE! The junction bellows and hose clips should be replaced every three years. Have the bellows checked and replaced by an authorized Volvo Penta dealer.



**WARNING:** Never work on the bellows or the drive's hydraulics without first locking the drive in position in such a way that there is no possibility of it falling down. If the drive falls it can cause severe injuries.

You can use Volvo Penta special tool no. 884863-2 to ensure that the drive control fall down while you are working on it. Proceed as follows:

Put your hand into the drive from underneath, aft of the heat shield zinc plate and grip the ear catch (1). Press the rear catch downwards, at the same time lifting the drive manually until it reaches the upper position. Holding the drive in that position, place the special tool no. 884863-2 (2) on the starboard side of the drive as shown in the diagram. NOTE: Do not overload the tool by standing on the drive while it is in the upper position.

80

Check the torque on the Allen-bolts which attached the steeringhelmet to the drive. Tightening torque – see "Technical Data".

81

Examine the paintwork on the outboard drive. Touch up any blemishes with genuine Volvo-Penta paint. Then paint the drive with Volvo-Penta anti-fouling paint.

Paint the bottom of the boat with anti-fouling paint.



**WARNING:** Anti-fouling paint that contains copper must not be used. Copper bottom paint can cause corrosion damage to outboard drive.

82

Check that the batteries are fully charged. Smear the terminals with pole grease. Connect the battery cables.



**WARNING: Do not reverse the polarity.** Tighten the cable terminals firmly.

83

If the boat is equipped with a propeller shaft seal of rubber, the following procedure should be observed after launching:

Vent the tubular sleeve and seal by pressing them together and pressing the seal down against the shaft until water emerges. Then press about 1 cm<sup>3</sup> of water resistant grease into the seal.



**WARNING!** The propeller shaft seal must be replaced after 500 hours of 5 years.

84

Start the engine. (Please see the foot of next page.) Check and make sure there is no fuel, water or exhaust gas leakage in the boat. Check also that all steering and control functions are in order.

When necessary, contact an authorized Volvo-Penta dealer. Let them service your engine and drive or reverse gear according to the instructions given in the servicing shedule.

## PROPELLER

### Propellers, Duoprop

85

The two propellers are classified together. Propellers with different color markings must not be installed on the same drive. A damaged propeller must be changed immediately. Great care must be taken when running with a damaged propeller. Never run with only one propeller fitted, as this can damage the propeller shafts.

The front propeller is locked with the nut (1) and the lock washer (2). One of the tabs on the lock washer must be bent into one of the holes of the nut. The rear propeller is locked with the nut (3). The nut is locked with the bolt (4), spanner width 13 mm. The shaft must be greased. Use Volvo Penta grease. (Part No. 828250). No. 828250).



**WARNING:** Handle the fish line cutter carefully, as the cutter edges are sharp and may cause injury.

## PROPELLERS

86

The propeller is locked onto the shaft by a bolt and a propeller cone. Remove the bolt and pull off the cone. Pull off the propeller. Note! On the inside of the propeller, there is a spacer sleeve and a deflector ring. Damaged propellers must always be replaced.

1. Apply a thin coat of grease to the propeller shaft.
2. Fit the deflector ring (5).
3. Fit the propeller.
4. Fit the plastic washer (3).
5. Fit and tighten the propeller cone (1).
6. Fit and tighten the center bolt.



**WARNING –** Engine must be off when changing propellers. Handle fish line cutter and drop carefully as they have sharp edges and many cause injury.

## TRIMMING THE DRIVE


### ADJUSTING THE LOCKING ROD

87

Check once per season and when necessary adjust the position of the locking rod against the retaining pawl (A). Adjustment is done as follows:


1. Remove the protective cover (1). Move the control lever to neutral.
2. Disconnect the shift control cable swivel (2) and yoke (3).

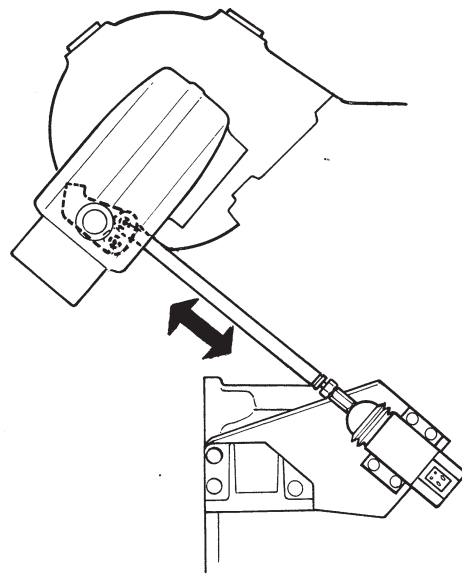
3. Slacken the lock nut for yoke (3). Adjust the yoke so that after having connected it to the level it gives push rod (4) a position where it reaches the clamp of the retaining pawl at "A" without pressing against it. Secure yoke (3) with the lock nut.
4. Adjust swivel (2) so that it can easily be moved into the hole on the shift yoke. Move the control lever to the "forward" position and check that the corner "C" does not touch the housing. Fit the cover (1).

 **WARNING:** When working around outdrive or propeller, avoid placing hands in areas where they could be injured by drive movements.

## ADJUSTING COURSE DEVIATION, DRIVE 290

Check for deviation in course by releasing the steering wheel when the boat is planning and observe its course. If the boat veers to port or starboard the outdrive trim tab should be adjusted as follows: If, e.g., the boat veers to port, the trim tab under the cavitation plate on the drive must be loosened and turned so that the rear edge of the trim tab is positioned slightly to port. Lock the trim tab slightly to port and lock the trim tab in this position. Testrun the boat. Adjust the trim tab further if the boat still tends to veer.

 **WARNING:** Before starting the engine, make sure that the exhaust pressure regulator turns freely.





## FAULT TRACING SCHEME

### Tracing faults when having interruptions in operation

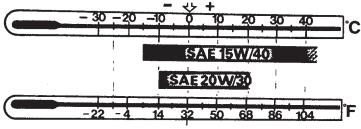
The fault tracing scheme given below lists only the most usual of faults that give rise to interruptions in operation. With the help of the instructions given in this hand-

book, the owner can generally remedy most of the faults listed below. When in doubt, always contact the nearest Volvo Penta service workshop.

Follow the maintenance scheme's recommendations – it helps provide trouble-free running.

Engine will not start	Engine stops	Engine does not attain top speed at full throttle	Engine runs unevenly or vibrates abnormally	Engine overheats	Probable cause
●					Main switch not switched on, flat battery, brake in electric circles or main fuse.
●	●				Empty fuel tank, closed fuel cock, blocked fuel filter.
●	●		●		Water, air or impurities in fuel
		●	●		Defective injector(s).
		●			Boat abnormally loaded. Marine growth on boat bottom.
		●			Blocked air-filter. Turbocharger faulty.
			●		Damaged propeller.
				●	Blockage in cooling water intake, water filter, defective impeller to thermostat, wrong level in fresh-water system, air in the fresh-water system.

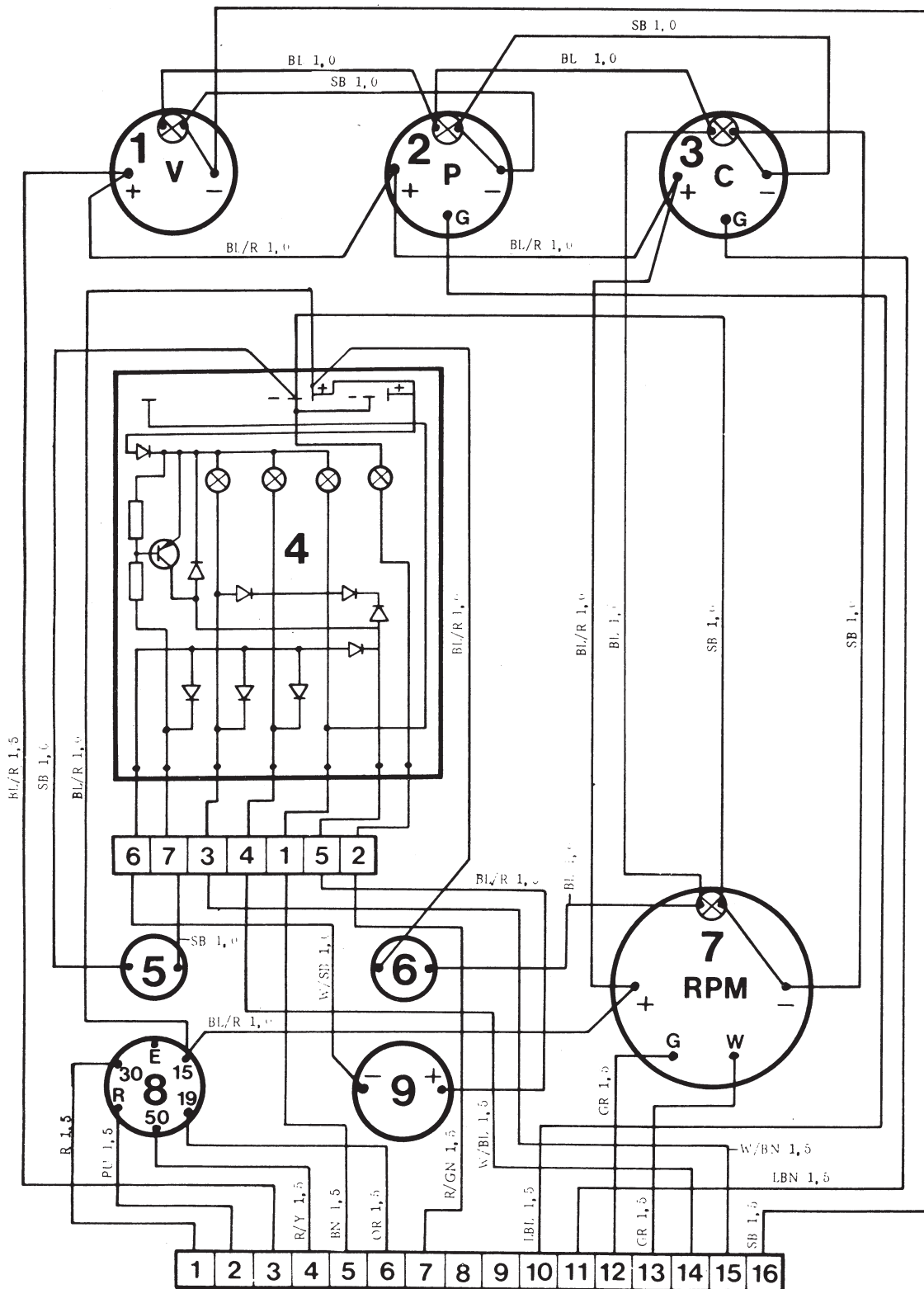
## Technical data

Type designation.....	AQAD31A MD31A TMD31A TAMD31A	AQD41A AQAD41A TMD41A TAMD41A
Output, see sales literature		
Idling speed, (r/m).....	650–750	600–700
Bore/Stroke, mm (inch).....	92,0/90,0 (3,6/3,54)	92,0/90,0 (3,6/3,54)
Displacement (lit).....	2,39 (1,46)	3,59 (220)
Firing order.....	1-3-4-2	1-5-3-6-2-4
Direction rotation (viewed from front).....	Clockwise	Clockwise
Max. forwards incl.....	4°	4°
Max. rearwards incl underway.....	15°	15°
Max. sideways incl. underway.....	20°	20°
Clearance, cold engine inlet mm (in)	0,40 (0,016)	0,40 (0,016)
outlet mm (in).....	0,40 (0,016)	0,40 (0,016)
<b>Lubrication system</b>		
Engine, oil capacity, (lit) excl filter.....	8,5 (9 qts)	10,5 (11,0 qts)
(lit) incl filter.....	9,0 (9,5 qts)	11,0 (11,5 qts)
At 15° rearwards incl., (lit) excl. filter.....	9,0 (9,5 qts)	11,0 (11,5 qts)
(lit) incl. filter.....	9,5 (10,0 qts)	11,5 (12,0 qts)
Oil quality (API).....	CD	CD
		
Oil pressure – engine hot, idling kp/cm <sup>2</sup> (lbs/in <sup>2</sup> ).....	2,2–3,0 (31,3–42)	2,2–3,0 (31,3–42)
max. revs kp/cm <sup>2</sup> (lbs/in <sup>2</sup> ).....	4,2–5,0 (59–71)	4,2–5,0 (59–71)
Drive 290		
Oil capacity dm <sup>3</sup> (lit).....	2,6 (2 2/3 qts)	2,6 (2 2/3 qts)
Oil quality, viscosity.....	Same as engine	Same as engine
Oil volume between max. and min.....	0,15 (1/6 qt)	0,15 (1/6 qt)
Oil volume Power Trim (lit).....	0,52 (1/2 qt)	0,52 (1/2 qt)
Oil quality, viscosity.....	Same as engine	Same as engine
Drive Duoprop		
Oil capacity dm <sup>3</sup> (lit).....	2,7 (2,8 qts)	2,7 (2,8 qts)
Oil quality, viscosity.....	API-GL5 (SAE 90 or 80W90)	
Oil volume between max. and min.....	0,15 (1/6 qt)	0,15 (1/6 qt)
Oil volume Power Trim (lit).....	0,52 (1/2 qt)	0,52 (1/2 qt)
Oil quality, viscosity.....	Same as engine	Same as engine
Reverse Gear MS2		
Oil volume (lit).....	0,8 (5/6 qt)	0,8 (5/6 qt)
Oil quality.....	Same as engine	Same as engine
Reverse Gear MS4A		
Oil volume (lit).....	1,7 (1,8 qts)	1,7 (1,8 qts)
Oil quality.....	API-GL5 (SAE 90 or 80W90)	
Reverse gear PRM301, oil volume (lit).....	1,5	–
Reverse gear PRM401, oil volume (lit).....	3,25	3,25
Oil quality, viscosity.....	Same as engine	Same as engine
<b>Cooling system</b>		
Thermostats open/fully open at.....	81°C/94°C (178°F/201°F)	81°C/94°C (178°F/201°F)
Fresh water system, capacity, lit.....	13 (13,5 qts)	19 (20,0 qts)
Normal temperature.....	75–90°C (167–194°F)	75–90°C (167–194°F)
<b>Electrical system</b>		
System voltage, V.....	12	12
Battery capacity, starter motor max. Ah.....	140	140
Battery electrolyte spec. grav.:		
Charging to be carried out at g/cm <sup>3</sup> .....	1,230	1,230
Fully charged battery, g/cm <sup>3</sup> .....	1,275–1,285	1,275–1,285
Alternator rating max.....	14V 50A	14V 50A
Starter motor rating, hp (kW).....	3,4 (2,3)	3,4 (2,3)
<b>Tightening torques</b>		
Steering Helmet Allen bolt.....	3,5 kpm (35 Nm) 25 ft lbs	3,5 kpm (35 Nm) 25 ft lbs

Transmission ratios	Pleasure duty	Light duty	Medium duty
<b>MD31</b>	<b>MS2B 2.4:1</b> <b>MS4A 1.91:1; 2.6:1</b>	<b>MS2B 2.4:1</b> <b>MS4A 1.91; 2.6:1</b>	—
<b>TMD31</b>	<b>MS4A 1.9:1; 2.6:1</b>	<b>MS4A 1.9:1; 2.6:1</b>	—
<b>TAMD31</b>	<b>MS4A 1.9:1; 2.6:1</b>	<b>MS4A 1.9:1; 2.6:1</b>	<b>PRM301 1.9:1; 2.9:1</b> <b>PRM401 3.95:1</b>
<b>AQAD31</b>	<b>290 1.61:1</b> <b>DP 2.3:1</b>	<b>290 1.61:1</b> <b>DP 2.3:1</b>	<b>DP 1.95:1</b>
<b>TMD41</b>	<b>MS4A 1.9:1; 2.6:1</b>	<b>MS4A 1.9:1; 2.6:1</b>	—
<b>TAMD41</b>	<b>MS4A 1.9:1; 2.6:1</b>	<b>MS4A 1.9:1; 2.6:1</b>	<b>PRM401 1.9:1; 2.9:1</b> <b>PRM401 3.95:1</b>
<b>AQD41</b>	<b>290 1.61:1</b> <b>290 DP 1.95:1</b>	<b>290 1.61:1</b> <b>290 DP 1.95:1</b>	—
<b>AQAD41</b>	<b>290 1.61:1</b> <b>290 DP 1.78:1</b> <b>290 DP 1.95:1</b>	<b>290 1.61:1</b> <b>290 DP 1.78:1</b>	<b>290 1.61:1</b> <b>290 DP 1.95:1</b>

Engine weights	Kg	lbs
<b>MD31A/MS2B</b>	<b>335</b>	<b>737</b>
<b>MD31A/MS4A</b>	<b>360</b>	<b>792</b>
<b>TMD31A/MS4A</b>	<b>375</b>	<b>825</b>
<b>TAMD31A/MS4A</b>	<b>385</b>	<b>847</b>
<b>AQAD31A/290DP</b>	<b>440</b>	<b>968</b>
<b>AQAD31A/290</b>	<b>433</b>	<b>952</b>
<b>TMD41A/MS4A</b>	<b>455</b>	<b>1000</b>
<b>AQD41A/290</b>	<b>503</b>	<b>1105</b>
<b>AQD41A/290DP</b>	<b>510</b>	<b>1122</b>
<b>TAMD41A/MS4A</b>	<b>465</b>	<b>1023</b>
<b>AQAD41A/290</b>	<b>513</b>	<b>1128</b>
<b>AQAD41A/290DP</b>	<b>520</b>	<b>1144</b>

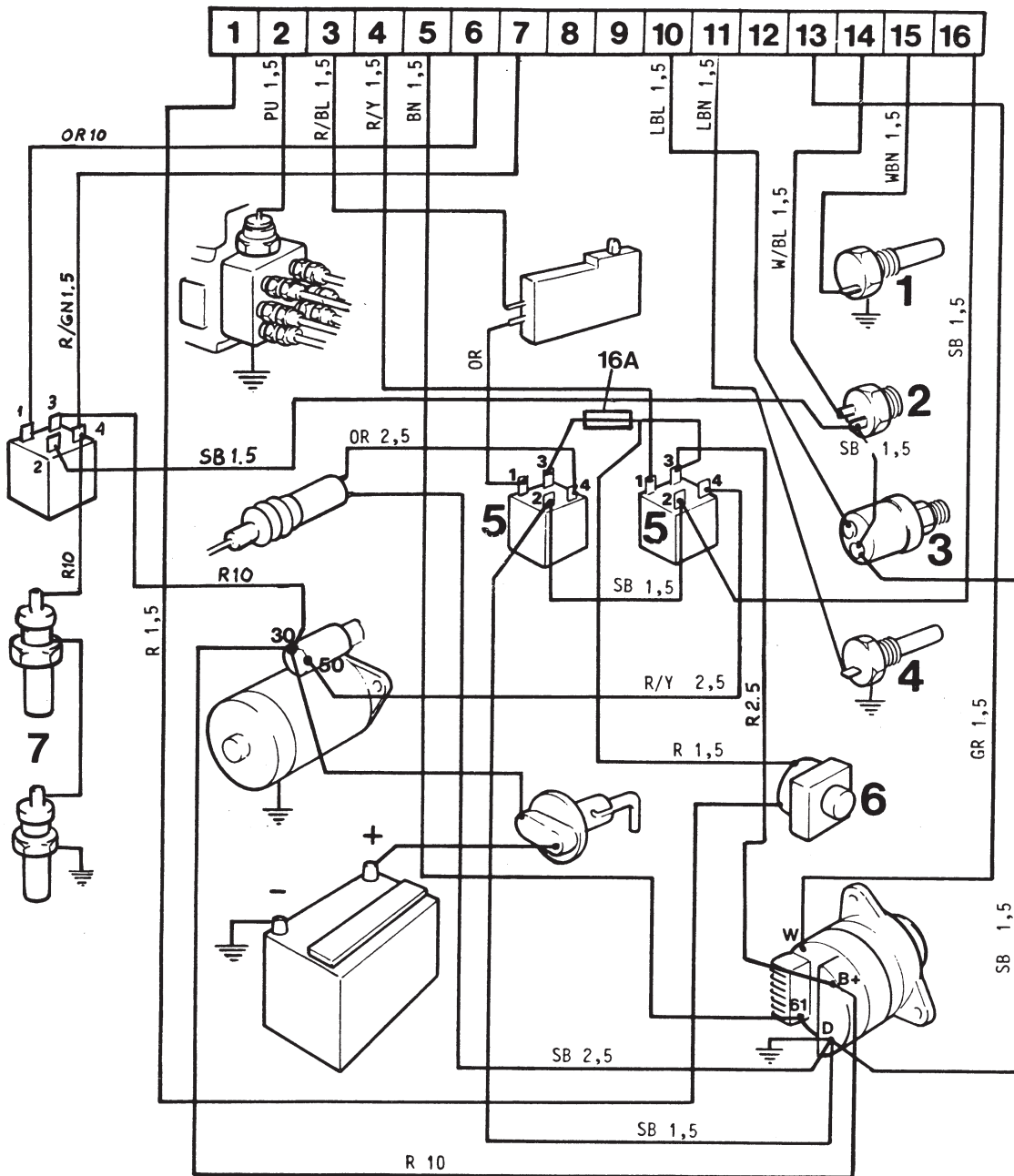
## Electrical Wiring Diagram (12V)



### Instrument panel

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Voltmeter</li> <li>2. Oil pressure gauge</li> <li>3. Coolant temperature gauge</li> <li>4. Printed circuit card</li> <li>5. Push button</li> </ol> | <ol style="list-style-type: none"> <li>6. Switch for instrument lighting</li> <li>7. Rev. counter</li> <li>8. Key switch</li> <li>9. Alarm</li> </ol> |
|--|---|





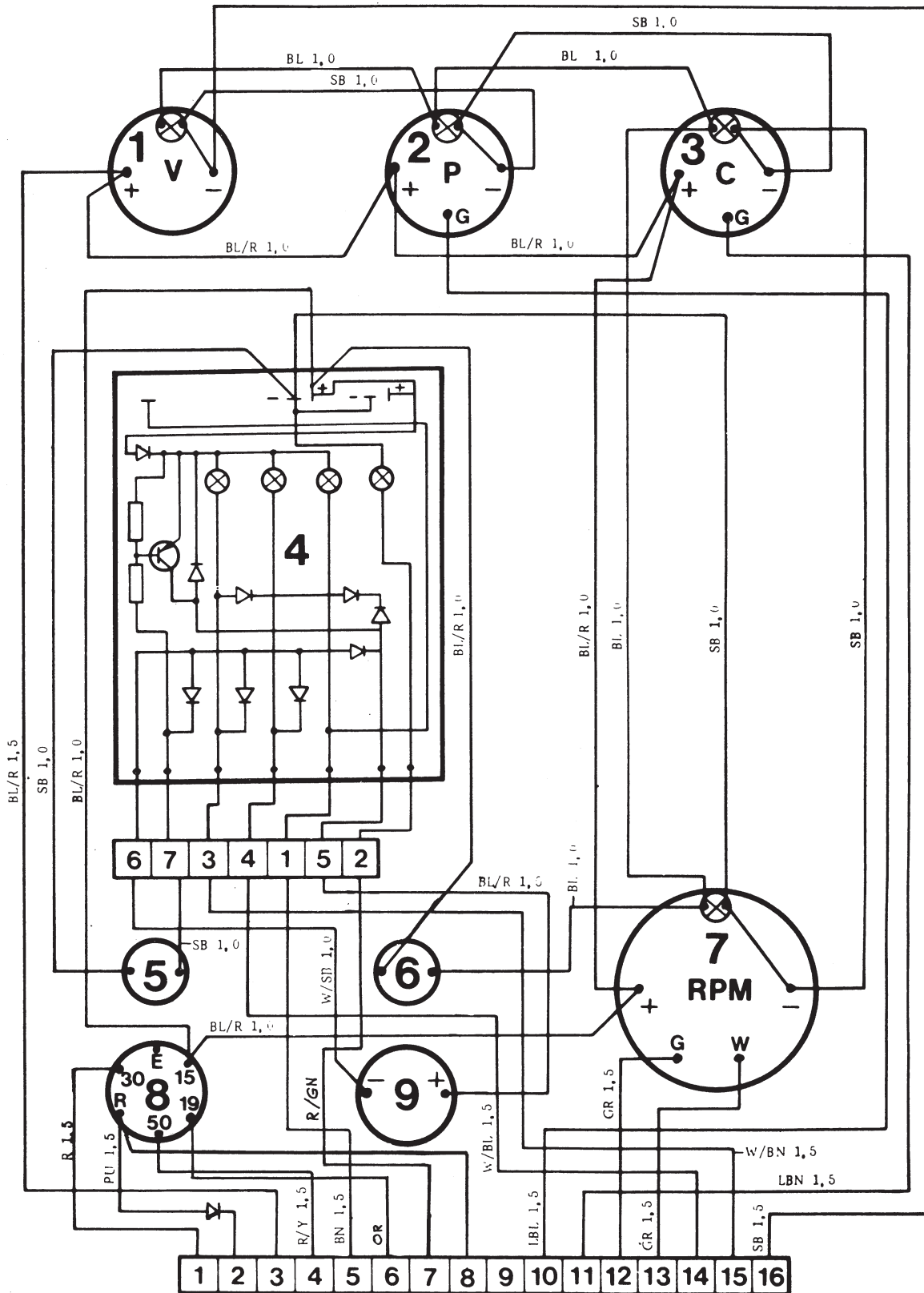
**Engine**

1. Coolant temperature check
2. Oil pressure check
3. Oil pressure sender
4. Coolant temperature sender
5. Relay
6. Fuse
7. Preheating

**Wire colour**

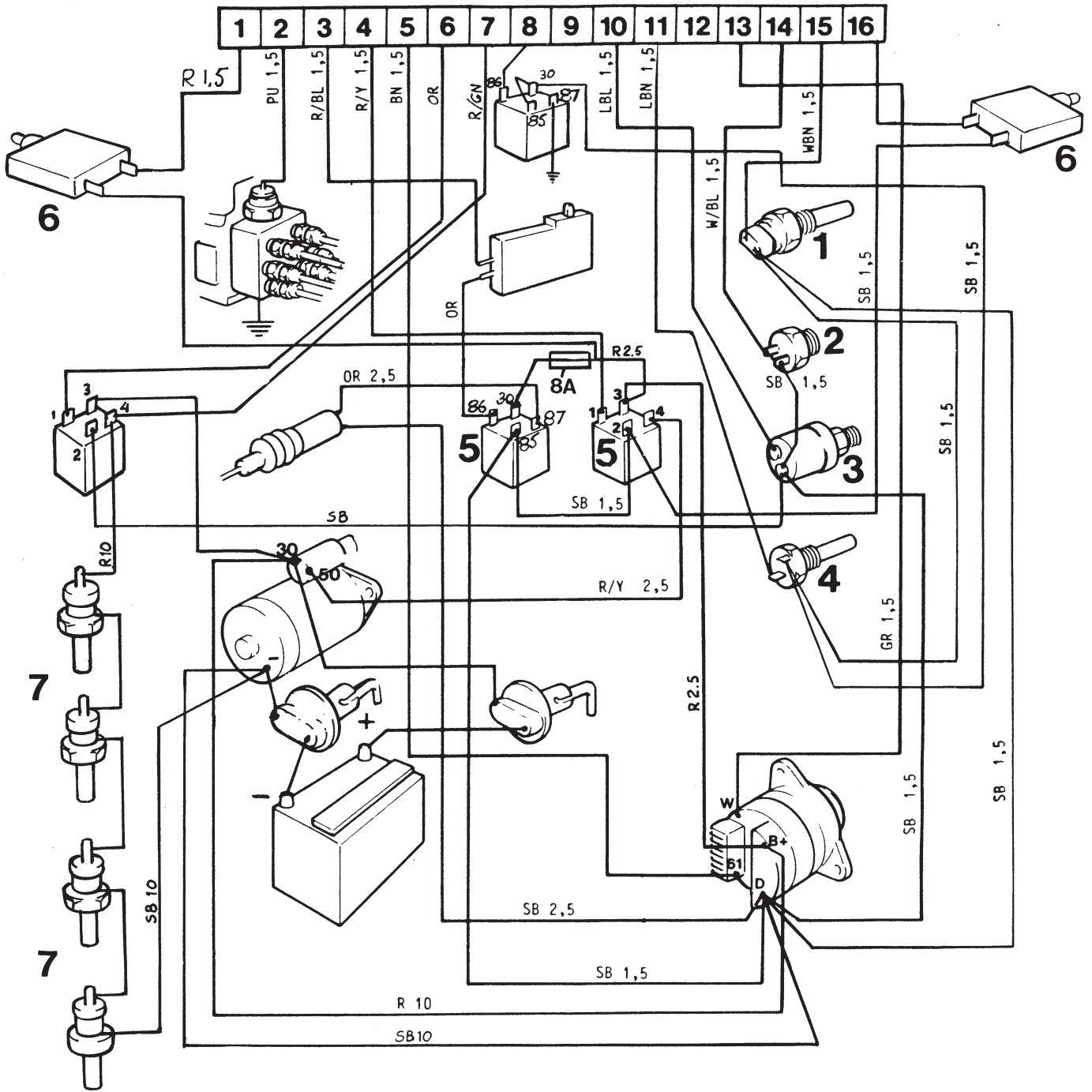
- GR = Grey
- SB = Black
- BN = Brown
- LBN = Light brown
- R = Red
- PU = Purple
- GN = Green
- Y = Yellow
- W = White
- BL = Blue
- LBL = Light blue

## Electrical Wiring Diagram (24V)



### Instrument panel

- |                              |                                   |
|------------------------------|-----------------------------------|
| 1. Voltmeter                 | 6. Switch for instrument lighting |
| 2. Oil pressure gauge        | 7. Rev. counter                   |
| 3. Coolant temperature gauge | 8. Key switch                     |
| 4. Printed circuit card      | 9. Alarm                          |
| 5. Push button               |                                   |



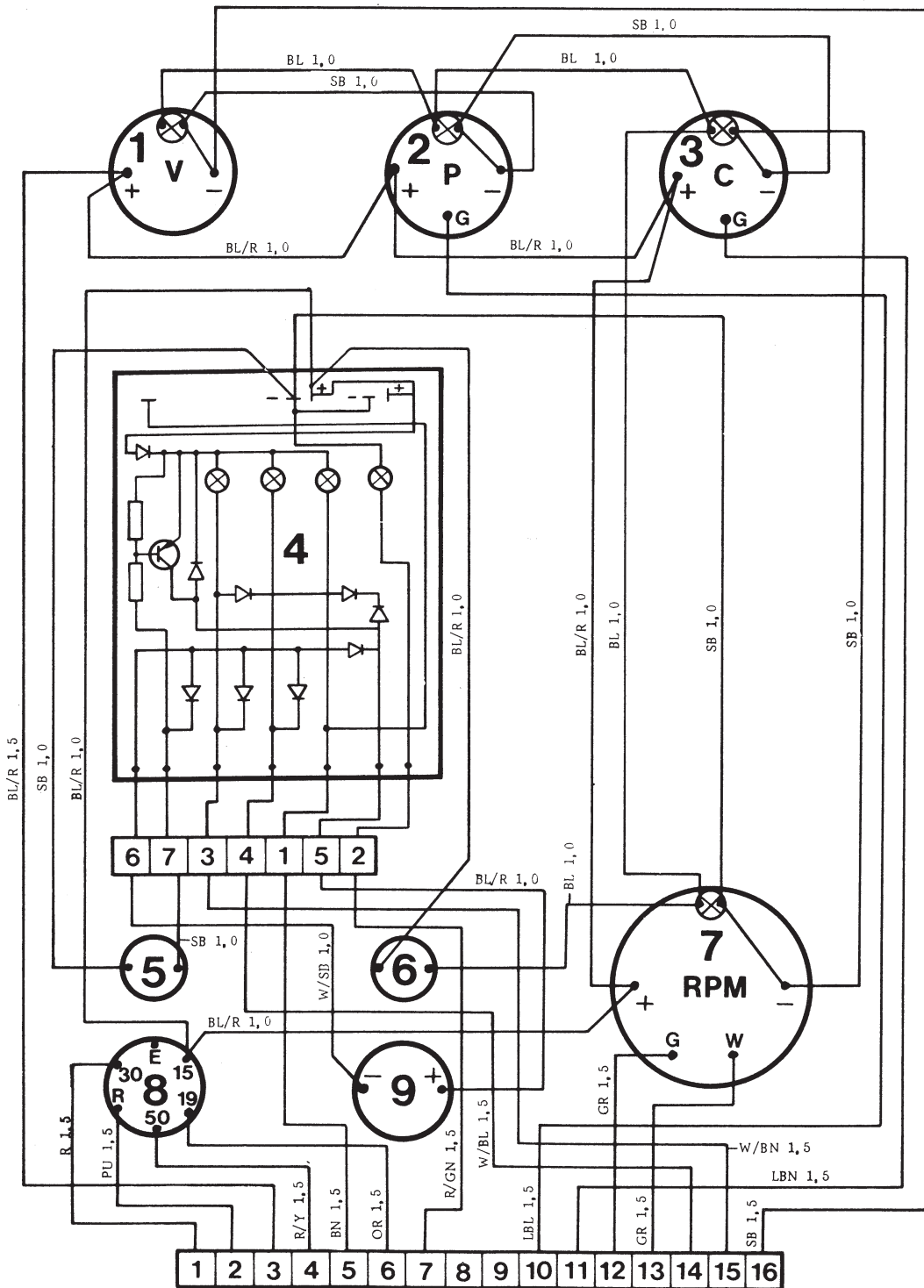
**Engine**

1. Coolant temperature check
2. Oil pressure check
3. Oil pressure sender
4. Coolant temperature sender
5. Relay
6. Fuse
7. Preheating

**Wire colour**

- GR = Grey
- SB = Black
- BN = Brown
- LBN = Light brown
- R = Red
- PU = Purple
- GN = Green
- Y = Yellow
- W = White
- BL = Blue
- LBL = Light blue

## Electrical Wiring Diagram (12V) MD31A



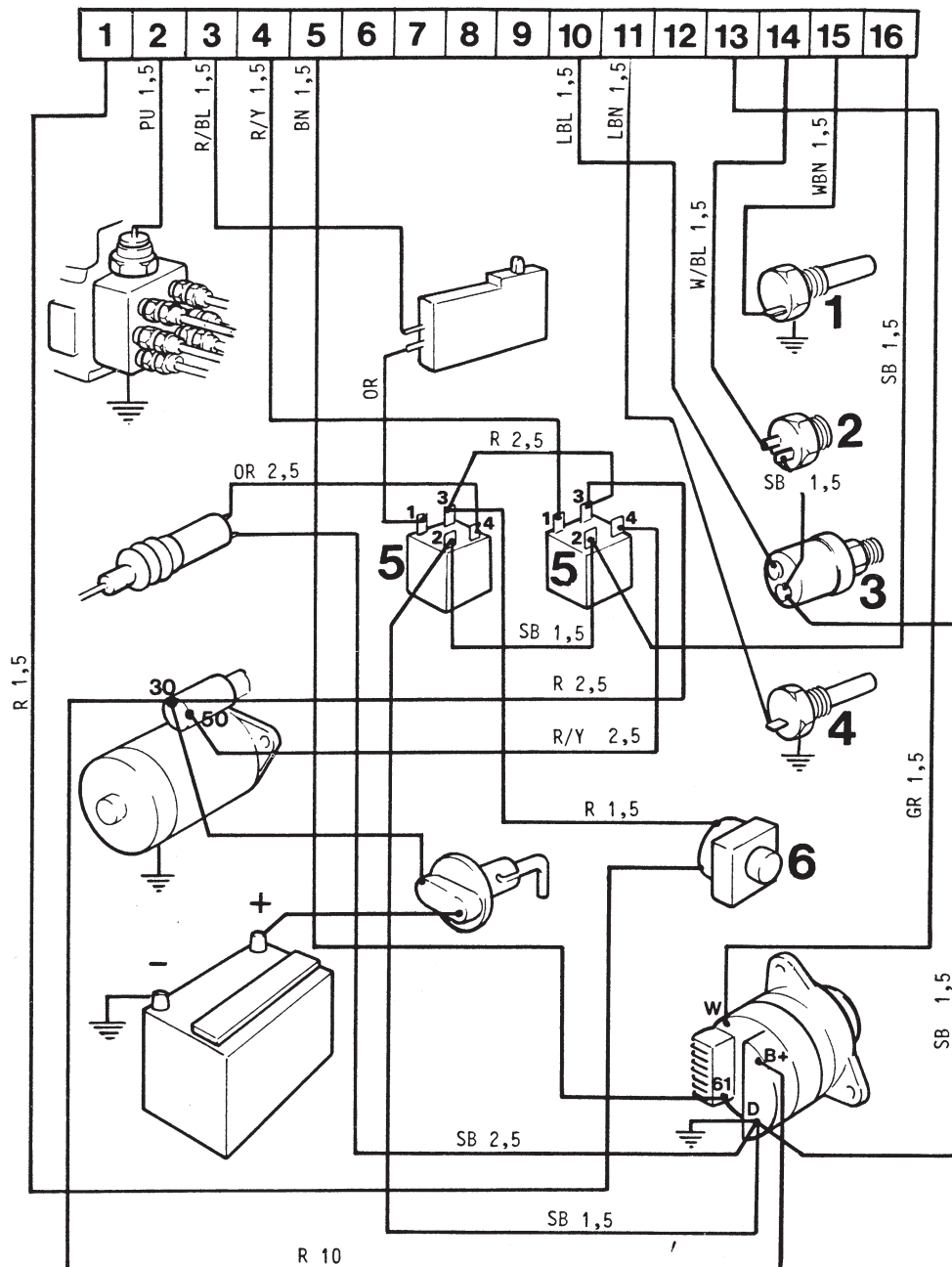
### Instrument panel

- |                              |                                   |
|------------------------------|-----------------------------------|
| 1. Voltmeter                 | 6. Switch for instrument lighting |
| 2. Oil pressure gauge        | 7. Rev. counter                   |
| 3. Coolant temperature gauge | 8. Key switch                     |
| 4. Printed circuit card      | 9. Alarm                          |
| 5. Push button               |                                   |



**Wire areas**

mm <sup>2</sup>	AWG
1.0	17
1.5	15
2.5	13
6	9
10	7



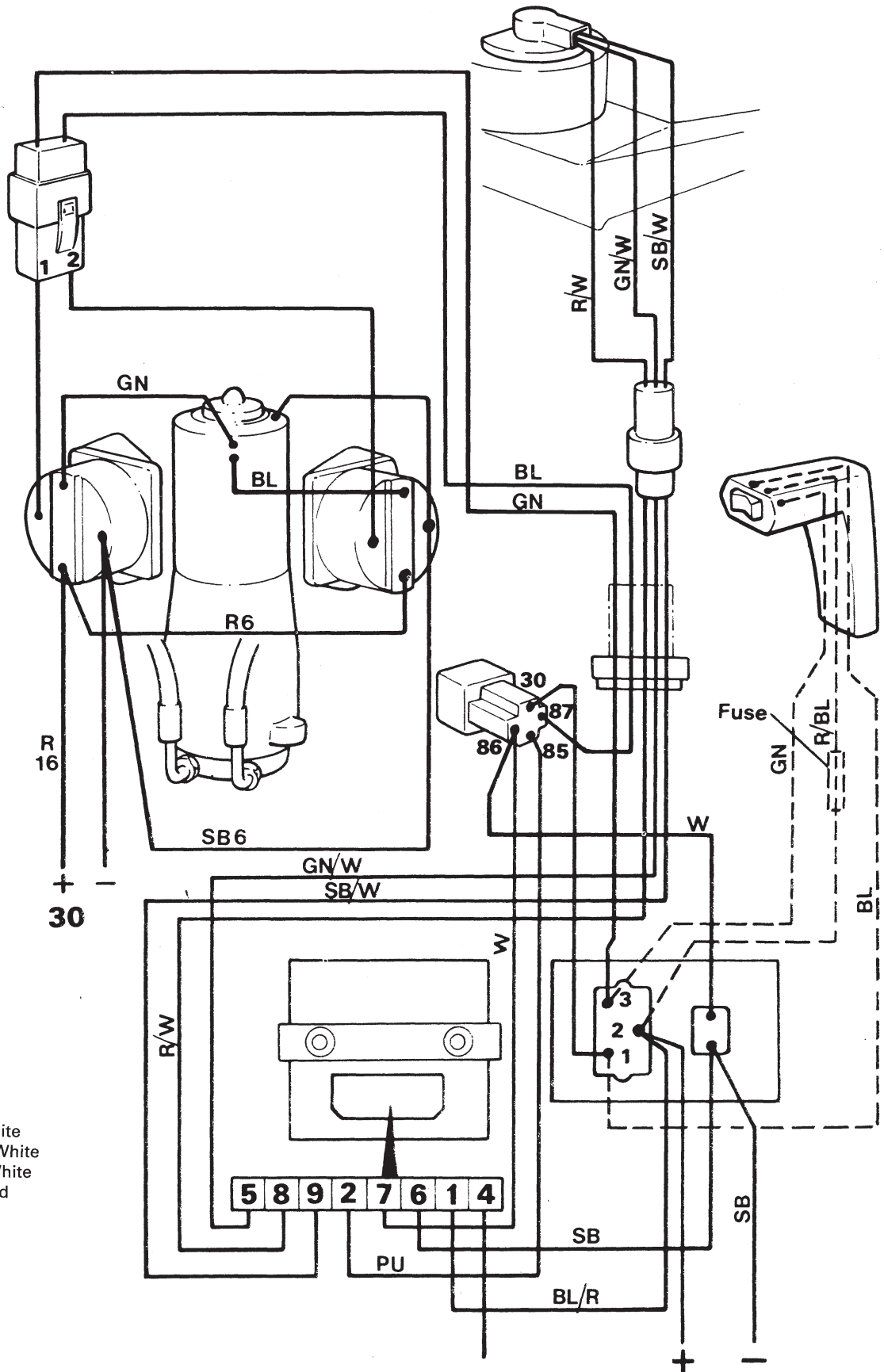
**Engine**

1. Coolant temperature check
2. Oil pressure check
3. Oil pressure sender
4. Coolant temperature sender
5. Relay
6. Fuse

**Wire colour**

- |     |               |
|-----|---------------|
| GR  | = Grey        |
| SB  | = Black       |
| BN  | = Brown       |
| LBN | = Light brown |
| R   | = Red         |
| PU  | = Purple      |
| GN  | = Green       |
| Y   | = Yellow      |
| W   | = White       |
| BL  | = Blue        |
| LBL | = Light blue  |

## Wiring diagram, Power Trim



### Cable colour code

- R = Red
- SB = Black
- GN = Green
- BL = Blue
- W = White
- R/W = Red/White
- GN/W = Green/White
- SB/W = Black/White
- BL/R = Blue/Red
- PU = Purple

Cable area 1,5 mm<sup>2</sup>



# **VOLVO PENTA**

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